

Microwave Digital Archive

IEEE Microwave Theory and Techniques Society

2001

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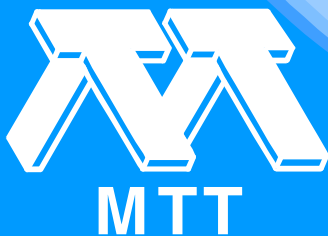
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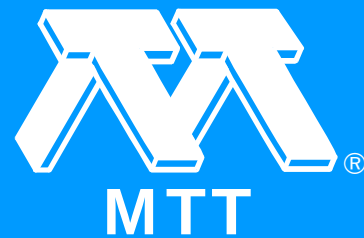
WELCOME:

The Microwave Theory and Techniques Society (www.mtt.org) of the IEEE continues the task of archiving the IEEE Transactions on Microwave Theory and Techniques, and all other major publications including the IEEE Microwave and Wireless Components Letters (formerly called IEEE Microwave and Guided Wave Letters), as well as the IEEE International Microwave Symposium. The 2001 annual Microwave Theory and Techniques CD-ROM archive is provided to keep everyone up-to-date.

The complete MTT Digital Archive CD-ROM set can be ordered via phone, fax, E-mail or mail order:

- Call IEEE at +1 800 678 4333 for US and Canada, or call +1 732 981 0060
- Fax +1 732 981 9667 or e-mail customer-service@ieee.org
- Mail your order to IEEE Customer Service Center, 445 Hoes Lane, Piscataway, NJ, 08854
- All payments must be in US dollars, drawn on US banks

The section “Getting Started” in this Index tells you how to optimize the Acrobat Reader preferences to improve the readability of the document. If you find errors in the CD-ROM, e-mail a note to the current President of the MTT Society at president@mtt.org or visit www.mtt.org to find out his/her contact details.



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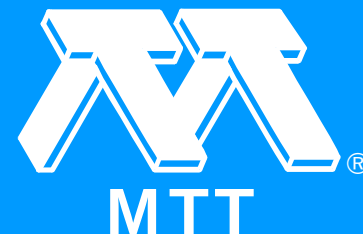
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All papers were electronic files or images scanned from hard copy and converted to Adobe Acrobat PDF file format for cross-platform access. The viewing quality will vary with the size and quality of fonts used. Even though the viewing quality on your monitor may vary, all papers should print clearly. Remember that the quality of the some journal articles is not perfect, and that some photographs will not be as clear as Technicolor. Also, the optical character recognition is good but not perfect, so some spelling errors will occur. None the less, you can copy and paste the material for your own use and personal study.

The 2001 CD-ROM archive was assembled from electronic files provided to us by Adam Philippidis at IEEE Headquarters. The material includes papers from the IEEE Transactions on Microwave Theory and Techniques edited by David Rutledge and his associated editors, and the IEEE Microwave and Wireless Components Letters edited by Samir El-Ghazaly and his associated editors.

The 2001 International Microwave Symposium Digest was edited by Bernard Sigmon, Rudy Emrick and Steve Rockwell. The RFIC Symposium Digest was edited by Luciano Boglione. Debabani Choudhury and Rashaunda Henderson managed the CD-ROM that included papers from both Symposia.

Many people have contributed the CD-ROM archival effort. Charlie Jackson and Roger Pollard have provided substantial amount of help in initiating and sustaining the archival project. I am also in debt for their constant help



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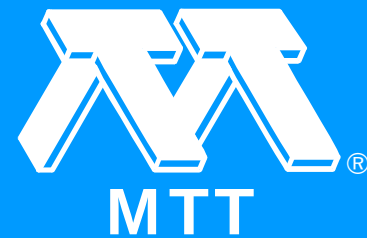


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to Charlie Jackson, John Barr IV and Arvind Sharma. I would also like to acknowledge the enthusiastic support by the team at InControl Productions, Inc. Special thanks go to Barbara Di Edwardo for her assistance in producing the new journal disc.

Thank you and enjoy!

Luciano Boglione,
Editor,
Microwave Digital Archive Project



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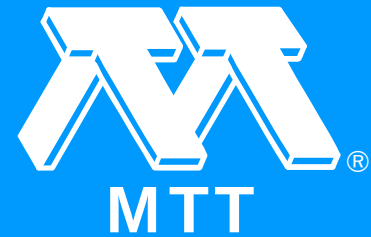


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IEEE Catalog Number: JC18003

ISBN: 0-7803-7639-0



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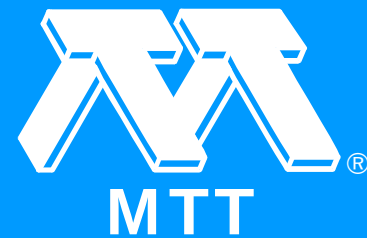
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ORIENTATION

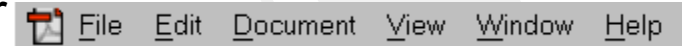
This Electronic Guide file contains hypertext links to individual article files. Links are represented by colored text (e.g., a name or title); clicking on the text activates the link.

The information on this CD-ROM is optimized for Adobe Acrobat Reader + Search 5.0. You can install this version of Adobe Acrobat Reader from the CD-ROM. If you already have Acrobat Reader installed on your system, make sure it is version 4.0 or higher and includes the Search plug-in.

The [README.TXT](#) file found on the root directory of this CD-ROM provides additional information.

In many instances, we refer to the “menu bar” and “tool bar”, shown here for reference.

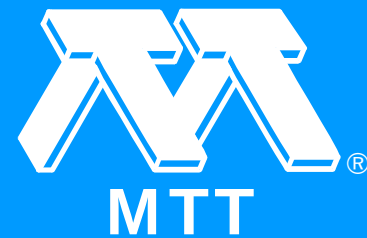
menu bar:



tool bar:



Be sure to read the following on how to achieve the best performance with this electronic guide.



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RECOMMENDATIONS FOR OPTIMAL PERFORMANCE

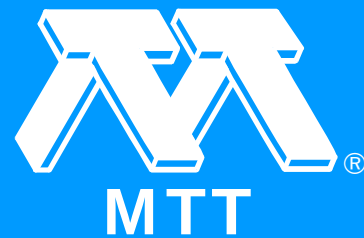
In order to take full advantage of the performance capabilities of this collection, we recommend that you do the following:

1. To make navigation and searching easier, we strongly recommend changing the following Acrobat Search Preferences (found under Edit> Preferences > Search on the menu bar.) In the dialog box shown for Acrobat Search Preferences, make the following changes:

A. Select the “Document Information” option so that Title, Author, Keywords, and Subject fields are visible when specifying search criteria. If for some reason this preference option is not present on your system, check to see that you have the Search plug-in installed. The Search icon  will be present on the Acrobat tool bar if the function is properly installed. Specifics of the Search function are described later in this section.

B. Change “Show first 100 documents” to “Show first 1000 documents”. (Type in “1000” in the field provided.) This allows the maximum number of hits to be displayed during a search.

These settings will become your new default.



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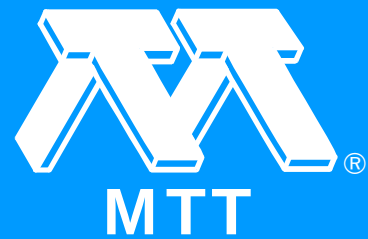
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USING BOOKMARKS

In addition to links, you can navigate through the Electronic Guide using Bookmarks. If they are not already visible, choose Window > Bookmarks from the menu bar or press the “Show/Hide Navigation Pane” button on the tool bar. A panel opens on the left side of the screen displaying Bookmarks in a hierarchy.

Each Bookmark corresponds to a location in the Electronic Guide. Click on the text in a Bookmark to go to that location.

Entries with lower level Bookmarks show a plus sign (+) when subordinate Bookmarks are hidden and a negative sign (-) when subordinate Bookmarks are visible. To view subordinate Bookmarks, click on the plus sign (+). To hide them, click on the negative sign (-). Dragging the right margin of the bookmark panel resizes it. Dragging the Bookmark tab moves the panel to a different location.



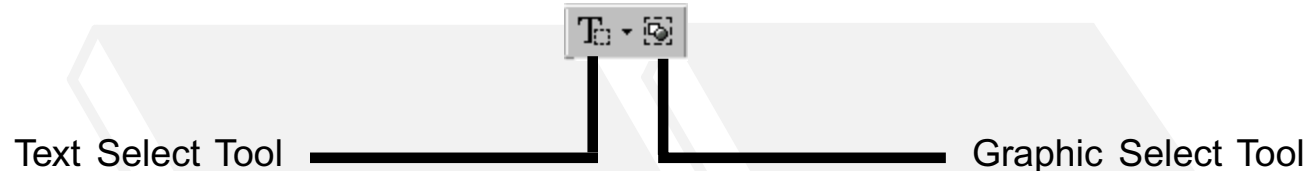
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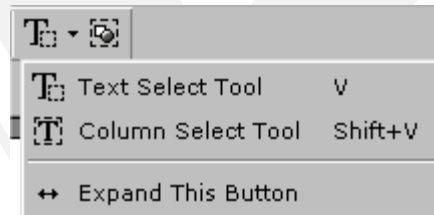
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SELECTING TEXT AND GRAPHICS

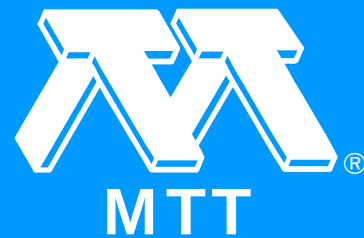
To select text or graphics, the appropriate select tool must be selected. The select tools share the same space on the tool bar.



To see more text selection tools you must click the arrow to the right of the Text Select Tool. A “flyout” menu will allow you to select the Column Select Tool.



See the Adobe Acrobat Reader 5.0 Guide (Help > Reader Help) for more information on these tools.



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NAVIGATION BUTTONS

Section Map

The current section is shown at the top of each page. The “path” to this section is shown at the right. Clicking these text buttons moves you to the start of that section.

Next Page

Click to advance to the next page in the section.



Previous Page

Click to go back to the previous page in the section.



(The Page Up and Page Down keys perform the same functions as the Next and Previous Page buttons.)

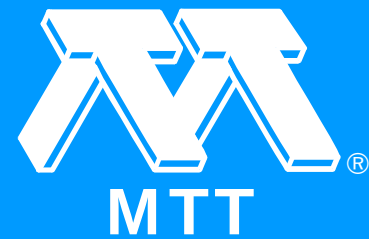
Fast Forward Pages

Click to advance (jump) multiple pages in the section.



Fast Back Pages

Click to go back (jump) multiple pages in the section.



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Note to Adobe Reader 4.0 users:

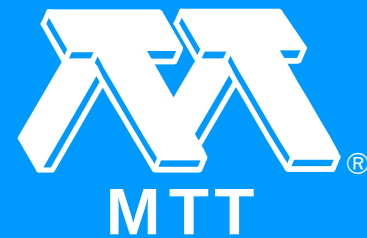
An error may be generated by Reader 4.0 when using the “View next paper” link found on the last page in a small number of papers from the 2001 International Microwave Symposium. To avoid the error it is recommended that Reader 4.0 users not use this link as a means of navigation on the disc.

Reader 4.0 users are strongly encouraged to install the latest version of Adobe Reader. The installations are included on this disc.

Note to All users:

The “Return to Main Menu” is an Adobe Reader action of “Go Back Document.”

In search mode this action will take you to the previously viewed paper. Otherwise, this link will take you back to the Electronic Guide at the point from which you left.

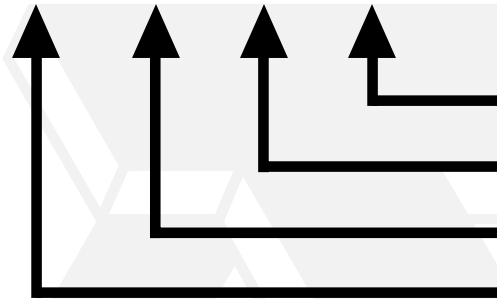


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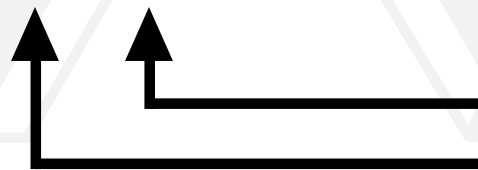
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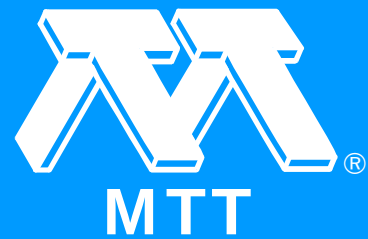
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Go Forward One Page
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Navigation



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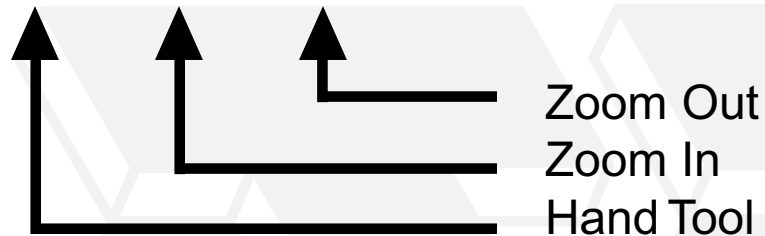


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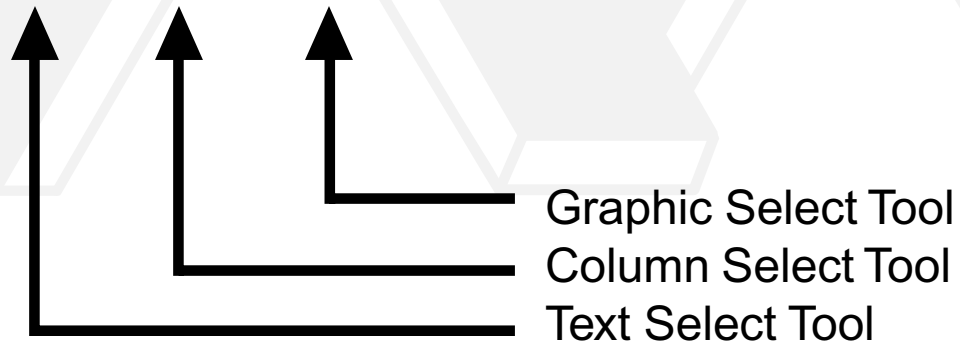
Zoom



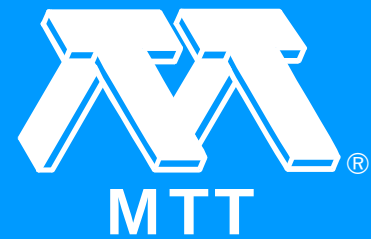
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Zoom In
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Graphic Select Tool
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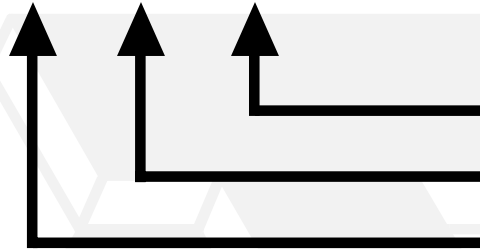


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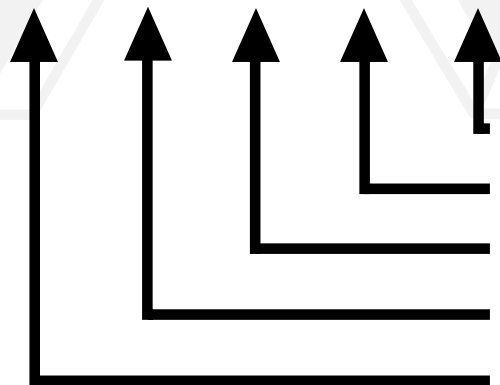
Page View



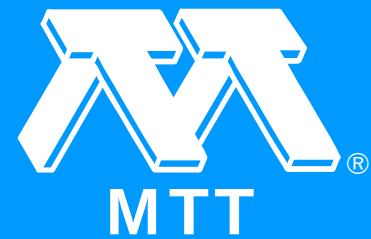
Fit Width
Fit in Window
Actual Size



Find/Search



Next Highlight (Hit)
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View Search Results
Search
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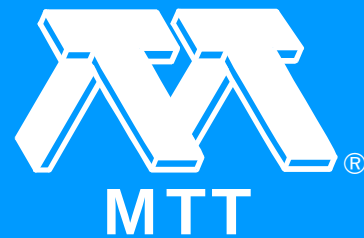
PERFORMING A “FIND”

Choosing Find opens a dialog box. Find scans linearly through the currently open Acrobat file from the cursor forward. If the Electronic Guide PDF is open, Find will scan the entire Electronic Guide for a match to your text. Type a text string in the field provided, check the appropriate options and press the “Find” button. Reader then highlights the first instance of the text string. To look at the next “hit”, click on the Find icon and press the “Find Again” button in the Acrobat Find window.

PERFORMING A “SEARCH”

Choosing the “Search” tool bar button or Search menu item (Edit > Search > Query), opens a dialog box from which you can access the more powerful full-text search engine (if you installed Acrobat Reader from this CD-ROM). Its dialog box is shown on the next page.

Typing a term in the text box at the top of the Search dialog box and pressing the “Search” button causes a full-text search of all words in the body of papers in the collection. If you have “Document Information” active in your Reader preferences, entering a term in one or more of the fixed fields (Title, Author, Subject or Keywords) will



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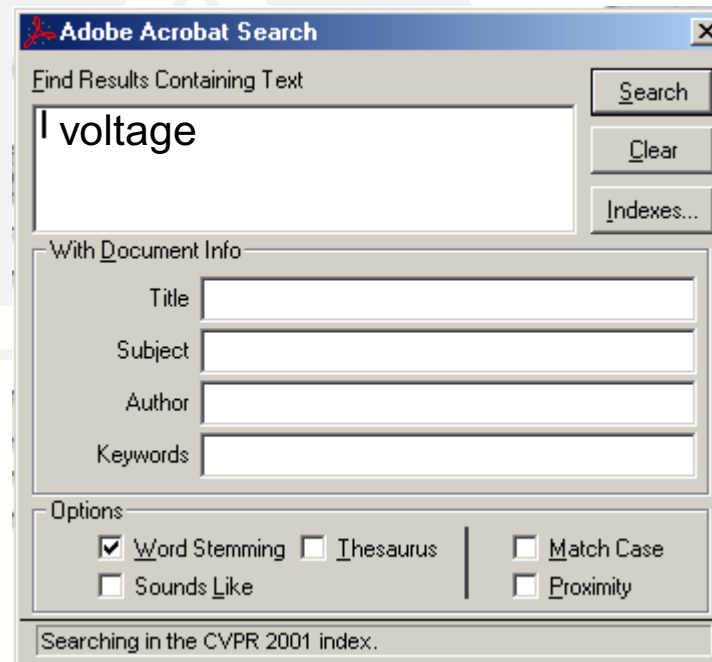


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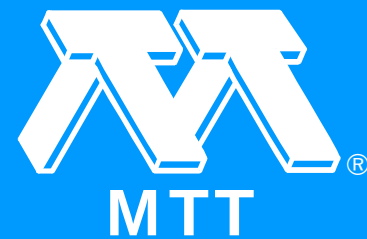
cause a search for hits in only those fields.

If you are not finding files you think should show in the results list, Acrobat may not be attached to the correct index file. To check, press the “Indexes...” button for a list of available indexes. If this collection is not listed, press the “Add...” button and look in the root directory of the CD-ROM for a file called “index.pdx”. Click on that file to add it to the list.

See the Reader Help (on Help menu) for more complete instructions on selecting appropriate options, constructing boolean queries, etc.



The screenshot shows the 'Adobe Acrobat Search' dialog box. It has a title bar with the Adobe logo and the text 'Adobe Acrobat Search'. Below the title bar is a section labeled 'Find Results Containing Text' with a text input field containing 'I voltage' and three buttons: 'Search', 'Clear', and 'Indexes...'. Below this is a section labeled 'With Document Info' containing four input fields: 'Title', 'Subject', 'Author', and 'Keywords'. At the bottom is an 'Options' section with four checkboxes: 'Word Stemming' (checked), 'Thesaurus' (unchecked), 'Match Case' (unchecked), and 'Sounds Like' (unchecked). There is also a 'Proximity' checkbox which is unchecked. At the very bottom of the dialog, a status bar reads 'Searching in the CVPR 2001 index.'



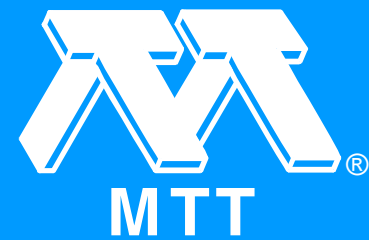
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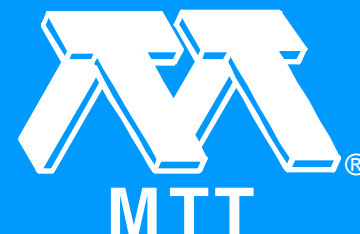
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2001 Transactions on Microwave Theory and Techniques

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- ☐ Jan. 2001 [T-MTT] (Mini-Special Issue on 2000 Radio-Frequency Integrated Circuits (RFIC) Conference and Automatic Radio Frequency Techniques Group (ARFTG) Meeting)
- ☐ Feb. 2001 [T-MTT]
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- ☐ Apr. 2001, Part I [T-MTT]
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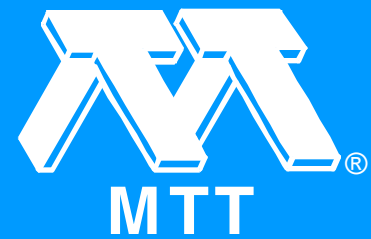


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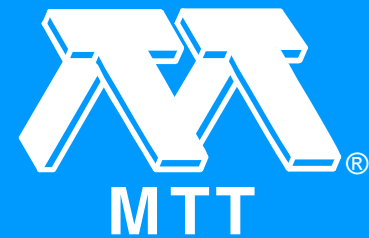
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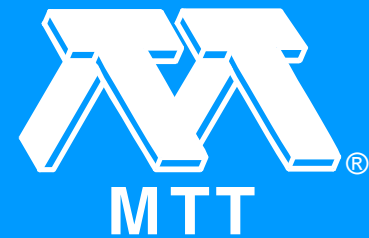
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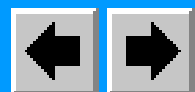


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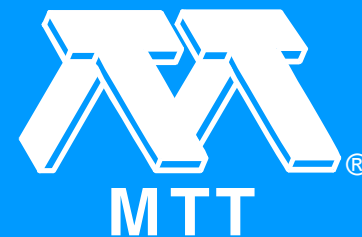
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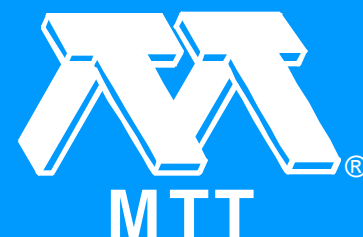
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- ❑ A compact manufacturable 76-77-GHz radar module for commercial ACC applications
- ❑ Cold tests and modeling of low-Q quasi-optical resonators
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- ❑ A design of the low-pass filter using the novel microstrip defected ground structure
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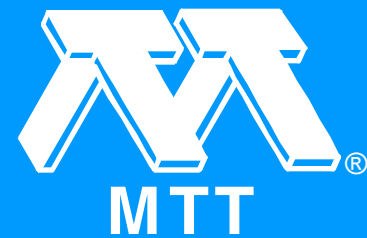
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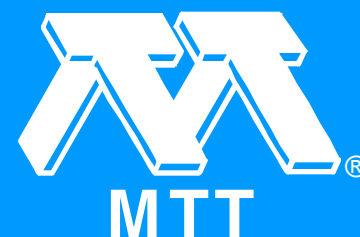
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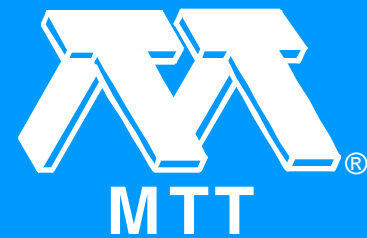
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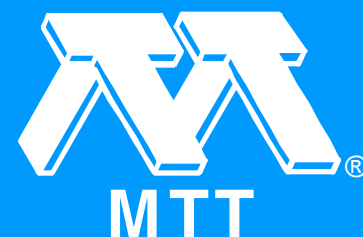
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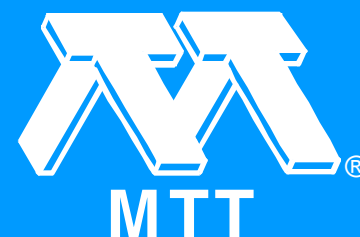
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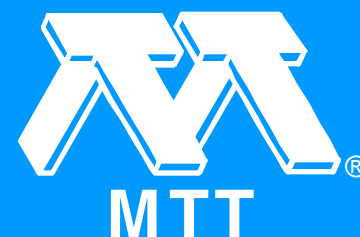
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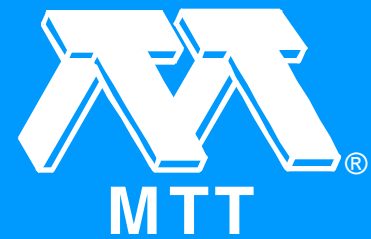
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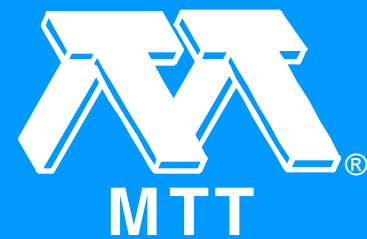
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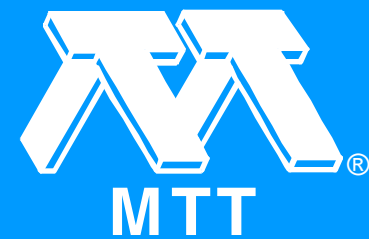
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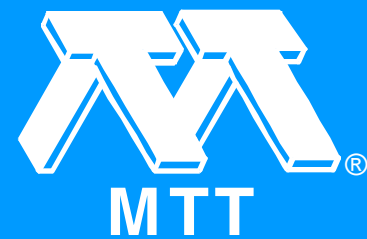
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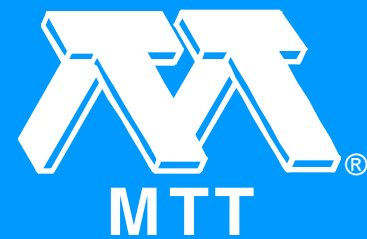
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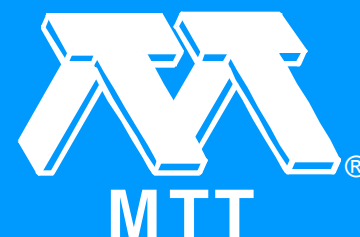
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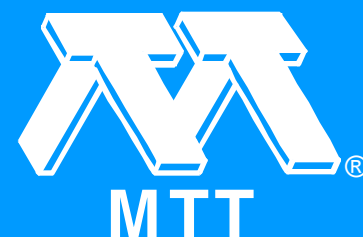
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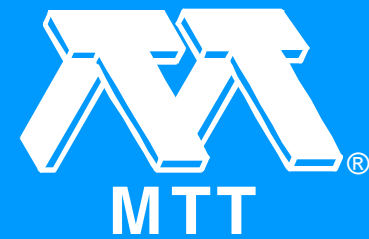
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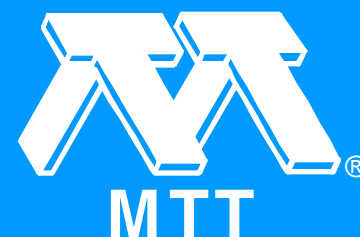
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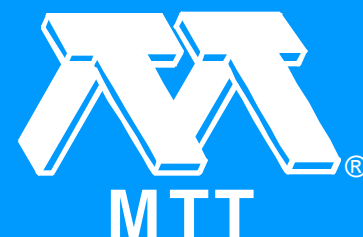
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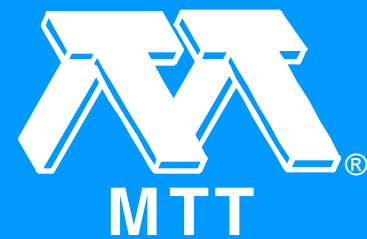
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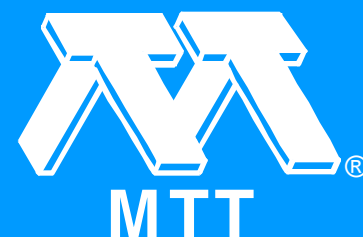
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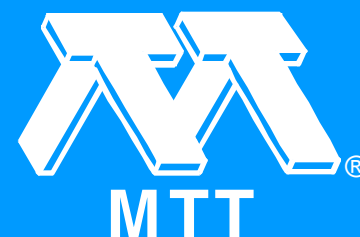
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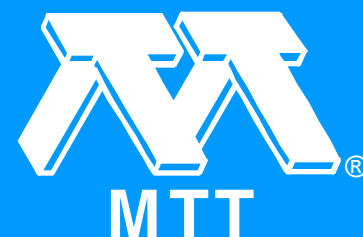
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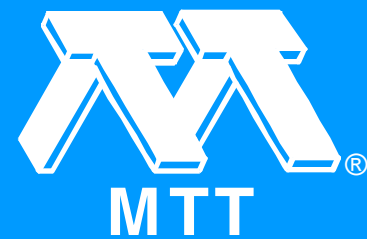
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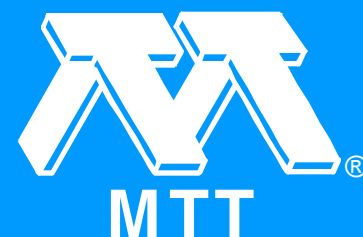
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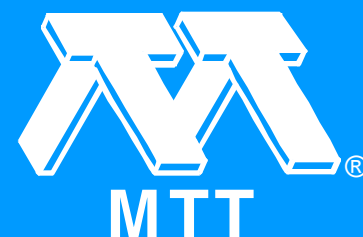
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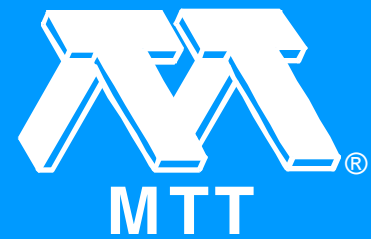
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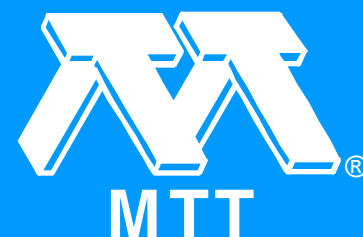
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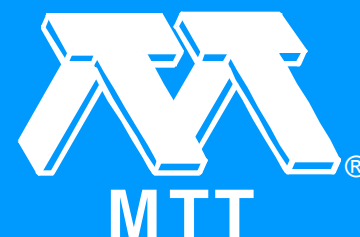
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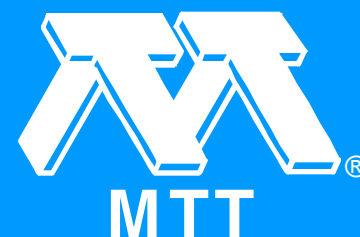
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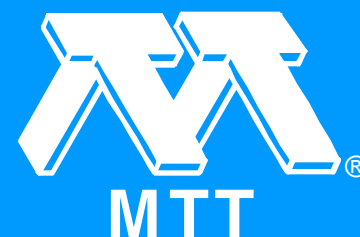
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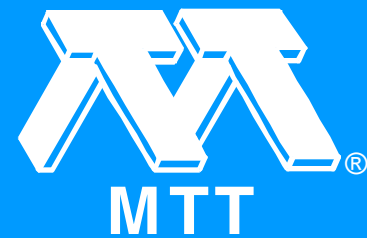
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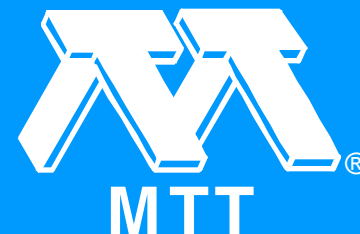


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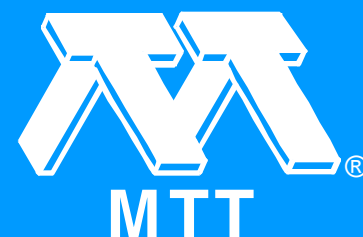
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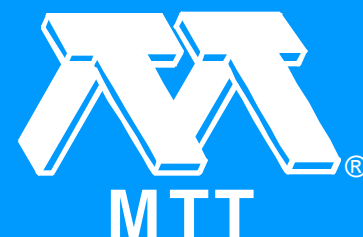
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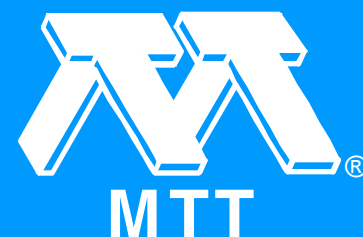
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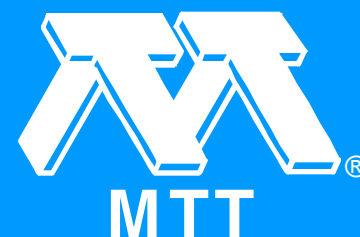
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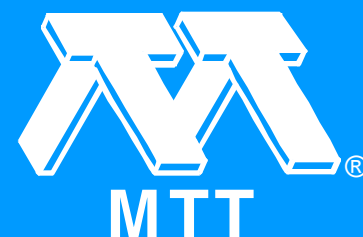
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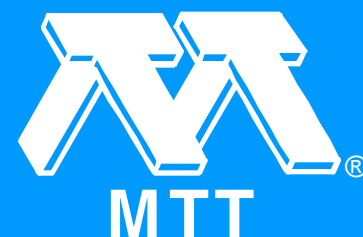
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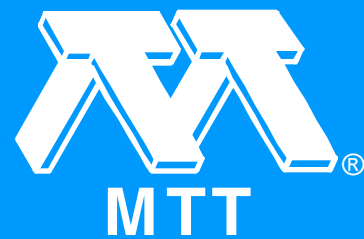
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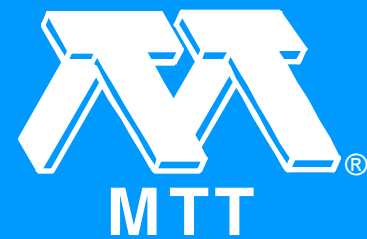
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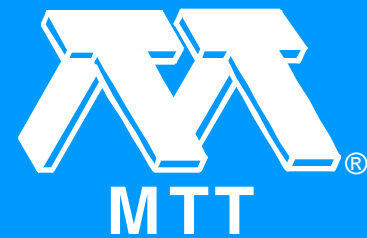
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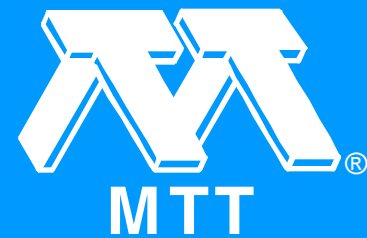
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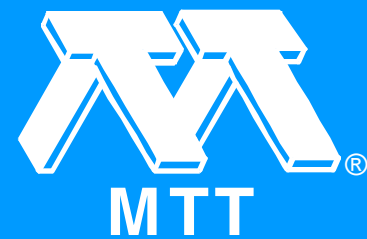
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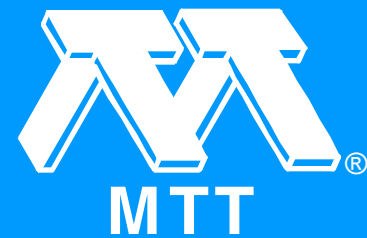
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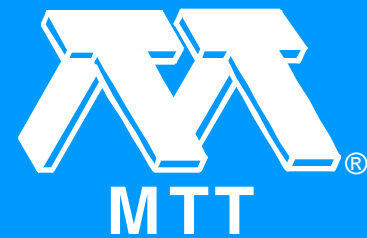
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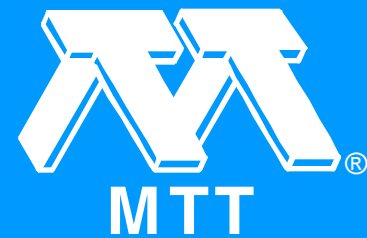
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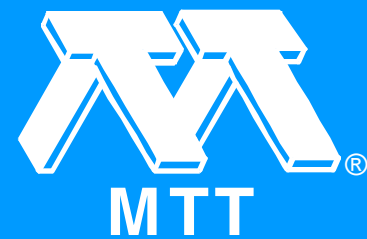
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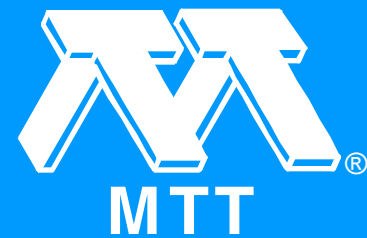
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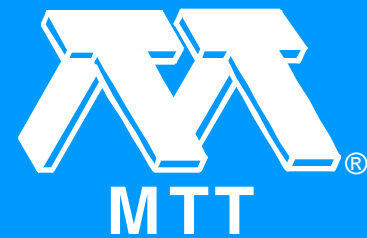
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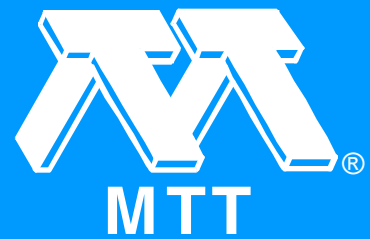
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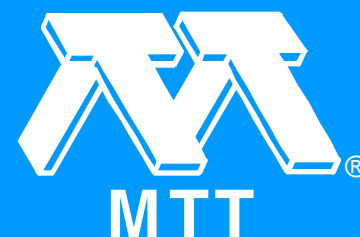
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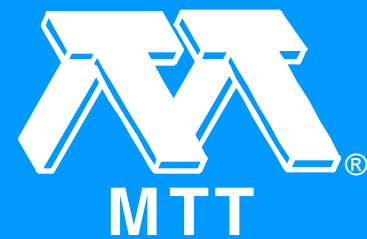
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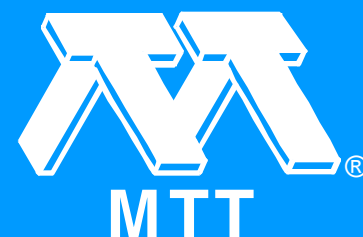
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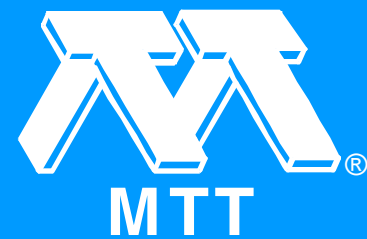
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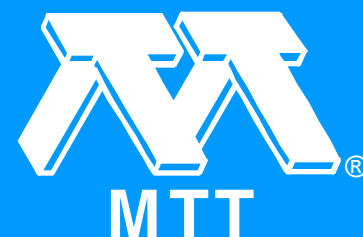
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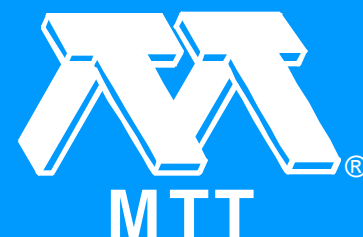
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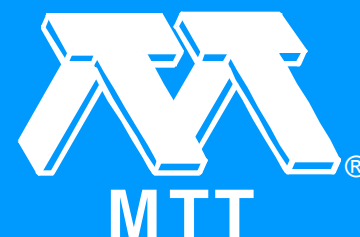
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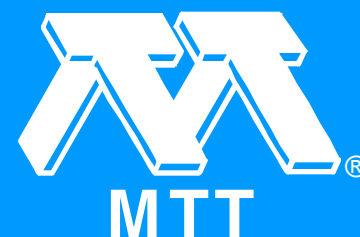
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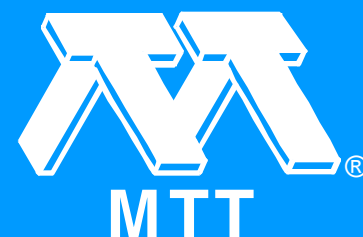
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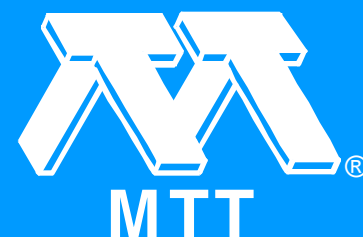
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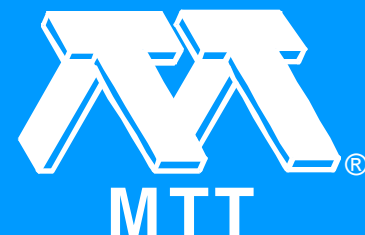
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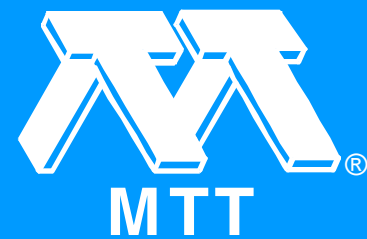
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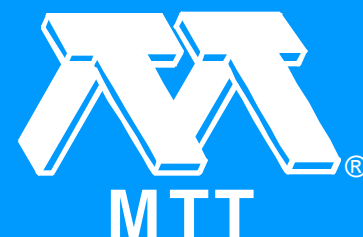
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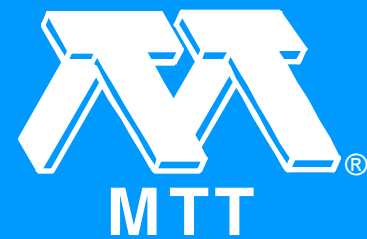
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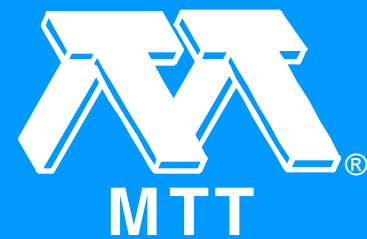
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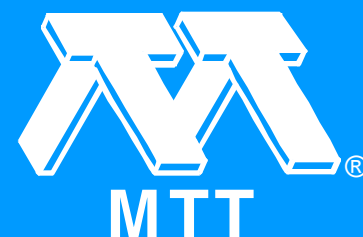
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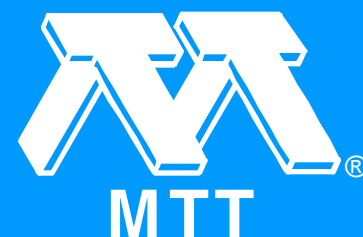
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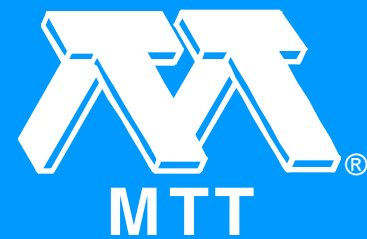
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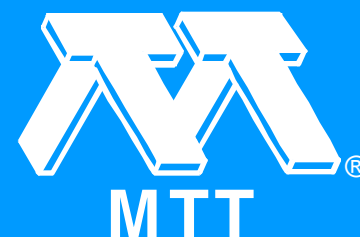
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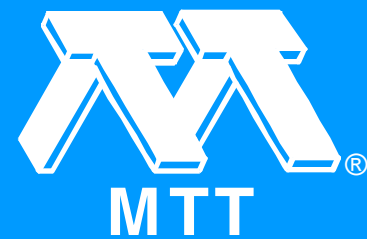
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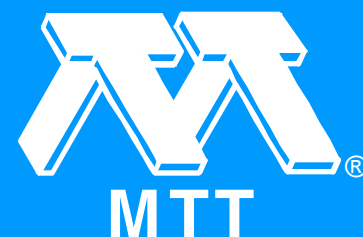
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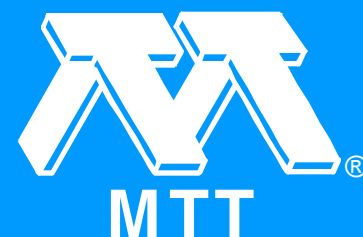
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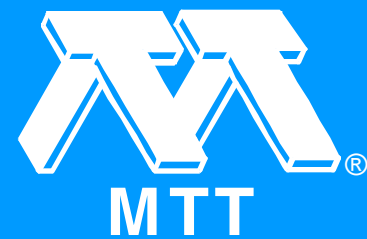
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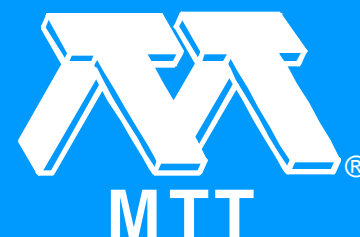
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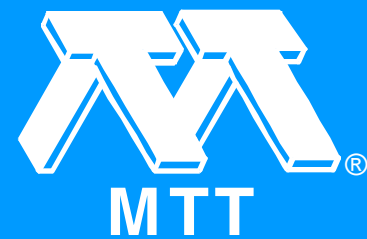
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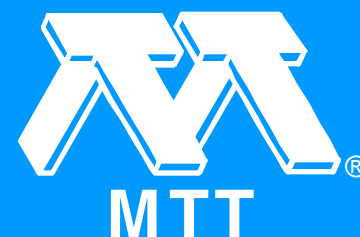
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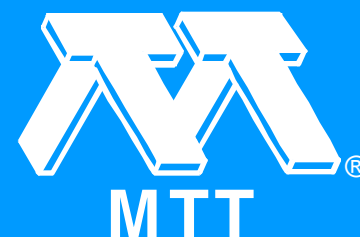
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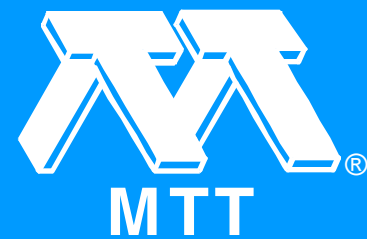
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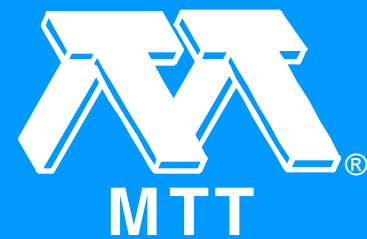
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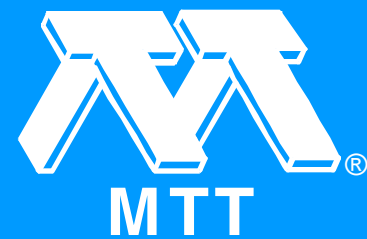
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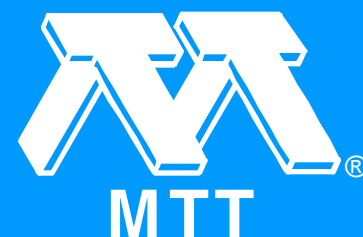
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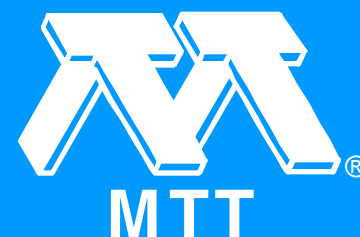
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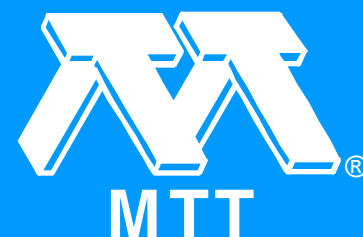
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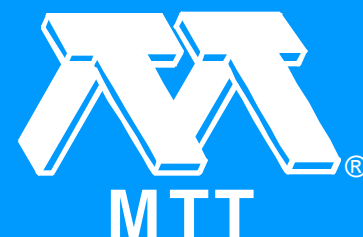
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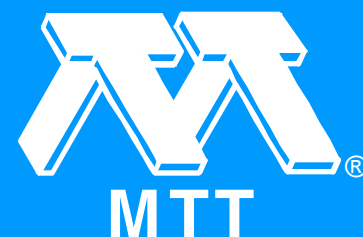
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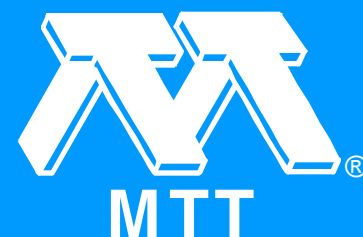
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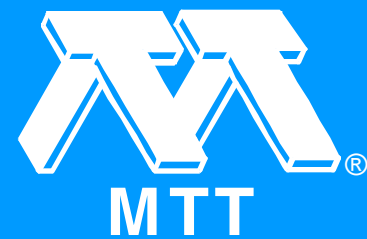
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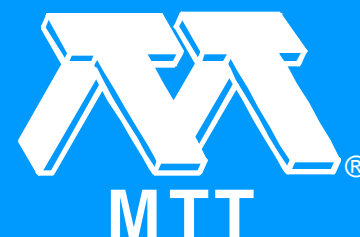
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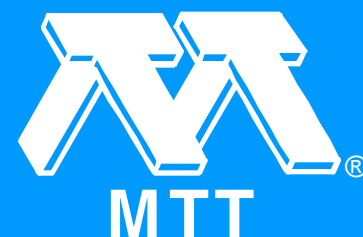
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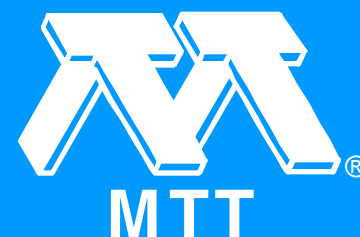
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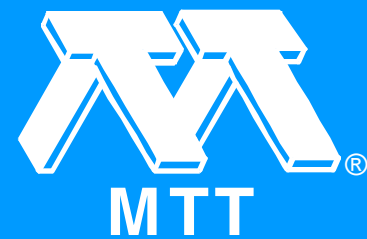
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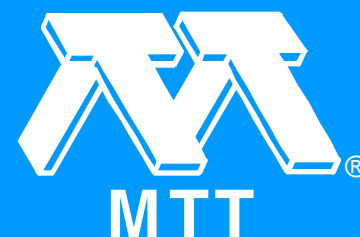
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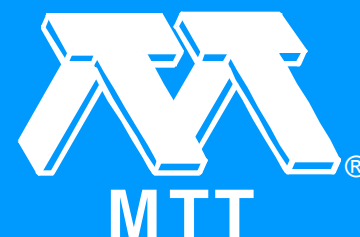
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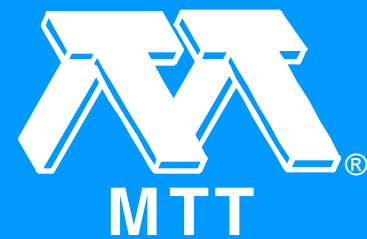
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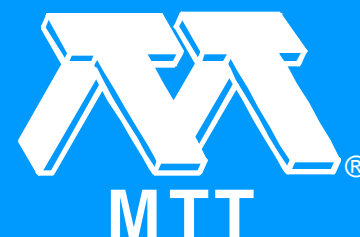
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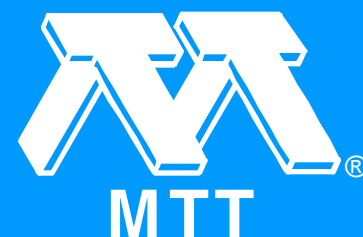
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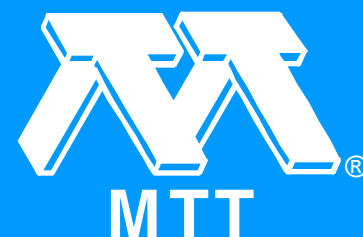
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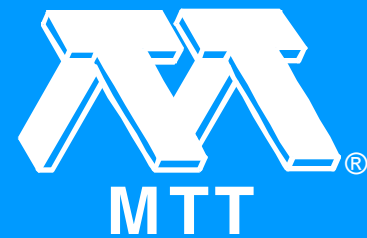
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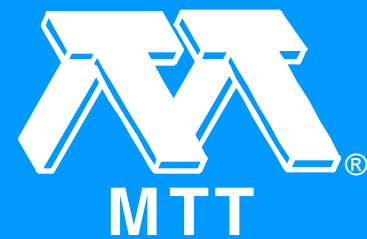
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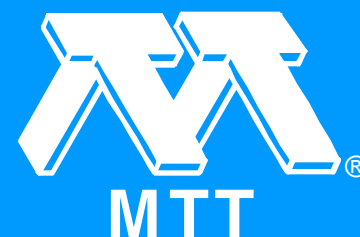
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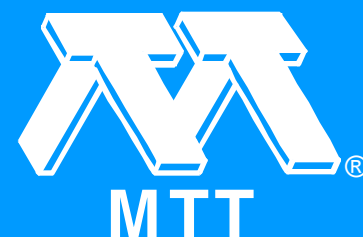
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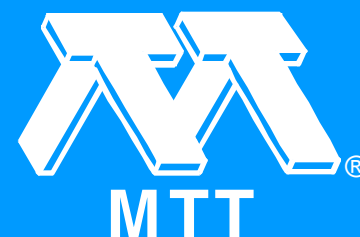
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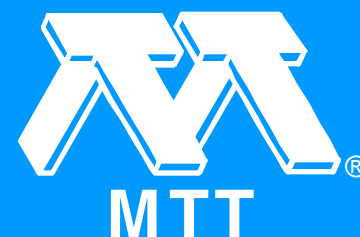
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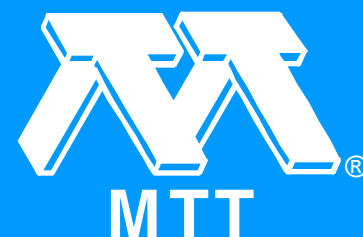
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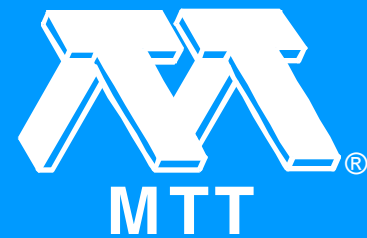
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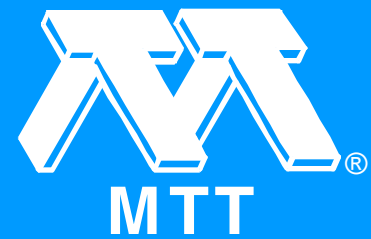
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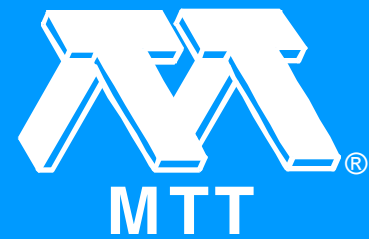
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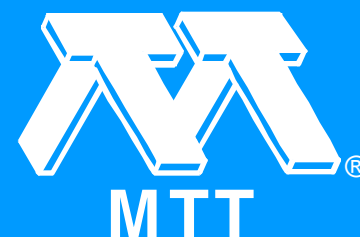
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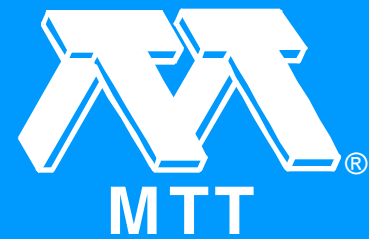
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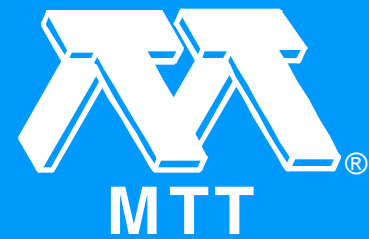
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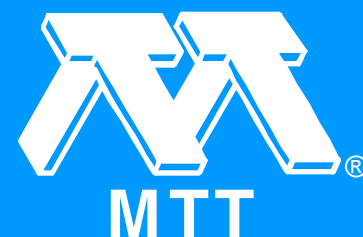
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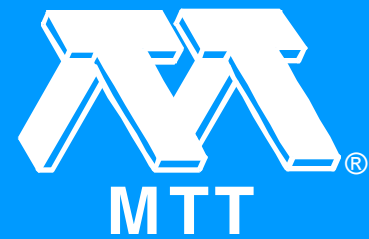
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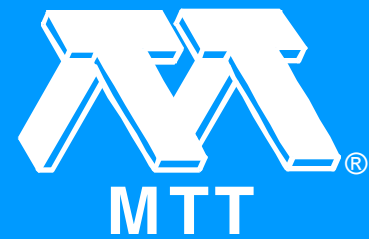
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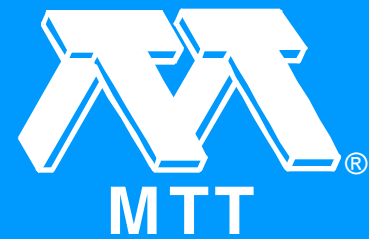
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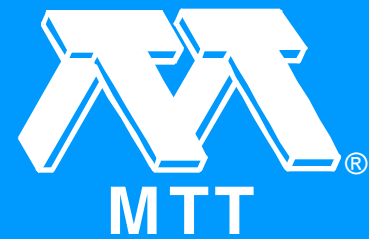
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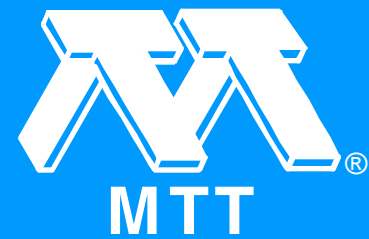
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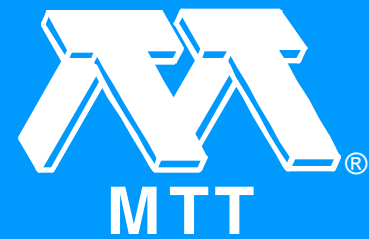
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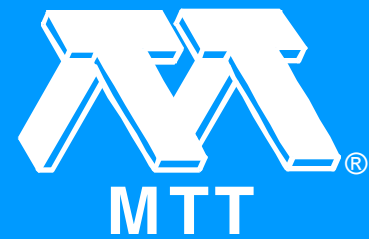
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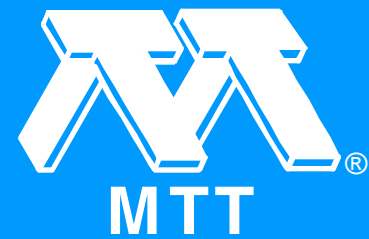
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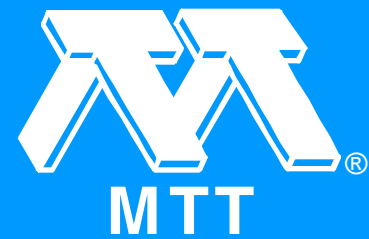
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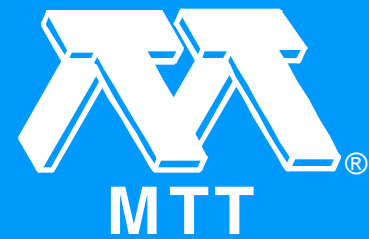
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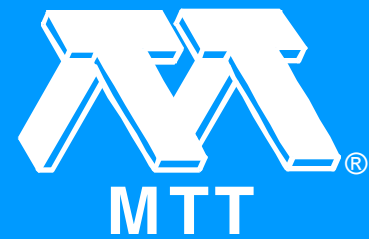
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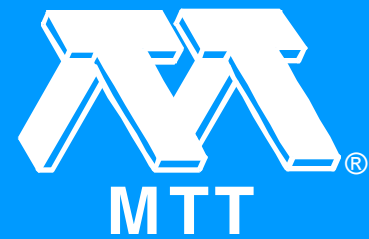
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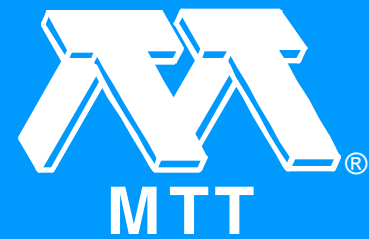
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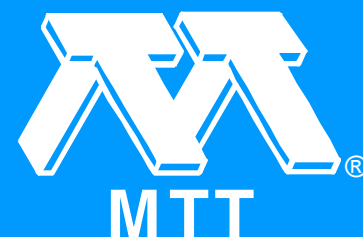
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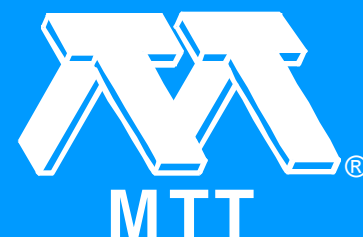
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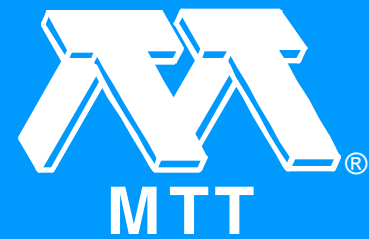
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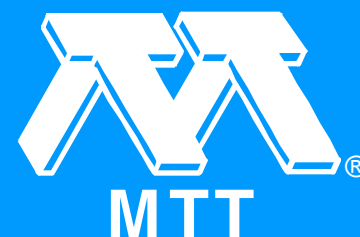
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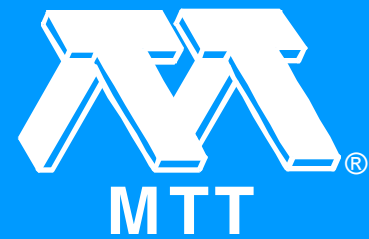
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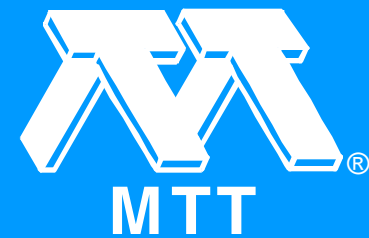
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Table of Contents (Jan. 2001 [T-MTT])

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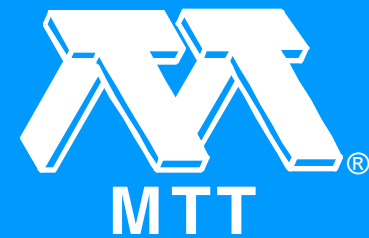
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"Inside Cover (Jan. 2001 [T-MTT])." 2001 Transactions on Microwave Theory and Techniques 49.1 (Jan. 2001 [T-MTT] (Mini-Special Issue on 2000 Radio-Frequency Integrated Circuits (RFIC) Conference and Automatic Radio Frequency Techniques Group (ARFTG) Meeting)): 0_3-0_4.



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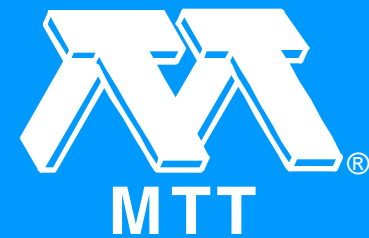
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J.W. Mink. "New Editor-in-Chief (Jan. 2001 [T-MTT])." 2001 Transactions on Microwave Theory and Techniques 49.1 (Jan. 2001 [T-MTT] (Mini-Special Issue on 2000 Radio-Frequency Integrated Circuits (RFIC) Conference and Automatic Radio Frequency Techniques Group (ARFTG) Meeting)): 1-1.



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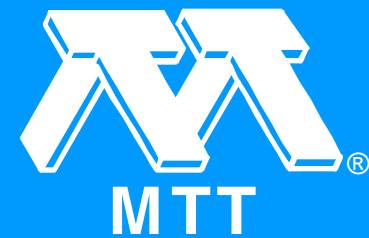
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Editorial (Jan. 2001 [T-MTT])

D. Rutledge. "Editorial (Jan. 2001 [T-MTT])." 2001 Transactions on Microwave Theory and Techniques 49.1 (Jan. 2001 [T-MTT] (Mini-Special Issue on 2000 Radio-Frequency Integrated Circuits (RFIC) Conference and Automatic Radio Frequency Techniques Group (ARFTG) Meeting)): 2-2.



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67-GHz static frequency divider using 0.2-/spl mu/m self-aligned SiGe HBTs

K. Washio, R. Hayami, E. Ohue, K. Oda, M. Tanabe, H. Shimamoto and M. Kondo. "67-GHz static frequency divider using 0.2-/spl mu/m self-aligned SiGe HBTs." 2001 Transactions on Microwave Theory and Techniques 49.1 (Jan. 2001 [T-MTT] (Mini-Special Issue on 2000 Radio-Frequency Integrated Circuits (RFIC) Conference and Automatic Radio Frequency Techniques Group (ARFTG) Meeting)): 3-8.

A 67-GHz 1/4 static frequency divider using 0.2-/spl mu/m self-aligned selective-epitaxial-growth SiGe heterojunction bipolar transistors, with a 122-GHz cutoff frequency, a 163-GHz maximum oscillation frequency, and an average emitter coupled logic gate delay time of 5.65 ps, was developed. The pretracking master-slave toggle flip-flop (MS-TFF) of the divider increases the maximum operating frequency to about 15% higher than that of a conventional MS-TFF, yet the power consumption of the divider is 175 mW, which is 1/5 that of comparable dividers, at a supply voltage of -5.2 V.



Power-amplifier modules covering 70-113 GHz using MMICs

Huei Wang, L. Samoska, T. Gaier, A. Peralta, Hsin-Hsing Liao, Y.C. Leong, S. Weinreb, Y.C. Chen, M. Nishimoto and R. Lai. "Power-amplifier modules covering 70-113 GHz using MMICs." *2001 Transactions on Microwave Theory and Techniques* 49.1 (Jan. 2001 [T-MTT] (Mini-Special Issue on 2000 Radio-Frequency Integrated Circuits (RFIC) Conference and Automatic Radio Frequency Techniques Group (ARFTG) Meeting)): 9-16.

A set of W-band power amplifier (PA) modules using monolithic microwave integrated circuits (MMICs) have been developed for the local oscillators of the far-infrared and sub-millimeter telescope (FIRST). The MMIC PA chips include three driver and three PAs, designed using microstrip lines, and another two smaller driver amplifiers using coplanar waveguides, covering the entire W-band. The highest frequency PA, which covers 100-113 GHz, has a peak power of greater than 250 mW (25 dBm) at 105 GHz, which is the best output power performance for a monolithic amplifier above 100 GHz to date. These monolithic PA chips are fabricated using 0.1- μm AlGaAs/InGaAs/GaAs pseudomorphic T-gate power high electron-mobility transistors on a 2-mil GaAs substrate. The module assembly and testing, together with the system applications, is also addressed in this paper.



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Fully integrated 5.35-GHz CMOS VCOs and prescalers

C.-M. Hung, B.A. Floyd, N. Park and K.O. Kenneth. "Fully integrated 5.35-GHz CMOS VCOs and prescalers." 2001 Transactions on Microwave Theory and Techniques 49.1 (Jan. 2001 [T-MTT] (Mini-Special Issue on 2000 Radio-Frequency Integrated Circuits (RFIC) Conference and Automatic Radio Frequency Techniques Group (ARFTG) Meeting)): 17-22.

Two 5.35-GHz monolithic voltage-controlled oscillators (VCOs) and two prescalers have been fabricated in a digital 0.25- μm CMOS process. One VCO uses p⁺/n-well diodes, while the other uses MOS varactors, Q of 57 at 5.5 GHz and 0 V bias (low-Q condition) for a p⁺/n-well varactor has been achieved. For an MOS varactor, it is possible to achieve a quality factor of 140 at 5.5 GHz. The tuning ranges of the VCOs are >310 MHz, and their phase noise is <-116.5 dBc/Hz at a 1-MHz offset while consuming 7 mW power at V_{DD}=1.5 V. The low phase noise is achieved by using only PMOS transistors in the VCO core and by optimizing the resonator layout. The prescalers utilize a variation of the source-coupled logic. The power consumption is 4.1 mW at 1.5-V V_{DD} and 5.4 GHz. By widening the transistors in the first three divide-by-two stages, the maximum operating frequency is increased to 9.96 GHz at V_{DD}=2.5 V.

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Effects of offsets on bipolar integrated circuit mixer even-order distortion terms

D. Coffing and E. Main. "Effects of offsets on bipolar integrated circuit mixer even-order distortion terms." 2001 Transactions on Microwave Theory and Techniques 49.1 (Jan. 2001 [T-MTT] (Mini-Special Issue on 2000 Radio-Frequency Integrated Circuits (RFIC) Conference and Automatic Radio Frequency Techniques Group (ARFTG) Meeting)): 23-30.

Second-order intermodulation products in bipolar double-balanced mixers can be generated due to device mismatches. These spurs are analyzed theoretically and in simulation. Guidelines are presented that show the maximum acceptable mismatch to meet a given second-order intercept-point specification.

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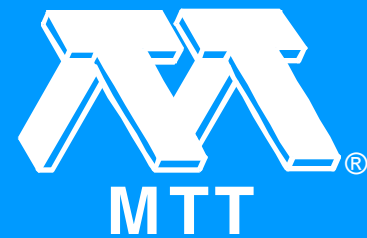
Analysis of current crowding effects in multiturn spiral inductors

W.B. Kuhn and N.M. Ibrahim. "Analysis of current crowding effects in multiturn spiral inductors." 2001 Transactions on Microwave Theory and Techniques 49.1 (Jan. 2001 [T-MTT] (Mini-Special Issue on 2000 Radio-Frequency Integrated Circuits (RFIC) Conference and Automatic Radio Frequency Techniques Group (ARFTG) Meeting)): 31-38.

The effective trace resistance of a multiturn spiral inductor operating at high frequencies is known to increase dramatically above its dc value, due to proximity effect or current crowding. This phenomenon, which dominates resistance increases due to skin effect, is difficult to analyze precisely and has generally required electromagnetic simulation for quantitative assessment. Current crowding is studied in this paper through approximate analytical modeling, and first-order expressions are derived for predicting resistance as a function of frequency. The results are validated through comparisons with electromagnetic simulations and compared with measured data taken from a spiral inductor implemented in a silicon-on-sapphire process.

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Accuracy evaluation of on-wafer load-pull measurements

A. Ferrero, V. Teppati and A. Carullo. "Accuracy evaluation of on-wafer load-pull measurements." 2001 Transactions on Microwave Theory and Techniques 49.1 (Jan. 2001 [T-MTT] (Mini-Special Issue on 2000 Radio-Frequency Integrated Circuits (RFIC) Conference and Automatic Radio Frequency Techniques Group (ARFTG) Meeting)): 39-43.

This paper investigates the residual calibration uncertainty effects in on-wafer load-pull measurements. After the systematic error correction (based on a traditional error-box model) has been applied, the residual uncertainty on absolute-power-level measurements can dramatically affect the accuracy of typical nonlinear parameters such as gain and power-added efficiency under different load conditions. The main residual uncertainty contributions are highlighted both by a theoretical analysis and experiments. Finally, one of the possible causes for intermodulation-distortion measurement errors is shown.

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A compact manufacturable 76-77-GHz radar module for commercial ACC applications

I. Gresham, N. Jain, T. Budka, A. Alexanian, N. Kinayman, B. Ziegner, S. Brown and P. Staecker. "A compact manufacturable 76-77-GHz radar module for commercial ACC applications." 2001 Transactions on Microwave Theory and Techniques 49.1 (Jan. 2001 [T-MTT] (Mini-Special Issue on 2000 Radio-Frequency Integrated Circuits (RFIC) Conference and Automatic Radio Frequency Techniques Group (ARFTG) Meeting)): 44-58.

The design and measured results of a single-substrate transceiver module suitable for 76-77-GHz pulsed-Doppler radar applications are presented. Emphasis on ease of manufacture and cost reduction of commercial millimeter-wave systems is employed throughout as a design parameter. The importance of using predictive modeling techniques in understanding the robustness of the circuit design is stressed. Manufacturing techniques that conform to standard high-volume assembly constraints have been used. The packaged transceiver module, including three waveguide ports and intermediate-frequency output, measures 20 mm/spl times/22 mm/spl times/8 mm. The circuit is implemented using discrete GaAs/AlGaAs pseudomorphic high electron mobility transistors (pHEMTs), GaAs Schottky diodes, and varactor diodes, as well as GaAs p-i-n and pHEMT monolithic microwave integrated circuits mounted on a low-cost 127-/spl mu/m-thick glass substrate. A novel microstrip-to-waveguide transition is described to transform the planar microstrip signal into the waveguide launch. The module is integrated with a quasi-optical antenna. The measured performance of both the component parts and the complete radar transceiver module is described.





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Cold tests and modeling of low-Q quasi-optical resonators

R.P. Fischer and A.W. Fliflet. "Cold tests and modeling of low-Q quasi-optical resonators." 2001 Transactions on Microwave Theory and Techniques 49.1 (Jan. 2001 [T-MTT] (Mini-Special Issue on 2000 Radio-Frequency Integrated Circuits (RFIC) Conference and Automatic Radio Frequency Techniques Group (ARFTG) Meeting)): 59-66.

Measurements are reported on low-Q open resonators at 85 GHz with a large centered coupling hole in each mirror. This is the first study of open resonators with large diffraction losses and efficient input coupling at millimeter wavelengths. The input resonator for a quasi-optical gyrokystron is described with quality factor $Q=2000$ and 13% round-trip losses where approximately 65% of the incident power in the waveguide is coupled to the fundamental TEM/sub 00/ mode. Two models have been developed to calculate the coupling from the rectangular waveguide through a circular aperture into the open resonator. Both models properly account for the increased diffraction loss of the resonator when coupling apertures are present. Measured results are in reasonably good agreement with values calculated using both scalar diffraction theory and an equivalent-circuit model.

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A generalized space-mapping tableau approach to device modeling

J.W. Bandler, N. Georgieva, M.A. Ismail, J.E. Rayas-Sanchez and Q.-J. Zhang. "A generalized space-mapping tableau approach to device modeling." 2001 Transactions on Microwave Theory and Techniques 49.1 (Jan. 2001 [T-MTT] (Mini-Special Issue on 2000 Radio-Frequency Integrated Circuits (RFIC) Conference and Automatic Radio Frequency Techniques Group (ARFTG) Meeting)): 67-79.

A comprehensive framework to engineering device modeling, which we call generalized space mapping (GSM) is introduced in this paper. GSM permits many different practical implementations. As a result, the accuracy of available empirical models of microwave devices can be significantly enhanced. We present three fundamental illustrations: a basic space-mapping super model (SMSM), frequency-space-mapping super model (FSMSM) and multiple space mapping (MSM). Two variations of MSM are presented: MSM for device responses and MSM for frequency intervals. We also present novel criteria to discriminate between coarse models of the same device. The SMSM, FSMSM, and MSM concepts have been verified on several modeling problems, typically utilizing a few relevant full-wave electromagnetic simulations. This paper presents four examples: a microstrip line, a microstrip right-angle bend, a microstrip step junction, and a microstrip shaped T-junction, yielding remarkable improvement within regions of interest.

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Temperature dependence of composite microwave cavities

D. Kajfez, S. Chebolu, A.A. Kishk and M.R. Abdul-Gaffoor. "Temperature dependence of composite microwave cavities." 2001 Transactions on Microwave Theory and Techniques 49.1 (Jan. 2001 [T-MTT] (Mini-Special Issue on 2000 Radio-Frequency Integrated Circuits (RFIC) Conference and Automatic Radio Frequency Techniques Group (ARFTG) Meeting)): 80-85.

Composite microwave resonant cavities contain several regions of different dielectric materials. The variation of the resonant frequency with temperature is described in terms of a linear model. One part of the frequency variation is caused by the physical expansion of material parts, and the other by the change in the relative dielectric constant. The frequency sensitivity coefficients for both types of variation are obtained with the use of a computer code for numerical analysis of the electromagnetic field inside bodies of revolution.

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A design of the low-pass filter using the novel microstrip defected ground structure

D. Ahn, J.-S. Park, C.-S. Kim, J. Kim, Y. Qian and T. Itoh. "A design of the low-pass filter using the novel microstrip defected ground structure." 2001 Transactions on Microwave Theory and Techniques 49.1 (Jan. 2001 [T-MTT] (Mini-Special Issue on 2000 Radio-Frequency Integrated Circuits (RFIC) Conference and Automatic Radio Frequency Techniques Group (ARFTG) Meeting)): 86-93.

A new defected ground structure (DGS) for the microstrip line is proposed in this paper. The proposed DGS unit structure can provide the bandgap characteristic in some frequency bands with only one or more unit lattices. The equivalent circuit for the proposed defected ground unit structure is derived by means of three-dimensional field analysis methods. The equivalent-circuit parameters are extracted by using a simple circuit analysis method. By employing the extracted parameters and circuit analysis theory, the bandgap effect for the provided defected ground unit structure can be explained. By using the derived and extracted equivalent circuit and parameters, the low-pass filters are designed and implemented. The experimental results show excellent agreement with theoretical results and the validity of the modeling method for the proposed defected ground unit structure.

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Extraction of network parameters in the electromagnetic analysis of planar structures using the method of moments

M.N. Abdulla and M.B. Steer. "Extraction of network parameters in the electromagnetic analysis of planar structures using the method of moments." 2001 Transactions on Microwave Theory and Techniques 49.1 (Jan. 2001 [T-MTT] (Mini-Special Issue on 2000 Radio-Frequency Integrated Circuits (RFIC) Conference and Automatic Radio Frequency Techniques Group (ARFTG) Meeting)): 94-103.

Integration of electromagnetic (EM) and circuit analyses for the modeling of spatially distributed microwave and millimeter-wave circuits requires the establishment of ports that are defined in both the circuit and EM realms. Four EM techniques are developed here and contrasted for the extraction of the port network parameters at circuit compatible ports. A full-wave method of-moments EM analysis directly yielding network parameters of a slot-stripline-slot structure is formulated.

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Model of thin-film microstrip line for circuit design

F. Schnieder and W. Heinrich. "Model of thin-film microstrip line for circuit design." 2001 Transactions on Microwave Theory and Techniques 49.1 (Jan. 2001 [T-MTT] (Mini-Special Issue on 2000 Radio-Frequency Integrated Circuits (RFIC) Conference and Automatic Radio Frequency Techniques Group (ARFTG) Meeting)): 104-110.

An equivalent-circuit model for the thin-film microstrip line (TFMSL) is presented in this paper. Its elements are calculated using closed-form expressions and, thus, this model can easily be implemented in common circuit design tools. For typical TFMSL dimensions, it holds from DC up to the submillimeter-wave frequency range. The model is validated by comparison to electromagnetic full-wave simulation data. Typical errors of phase constant and characteristic impedance are below 2% and 3%, respectively. Regarding attenuation, deviations below 8% are found.

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Resonant modes of a concentric spherical cavity with conically stratified medium

P. Kandasamy and N. Okamoto. "Resonant modes of a concentric spherical cavity with conically stratified medium." 2001 Transactions on Microwave Theory and Techniques 49.1 (Jan. 2001 [T-MTT] (Mini-Special Issue on 2000 Radio-Frequency Integrated Circuits (RFIC) Conference and Automatic Radio Frequency Techniques Group (ARFTG) Meeting)): 111-118.

An analysis on electromagnetic fields of a cavity formed by two concentric conducting spheres with a conically stratified medium is presented in this paper. Angular transmission formulation and the radial eigenfunction expansion are used to formulate the field components. Boundary matching methods are applied to obtain the characteristic equations containing various infinite series of spherical Hankel functions and Legendre functions of complex order for resonant frequencies. The first two resonant frequencies and field expansion coefficients are determined numerically. The distribution pattern of angular field components and the forms of typical electric field lines and magnetic field lines for the first resonant fields are also indicated.

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A multiresolution MoM analysis of multiport structures using matched terminations

R. Loison, R. Gillard, J. Citerne, G. Piton and H. Legay. "A multiresolution MoM analysis of multiport structures using matched terminations." 2001 Transactions on Microwave Theory and Techniques 49.1 (Jan. 2001 [T-MTT] (Mini-Special Issue on 2000 Radio-Frequency Integrated Circuits (RFIC) Conference and Automatic Radio Frequency Techniques Group (ARFTG) Meeting)): 119-127.

This paper presents the modeling of microstrip structures involving matched terminations with a one-dimensional multiresolution method of moment (MRMoM). Semiorthogonal spline wavelets are used as basis and testing functions. For large structures, the MRMoM generates a sparse linear system, which permits a significant reduction of the central processing unit time and of the memory storage. The modeling of matched terminations also enables a full characterization of multiport microstrip structures. Theoretical results involving microstrip dipoles are presented and compared with experiments.

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Criteria for wide-band radial switch design

Q. Wang, M. Lecours and C. Vergnolle. "Criteria for wide-band radial switch design." 2001 Transactions on Microwave Theory and Techniques 49.1 (Jan. 2001 [T-MTT] (Mini-Special Issue on 2000 Radio-Frequency Integrated Circuits (RFIC) Conference and Automatic Radio Frequency Techniques Group (ARFTG) Meeting)): 128-132.

This paper presents criteria for the design of radial switches, such as can be used in electronically steered circular array antennas for satellite communications mobile terminals. The choice of the switching circuit and diode used in each channel is discussed and the required inductance for the diode shunt capacitance compensation for lower insertion loss is given. Analytical formulas are derived for the general case of an ideal transmission-line switch to show the dependence of the return-loss bandwidth on the choices of the line impedance. Important optimization criteria for lower insertion loss and increased bandwidth are drawn. The criteria have been used to guide the design of economical L-band microstrip switches for use in INMARSAT/MSAT antenna arrays, using low-cost printed-circuits and surface-mount plastic-encapsulated p-i-n diodes. Implementation results for insertion loss, reflection coefficient, and isolation between channels are reported.

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An algorithm for calculating the coupling between MMICs with block dielectric coverings

Z. Wang and R.W. Jackson. "An algorithm for calculating the coupling between MMICs with block dielectric coverings." 2001 Transactions on Microwave Theory and Techniques 49.1 (Jan. 2001 [T-MTT] (Mini-Special Issue on 2000 Radio-Frequency Integrated Circuits (RFIC) Conference and Automatic Radio Frequency Techniques Group (ARFTG) Meeting)): 133-141.

In this paper, a computer-aided design (CAD) algorithm is presented for determining the coupling between sealant covered monolithic microwave integrated circuits (MMICs) in a multichip module. It is assumed that the MMICs are sufficiently separated that near-field coupling can be neglected and that TM/sub 0/ parallel-plate fields dominate. It is also assumed that the MMICs are each covered by a sealant of size commensurate with the MMIC. The technique presented is computationally simple, appropriate for use with layout-based circuit CAD software, and uses no numerical electromagnetics. It has been tested by comparison to full-wave electromagnetic simulation. In simple test cases, this technique showed over two orders of magnitude increase in speed. For larger problems, the increase in speed will be more pronounced.

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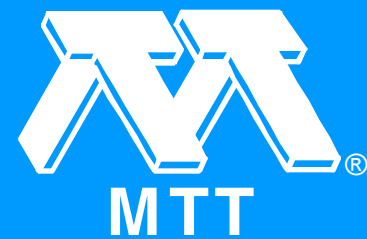
Modeling and characterization of the bonding-wire interconnection

F. Alimenti, P. Mezzanotte, L. Roselli and R. Sorrentino. "Modeling and characterization of the bonding-wire interconnection." 2001 Transactions on Microwave Theory and Techniques 49.1 (Jan. 2001 [T-MTT] (Mini-Special Issue on 2000 Radio-Frequency Integrated Circuits (RFIC) Conference and Automatic Radio Frequency Techniques Group (ARFTG) Meeting)): 142-150.

In this paper, the bonding-wire interconnection has been studied from the points of view of its modeling and electrical characterization. Both single and double-wire structures have been considered, the latter under the assumption of parallel wires. Two electrical models of the bonding wire are discussed. First, the finite-difference time-domain (FDTD) method is proposed for the rigorous analysis of such structures. This method uses a suitable discretization technique, which accounts for the wire curvature by means of a polygonal approximation. A quasi-static model of the bonding wire, suitable for commercial microwave computer-aided-design tools is then proposed. This model is based on the representation of the structure with four sections of a uniform transmission line and the model parameters are evaluated analytically from the dimensions of the interconnection. Accuracy and applicability of the quasi-static model have been assessed by analyzing several test structures, the reference results being obtained with the FDTD method. Finally, the quasi-static model has been used to provide an extensive electrical characterization of the bonding wire versus its main geometrical parameters. This characterization is given in terms of an equivalent series inductance and two equivalent shunt capacitances forming a π low-pass network. This representation is particularly useful in the matching of the bonding-wire discontinuity.

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Efficient large-domain MoM solutions to electrically large practical EM problems

B.M. Notaros, B.D. Popovic, J.P. Weem, R.A. Brown and Z. Popovic. "Efficient large-domain MoM solutions to electrically large practical EM problems." 2001 Transactions on Microwave Theory and Techniques 49.1 (Jan. 2001 [T-MTT] (Mini-Special Issue on 2000 Radio-Frequency Integrated Circuits (RFIC) Conference and Automatic Radio Frequency Techniques Group (ARFTG) Meeting)): 151-159.

A numerical method is presented for the analysis and design of a wide variety of electromagnetic (EM) structures consisting of dielectric and conducting parts of arbitrary shapes. The method is based on the integral-equation formulation in frequency domain, and represents a large domain (high-order expansion) Galerkin-type version of the method of moments (MoM). The method is formulated in two versions concerning the type of the equivalence (volume and surface) utilized in the treatment of the dielectric parts of the structure. The generality, versatility, accuracy, and practicality of the method and code are demonstrated on four very diverse, electrically large, and complex EM problems. The examples are: an X-band reflector antenna modeled after a bat's ear, which is about $11/\sqrt{3}$ large at X-band; a broad-band (0.5-4.5 GHz) nested array of crossed loaded dipoles; an EM system consisting of a dipole antenna and a human body, and a broad-band (1-5 GHz) microstrip-fed Vivaldi antenna with a high-permittivity dielectric substrate. The central processing unit times with a modest personal computer are on the order of several minutes for a single-frequency application.

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On the definition of the generalized scattering matrix of a lossless multiport

A. Morini and T. Rozzi. "On the definition of the generalized scattering matrix of a lossless multiport." 2001 Transactions on Microwave Theory and Techniques 49.1 (Jan. 2001 [T-MTT] (Mini-Special Issue on 2000 Radio-Frequency Integrated Circuits (RFIC) Conference and Automatic Radio Frequency Techniques Group (ARFTG) Meeting)): 160-165.

In this paper, we reconsider the question of the definition of the generalized scattering matrix (GSM) of a lossless device, and show the conditions that the GSM must satisfy in order to correctly represent a lossless device, independently of the method used for its calculation. Moreover, starting from circuit theory, possible choices are considered, and among them the one is examined that seems to be the most meaningful when dealing with modes below cutoff. When the circuit is lossless, in fact, the resulting GSM is unitary, even when modes below cutoff are taken as accessible. This property provides an immediate check of the correctness of the computational implementation of actual problems. Finally, a practical example of the usefulness of the conditions provided is shown.



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Analysis of eddy-current losses over conductive substrates with applications to monolithic inductors and transformers

A.M. Niknejad and R.G. Meyer. "Analysis of eddy-current losses over conductive substrates with applications to monolithic inductors and transformers." 2001 Transactions on Microwave Theory and Techniques 49.1 (Jan. 2001 [T-MTT] (Mini-Special Issue on 2000 Radio-Frequency Integrated Circuits (RFIC) Conference and Automatic Radio Frequency Techniques Group (ARFTG) Meeting)): 166-176.

In this paper, a closed-form integral representation for the eddy-current losses over a conductive substrate is presented. The results are applicable to monolithic inductors and transformers, especially when such structures are realized over an epitaxial CMOS substrate. The technique is verified against measured results from 100 MHz to 14 GHz for spiral inductors.

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Full-wave analysis of nonplanar transmission lines on layered medium by means of MPIE and complex image theory

J. Bernal, F. Medina and R.R. Boix. "Full-wave analysis of nonplanar transmission lines on layered medium by means of MPIE and complex image theory." 2001 Transactions on Microwave Theory and Techniques 49.1 (Jan. 2001 [T-MTT] (Mini-Special Issue on 2000 Radio-Frequency Integrated Circuits (RFIC) Conference and Automatic Radio Frequency Techniques Group (ARFTG) Meeting)): 177-185.

In this paper, a multiconductor transmission line consisting of arbitrary cross-sectional perfect conductors printed on a layered isotropic or uniaxial anisotropic dielectric medium is analyzed by solving the mixed-potential integral equation for the free-surface currents. Closed-form expressions of the two-dimensional space-domain Green's functions for the electrodynamic potentials are used. These expressions are obtained by applying the complex image technique to the spectral functions remaining after removing the asymptotic and pole contributions from the original Green's functions. A single set of complex images is obtained for any guess value of the unknown propagation constant and for any pair of source/field points. In addition, the reaction integrals involved in the application of the method of moments are worked out in a quasi-analytical way. The final result is an accurate and highly efficient computation code for analyzing multiconductor structures printed on a layered medium.

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A unified model for single/multifinger HBTs including self-heating effects

A. Garlapati and S. Prasad. "A unified model for single/multifinger HBTs including self-heating effects." 2001 Transactions on Microwave Theory and Techniques 49.1 (Jan. 2001 [T-MTT] (Mini-Special Issue on 2000 Radio-Frequency Integrated Circuits (RFIC) Conference and Automatic Radio Frequency Techniques Group (ARFTG) Meeting)): 186-191.

This paper presents a unified analytical large-signal model that includes self-heating effects. The model is applied to a single-finger AlGaAs/GaAs heterojunction bipolar transistor (HBT) and a multifinger InGaAs/GaAs HBT. The self-heating effect in the HBT is simulated as a feedback from the collector current to the base-emitter voltage. The main advantage of the circuit presented here is that additional analysis of coupling between electrical and thermal circuits is not required, as is the case with the existing models. The small-signal HBT model is implemented based on the S-parameters at multiple frequencies measured at multiple bias points. This model is verified by comparing the measured and simulated S-parameters. The large-signal model is based on the forward Gummel plot and is built over the small-signal model. This model is verified by comparing the simulated and measured dc I-V characteristics.

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Relationship between group delay and stored energy in microwave filters

C. Ernst, V. Postoyalko and N.G. Khan. "Relationship between group delay and stored energy in microwave filters." 2001 Transactions on Microwave Theory and Techniques 49.1 (Jan. 2001 [T-MTT] (Mini-Special Issue on 2000 Radio-Frequency Integrated Circuits (RFIC) Conference and Automatic Radio Frequency Techniques Group (ARFTG) Meeting)): 192-196.

In this paper, an expression for the time average stored energy (t.a.s.e.) in a passive lossless two-port is derived in terms of its scattering parameters. In particular, it is shown that the t.a.s.e. in a passive lossless reciprocal symmetrical or antisymmetrical two-port is proportional to the group delay. One implication of this result is that the t.a.s.e., which is linked to the power-handling capability in many passive filters used in practice, is proportional to the group delay of the filter. This rigorous derivation is based on a variational theorem, which has been used in the past to prove energy storage results for passive lossless one-ports and periodic two-ports.

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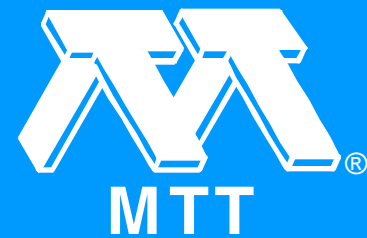


Abstracts

Exact analysis of coupled nonuniform transmission lines with exponential power law characteristic impedance

A. Cheldavi. "Exact analysis of coupled nonuniform transmission lines with exponential power law characteristic impedance." 2001 Transactions on Microwave Theory and Techniques 49.1 (Jan. 2001 [T-MTT] (Mini-Special Issue on 2000 Radio-Frequency Integrated Circuits (RFIC) Conference and Automatic Radio Frequency Techniques Group (ARFTG) Meeting)): 197-199.

A new method for frequency domain and transient analysis of the multiple coupled lossless nonuniform transmission lines with general exponential power law characteristic impedance will be presented in this paper. First, the analytical solution in frequency domain (as ABCD and S-parameters matrices) is obtained using the Frobenius method, and then a simple fast Fourier transform algorithm is used to find the time-domain response of the lines.



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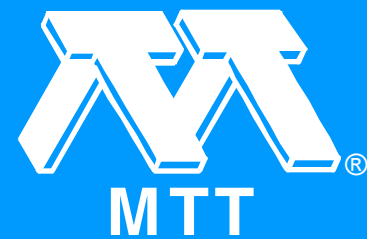


Abstracts

Design and characterization of a microwave feed-forward amplifier with improved wide-band distortion cancellation

Y.K.G. Han, V. Postoyalko and J.R. Richardson. "Design and characterization of a microwave feed-forward amplifier with improved wide-band distortion cancellation." 2001 Transactions on Microwave Theory and Techniques 49.1 (Jan. 2001 [T-MTT] (Mini-Special Issue on 2000 Radio-Frequency Integrated Circuits (RFIC) Conference and Automatic Radio Frequency Techniques Group (ARFTG) Meeting)): 200-203.

A new approach to the design of a wide-band feed-forward amplifier (FFAMP) is presented in this paper. Phase equalizers are employed in an FFAMP to match the nonlinear delay/phase characteristics of the main and error amplifiers, improving phase balances within the cancellation loops and providing improvement in signal cancellations over a wide bandwidth. The proposed 1.7-1.9-GHz FFAMP was fabricated and characterized. The conventional FFAMP obtains an average of 15-dB third-order intermodulation (IM3) distortion cancellation over the whole bandwidth. With the phase equalizers, the proposed FFAMP achieves a further 6-dB reduction on IM3 level.



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Design of a low-supply-voltage high-efficiency class-E voltage-controlled MMIC oscillator at C-band

F. Ellinger, U. Lott and W. Bachtold. "Design of a low-supply-voltage high-efficiency class-E voltage-controlled MMIC oscillator at C-band." 2001 Transactions on Microwave Theory and Techniques 49.1 (Jan. 2001 [T-MTT] (Mini-Special Issue on 2000 Radio-Frequency Integrated Circuits (RFIC) Conference and Automatic Radio Frequency Techniques Group (ARFTG Meeting))): 203-206.

In this paper, a monolithically integrated voltage-controlled class-E tuned oscillator for C-band has been designed and measured. Large-signal optimization was performed using analytically calculated starting values to reach high efficiencies at ultra-low supply voltages down to 0.9 V. The range of the tuning voltage is from 0 to the supply voltage. With a supply voltage of 1.8 V, an output power of 6.5 dBm, an efficiency of 43%, and a tuning range of 150 MHz is achieved at a center frequency of 4.4 GHz. With a supply voltage of only 0.9 V, the efficiency is 36%, with an output power of 1.1 dBm, and a tuning range of 80 MHz at a frequency of 3.6 GHz. Chip size is less than 1 mm/sup 2/.

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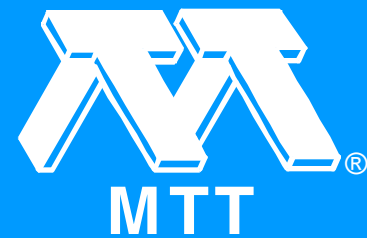
Application of the nonuniform FDTD technique to analysis of coaxial discontinuity structures

W. Yu, R. Mittra and S. Dey. "Application of the nonuniform FDTD technique to analysis of coaxial discontinuity structures." 2001 Transactions on Microwave Theory and Techniques 49.1 (Jan. 2001 [T-MTT] (Mini-Special Issue on 2000 Radio-Frequency Integrated Circuits (RFIC) Conference and Automatic Radio Frequency Techniques Group (ARFTG) Meeting)): 207-209.

In this paper, we employ the nonuniform finite-difference time-domain (NUFDTD) technique to accurately model discontinuities in complex coaxial configurations. We take advantage of the azimuthal symmetry of the structure to reduce the original problem into an equivalent two-dimensional one, and we do this by projecting the three-dimensional Yee cell onto two-dimensional planes. Numerical results are presented for various discontinuities to illustrate the application of the method. We show that the NUFDTD technique yields results that are in excellent agreement with the mode-matching method.

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Application of Sonie-Schafheitlin formula and sampling theorem in spectral-domain method

B.-L. Ooi, P.-S. Kooi and M.-S. Leong. "Application of Sonie-Schafheitlin formula and sampling theorem in spectral-domain method." 2001 Transactions on Microwave Theory and Techniques 49.1 (Jan. 2001 [T-MTT] (Mini-Special Issue on 2000 Radio-Frequency Integrated Circuits (RFIC) Conference and Automatic Radio Frequency Techniques Group (ARFTG) Meeting)): 210-213.

In this paper, the Sonie-Schafheitlin integration formula and the sampling theorem are integrated into the conventional spectral-domain method to form an efficient and fast convergent hybrid method. As a simple demonstration of the method, the novel technique is applied to the microstrip dispersion problem. The incorporation of the Sonie-Schafheitlin integration formula and the sampling theorem aid to accelerate the convergence of the Sommerfeld integral. Good agreement between the simulated results and the conventional method are obtained.

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Scattering matrices representing the transformations between modal bases in rectangular waveguide

A. Morini, T. Rozzi and L. Zappelli. "Scattering matrices representing the transformations between modal bases in rectangular waveguide." 2001 Transactions on Microwave Theory and Techniques 49.1 (Jan. 2001 [T-MTT] (Mini-Special Issue on 2000 Radio-Frequency Integrated Circuits (RFIC) Conference and Automatic Radio Frequency Techniques Group (ARFTG) Meeting)): 213-216.

The excitation of hybrid modes by discontinuities in rectangular waveguide can often be decomposed into separate LSE/LSM or TE/TM mechanisms, so that each component can be analyzed with the most suitable modal base. Correct interfacing, however, is required. We report the scattering matrices representing all the possible transformations of modal bases in rectangular waveguide. Such matrices provide an useful tool to simulate complex circuits made up of components strongly interacting, without requiring the use of a common modal base for the characterization of each element. Since the transformation matrices can easily include pieces of transmission lines, their use does not require any additional computation effort.

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Inductance extraction of multilayer finite-thickness superconductor circuits

M.M. Khapaev. "Inductance extraction of multilayer finite-thickness superconductor circuits." 2001 Transactions on Microwave Theory and Techniques 49.1 (Jan. 2001 [T-MTT] (Mini-Special Issue on 2000 Radio-Frequency Integrated Circuits (RFIC) Conference and Automatic Radio Frequency Techniques Group (ARFTG) Meeting)): 217-220.

In this paper, an efficient numerical technique is presented for inductance extraction and current calculation in multilayer planar superconductor microelectronic circuits. The rigorous definition of a three-dimensional problem based on London equations and stream function is presented. The finite thickness of conductors is taken into account. The results can be directly applied to perfect and extended to normal conductors.

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A design of the ceramic chip balun using the multilayer configuration

D.-W. Lew, J.-S. Park, D. Ahn, N.-K. Kang, C.S. Yoo and J.-B. Lim. "A design of the ceramic chip balun using the multilayer configuration." 2001 Transactions on Microwave Theory and Techniques 49.1 (Jan. 2001 [T-MTT] (Mini-Special Issue on 2000 Radio-Frequency Integrated Circuits (RFIC) Conference and Automatic Radio Frequency Techniques Group (ARFTG) Meeting)): 220-224.

This paper presents the design method and performance characteristics of a chip-type balun using a multilayer structure. The design method for a chip-type balun is based on the lumped-element equivalent circuit of quarter-wave transformer. The proposed design method and equivalent circuit can make it easy to design the ceramic multilayer chip-type balun. The size 2012 and 3216 chip-type baluns were designed and fabricated using the proposed design method and the equivalent-circuit model of a quarter-wave transformer. Fabrications and measurements of designed chip-type baluns show smaller size than conventional chip-type baluns and good agreement with simulated results.



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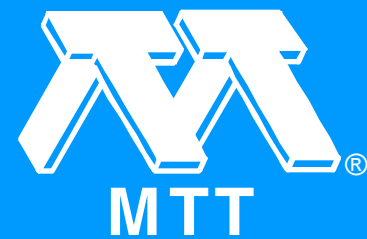
A suitable integral equation for the quasi-TEM analysis of hybrid strip/slot-like structures

J. Martel and F. Medina. "A suitable integral equation for the quasi-TEM analysis of hybrid strip/slot-like structures." 2001 Transactions on Microwave Theory and Techniques 49.1 (Jan. 2001 [T-MTT] (Mini-Special Issue on 2000 Radio-Frequency Integrated Circuits (RFIC) Conference and Automatic Radio Frequency Techniques Group (ARFTG) Meeting)): 224-227.

This paper reports on a suitable formulation of the spectral domain/integral-equation method for the quasi-TEM analysis of hybrid strip/slot-like planar lines. The free surface charge distribution is used as an unknown on the strip-like interface, whereas the electric field is used on the slot-like region. This formulation allows us to reduce the number of basis functions and makes possible a unified treatment of the problem. A single type of basis functions is used, leading to a quasi-analytical evaluation of the Galerkin matrix entries. The performance of the method is illustrated with a practical example structure useful for coupler design.

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High-impedance electromagnetic surfaces with a forbidden frequency band (Comments and reply)

K. Kumar, D. Sievenpiper, Lijun Zhang, R.F. Jimenez Broas, N.G. Alexopolous and E. Yablonovitch. "High-impedance electromagnetic surfaces with a forbidden frequency band (Comments and reply)." 2001 Transactions on Microwave Theory and Techniques 49.1 (Jan. 2001 [T-MTT] (Mini-Special Issue on 2000 Radio-Frequency Integrated Circuits (RFIC) Conference and Automatic Radio Frequency Techniques Group (ARFTG) Meeting)): 228-228.

For the original paper see *ibid.*, vol. 47, no. 11, p. 2059-2074 (1999). In the aforementioned paper the authors used a jar of water as a substitute for a human's head and then made a statement that the dielectric constant of water is similar to most human tissues. The commenter disagrees with this statement. In reply the authors also disagree with the comments, pointing out that while a jug of water and a human head may differ significantly in function, they differ little in form from the perspective of an electromagnetic field, and the substitution of one for the other offers simple insight into antenna performance near a high-dielectric lossy mass. They concede that the dielectric constant of water is roughly 1.5 times that of average human tissue. However, they believe that this neither invalidates their observation that antenna performance is significantly affected by the presence of a watery mass, nor their statement that one may expect similar degradation of performance near a human head.

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Abstracts

Effects of carrier tracking in RAKE reception of wide-band DSSS in ricean fading (Corrections)

R.E. Ziemer, B.R. Vojcic, L.B. Milstein and J.G. Proakis. "Effects of carrier tracking in RAKE reception of wide-band DSSS in ricean fading (Corrections)." 2001 Transactions on Microwave Theory and Techniques 49.1 (Jan. 2001 [T-MTT] (Mini-Special Issue on 2000 Radio-Frequency Integrated Circuits (RFIC) Conference and Automatic Radio Frequency Techniques Group (ARFTG) Meeting)): 228-228.



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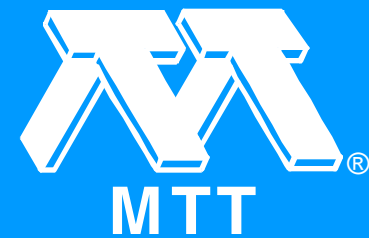
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Information for Authors (Jan. 2001 [T-MTT])

"Information for Authors (Jan. 2001 [T-MTT])." 2001 Transactions on Microwave Theory and Techniques 49.1 (Jan. 2001 [T-MTT] (Mini-Special Issue on 2000 Radio-Frequency Integrated Circuits (RFIC) Conference and Automatic Radio Frequency Techniques Group (ARFTG) Meeting)): 0_5-0_5.



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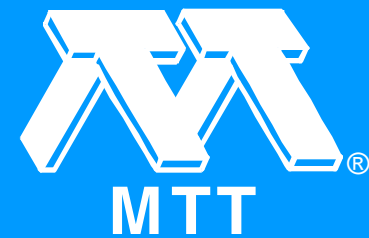
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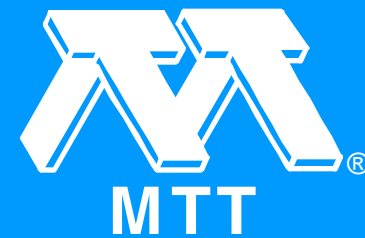
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Abstracts

Inside Cover (Feb. 2001 [T-MTT])

"Inside Cover (Feb. 2001 [T-MTT])." 2001 Transactions on Microwave Theory and Techniques 49.2 (Feb. 2001 [T-MTT]): 0_3-0_4.



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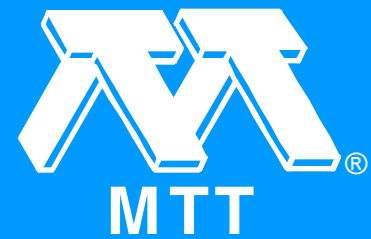
Synchronization of oscillators coupled through narrow-band networks

J.J. Lynch and R.A. York. "Synchronization of oscillators coupled through narrow-band networks." 2001 Transactions on Microwave Theory and Techniques 49.2 (Feb. 2001 [T-MTT]): 237-249.

The ability of two coupled oscillators to synchronize depends critically on the coupling network. Previous analyses have accurately predicted the performance of quasi-optical microwave oscillator arrays for both weak and strong coupling, but have been limited to coupling networks with bandwidths considerably larger than the locking bandwidths of the oscillators. In this paper, the authors develop a method for deriving a suitable system of nonlinear differential equations describing the oscillator amplitude and phase dynamics using a generalization of Kurokawa's method. The method is applied to the case of two Van der Pol oscillators coupled through a resonant network for a wide range of coupling strengths and bandwidths. Simple approximate formulas are developed for the size of the frequency locking region as functions of the basic circuit parameters.

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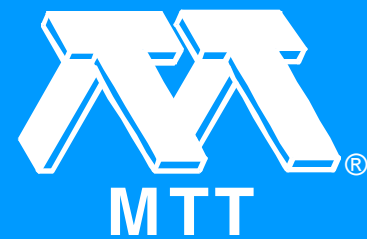
The effect of dielectric loss in FDTD simulations of microstrip structures

D.C. Wittwer and R.W. Ziolkowski. "The effect of dielectric loss in FDTD simulations of microstrip structures." 2001 Transactions on Microwave Theory and Techniques 49.2 (Feb. 2001 [T-MTT]): 250-262.

The importance of dielectric losses in planar microstrip structures is evaluated with the finite-difference time-domain (FDTD) method. This analysis was previously not possible in many FDTD simulators due to a lack of absorbing boundary conditions (ABCs), which appropriately terminate air/dielectric interfaces for which the dielectric is lossy. The newly proposed lossy two-time derivative Lorentzian material (L2TDLM) model ABC allows for these terminations and is presented and implemented here for three-dimensional FDTD simulations. The effect of dielectric losses on several well-known planar microstrip structures is evaluated. It is shown that the inclusion of these losses in FDTD simulations, which is facilitated by the L2TDLM ABC, is, in fact, important to predict the performance of resonant structure on lossy dielectric substrates.

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Subjects

Application of a new MPIE formulation to the analysis of a dielectric resonator embedded in a multilayered medium coupled to a microstrip circuit

J. Chen, A.A. Kishk and A.W. Glisson. "Application of a new MPIE formulation to the analysis of a dielectric resonator embedded in a multilayered medium coupled to a microstrip circuit." 2001 Transactions on Microwave Theory and Techniques 49.2 (Feb. 2001 [T-MTT]): 263-279.

A new mixed-potential integral-equation (MPIE) formulation is developed for the analysis of electromagnetic problems due to conducting or dielectric objects of arbitrary shape embedded in a planarly stratified medium. In the new MPIE formulation, the dyadic kernel of the vector potential is kept in the simple form originally developed by Sommerfeld. The scalar potential, which is related to the vector potential via the Lorenz gauge, is then represented by a double dot product of a dyadic kernel with a dyadic charge density. An extra line integral term, which is well behaved and nonsingular, will appear when the object penetrates an interface. The numerical implementation of the double dot product is found to be trivial if one takes advantage of the well-established basis functions in which the unknown current density is expressed. The new MPIE formulation is employed in conjunction with the triangular patch model to treat the problem of a dielectric resonator (DR) excited by microstrip circuit. A matched-load simulation procedure has been used to extract the network S-parameters of a DR microstrip circuit. The diameters of the Q circles have been measured to determine the coupling coefficients and the Q factors of the DR excited by a microstrip circuit. The validity of the new MPIE formulation and the numerical procedure have been verified by comparing the obtained S-parameters, with available measurement data.





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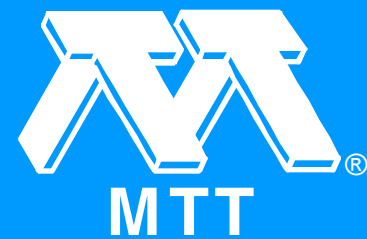
Dispersion of homogeneous and inhomogeneous waves in the Yee finite-difference time-domain grid

J.B. Schneider and R.J. Kruhlak. "Dispersion of homogeneous and inhomogeneous waves in the Yee finite-difference time-domain grid." 2001 Transactions on Microwave Theory and Techniques 49.2 (Feb. 2001 [T-MTT]): 280-287.

The numerical dispersion relation governing the propagation of homogeneous plane waves in a finite-difference time-domain (FDTD) grid is well known. However, homogeneous plane waves, by themselves, do not form a complete basis set capable of representing all valid field distributions. A complete basis set is obtained by including inhomogeneous waves, where, in the physical world, constant phase planes must be orthogonal to constant amplitude planes for lossless media. In this paper, we present a dispersion analysis for both homogeneous and inhomogeneous plane waves in the Yee FDTD grid. We show that, in general, the constant amplitude and constant phase planes of inhomogeneous plane waves are not orthogonal, but they approach orthogonality for fine discretization. The dispersion analysis also shows that, for very coarsely resolved fields, homogeneous waves will experience exponential decay as they propagate and they may propagate faster than the speed of light. Bounds are established for the speed of propagation within the grid, as well as the highest frequency and the shortest wavelength that can be coupled into the grid. Analysis is restricted to the classic Yee algorithm, but a similar approach can be used to analyze other time-domain finite-difference methods.

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Dispersion-induced power penalties in millimeter-wave signal transmission using multisection DBR semiconductor laser

C. Lim, D. Novak, A. Nirmalathas and G.H. Smith. "Dispersion-induced power penalties in millimeter-wave signal transmission using multisection DBR semiconductor laser." 2001 Transactions on Microwave Theory and Techniques 49.2 (Feb. 2001 [T-MTT]): 288-296.

In this paper, we present a simple analytical model to characterize the effect of fiber chromatic dispersion when using a multisection distributed-Bragg reflector (DBR) semiconductor laser as a millimeter-wave optical transmitter in a millimeter-wave fiber-radio system. We characterize the dispersion penalty of the laser as a function of the laser operating conditions and establish that the penalty is dependent on the distribution of optical power among the modes in the laser output. This, in turn, is dependent on the spectrum-filtering property of the laser DBR section and the gain profile of the laser. In addition to the dispersion penalty, the stability of the generated millimeter-wave carrier from the multisection laser is investigated, including the detected RF power and resulting phase noise. We establish that a compromise must be made when finding the optimum bias condition of the laser which provides minimum dispersion penalty, maximum received RF power, and minimum phase noise of the generated millimeter-wave carrier.

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Monolithic waveguide filters using printed photonic-bandgap materials

C.A. Kyriazidou, H.F. Contopanagos and N.G. Alexopoulos. "Monolithic waveguide filters using printed photonic-bandgap materials." 2001 Transactions on Microwave Theory and Techniques 49.2 (Feb. 2001 [T-MTT]): 297-307.

A system of N dielectric layers imprinted with a transverse lattice of planar metallic scatterers and stacked monolithically along the longitudinal direction of a rectangular waveguide is examined in this paper. This monolithically constructed photonic crystal exhibits valuable filtering properties. The resulting optimized filters are inexpensive to fabricate because the building block (printed layer) is ideal for mass production. The complete filter contains no air gaps (monolithic) and can be modularly built up, or reconfigured, by simple stacking requiring no adhesives (modular). The filter response is designed using our analytical expressions and fast software, as well as using commercial software such as HFSS. A comparison of the two design methods shows that our approach is five orders of magnitude faster than HFSS and significantly reduces the memory requirements. Prototype measurements in the Ka-band show excellent agreement with predictions of our design method. Optimized designs displaying reduced size, extremely flat passbands (0.25 dB), and great isolation (-100 dB) are also presented.



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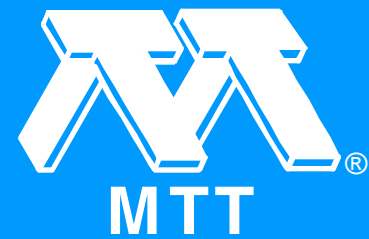
Micromachined filters on synthesized substrates

R.F. Drayton, S.P. Pacheco, L.P.B. Katehi, J. Wang and J.-G. Yook. "Micromachined filters on synthesized substrates." 2001 Transactions on Microwave Theory and Techniques 49.2 (Feb. 2001 [T-MTT]): 308-314.

Effective high-frequency spectrum usage requires high-performance filters to have a sharp cutoff frequency and high stopband attenuation. Stepped-impedance low-pass designs achieve this function best with large ratios of high-to-low-impedance values. In high-index materials, such as Si (11.7) and GaAs (12.9), however these high-to-low-impedance ratios are around five, thereby significantly limiting optimum filter performance. This paper characterizes the use of Si micromachining for the development of synthesized substrates, which, when utilized appropriately, can further reduce the low-impedance value or increase the high-impedance value. Both designs have demonstrated high-to-low-impedance ratios that are 1.5-2 times larger than conventional techniques.

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Scattering from a cylindrical waveguide with rectangular corrugations

H.S. Lee and H.J. Eom. "Scattering from a cylindrical waveguide with rectangular corrugations." 2001 Transactions on Microwave Theory and Techniques 49.2 (Feb. 2001 [T-MTT]): 315-320.

Electromagnetic scattering from a circular cylindrical waveguide with rectangular corrugations is considered in this paper. An analysis method based on dyadic Green's functions and Fourier transforms is used to get the field in terms of modal currents induced on the corrugation openings. The fields are expressed through a series of modal eigenfunctions in the corrugations, and are integrated to get the unknown expansion coefficients. This analysis method can easily be extended to find the dispersion relations of the corrugated waveguide. The series solution obtained is analytic and suitable for numerical computation. Numerical results are presented to illustrate the scattering behavior of a corrugated cylindrical waveguide in terms of frequency and waveguide geometry.

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The design of microstrip six-pole quasi-elliptic filter with linear phase response using extracted-pole technique

K.S.K. Yeo and M.J. Lancaster. "The design of microstrip six-pole quasi-elliptic filter with linear phase response using extracted-pole technique." 2001 Transactions on Microwave Theory and Techniques 49.2 (Feb. 2001 [T-MTT]): 321-327.

The development of microstrip filters has been in great demand due to the rapid growth of wireless communication systems in this decade. Quasi-elliptic response filters are very popular in communication systems because of their high selectivity, which is introduced by a pair of transmission zeros. A number of ways of implementing the quasi-elliptic response filter on microstrip have been studied over the last two decades, i.e., the cascaded quadruplet filter, canonical filter, and extracted-pole filter. However, there is very little information in the literature giving the design details for microstrip extracted-pole filters. In this paper, design equations of the extracted-pole filter for microstrip are reviewed. A new class of microstrip filter is also presented here. This class of filter will have a quasi-elliptic function response and at the same time linear phase in the passband. The linear phase of the filter is introduced by an in-phase cross coupling, while the transmission zero is realized using an extracted-pole technique. Experimental results, together with a theoretical comparison between the group delay of this design, and the conventional quasi-elliptic six-pole filter are also presented.





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Low-distortion MMIC power amplifier using a new form of derivative superposition

D.R. Webster and D.G. Haigh. "Low-distortion MMIC power amplifier using a new form of derivative superposition." 2001 Transactions on Microwave Theory and Techniques 49.2 (Feb. 2001 [T-MTT]): 328-332.

Reduction of interchannel interference produced by a power amplifier near 1-dB compression is a key concern for the wireless communications industry. In this paper, we present a 100-mW monolithic-microwave integrated-circuit (MMIC) power amplifier designed using a novel form of the derivative superposition method. The measured results of the MMIC power amplifier showed a two-tone carrier-to-interference (C/I) ratio of 45 dBc with an efficiency of 22.5% when backed off by 4.5 dB from the 1-dB compression point. We demonstrate that the MMIC power amplifier represents a good compromise between C/I ratio, output power, efficiency, and gain at the cost of an increase in total gate width, by comparing it to class-A, class-AB, and class-B single field-effect-transistor amplifiers.

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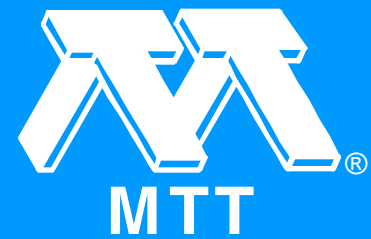
The origin of the kink phenomenon of transistor scattering parameter S_{22}

S.-S. Lu, T.-W. Chen, H.-C. Chen and C. Meng. "The origin of the kink phenomenon of transistor scattering parameter S_{22} ." 2001 Transactions on Microwave Theory and Techniques 49.2 (Feb. 2001 [T-MTT]): 333-340.

A novel theory based on dual-feedback circuit methodology is proposed to explain the kink phenomenon of transistor scattering parameter S_{22} . Our results show that the output impedance of all transistors intrinsically shows a series RC circuit at low frequencies and a parallel RC circuit at high frequencies. It is this inherent ambivalent characteristic of the output impedance that causes the appearance of kink phenomenon of S_{22} in a Smith chart. It was found that an increase of transistor transconductance enhances the kink effect while an increase of drain-to-source (or collector-to-emitter) capacitance obscures it. This explains why it is much easier to see the kink phenomenon in bipolar transistors, especially heterojunction bipolar transistors, rather than in field-effect transistors (FETs). It also explains why the kink phenomenon is seen in larger size FETs and not in smaller size FETs. Our model not only can predict the behavior of S_{22} , but also calculate all S-parameters accurately. Experimental data of submicrometer gate Si MOSFETs and GaAs FETs are used to verify our theory. A simple method for extracting transistor equivalent-circuit parameters from measured S-parameters is also proposed based on our theory. Compared with traditional Z- or Y-parameter methods, our theory shows another advantage of giving deep insight into the physical meaning of S-parameters.

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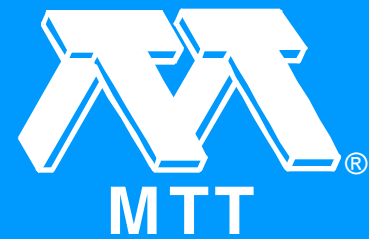
Low-loss RF transport over long distances

M. Friedman and F. Fernsler. "Low-loss RF transport over long distances." 2001 Transactions on Microwave Theory and Techniques 49.2 (Feb. 2001 [T-MTT]): 341-348.

Electromagnetic RF energy can be transported over a kilometer or more using antennas, but the efficiency is low unless the injecting and receiving antennas are extremely large. Other means of transporting RF energy such as waveguides and coaxial lines are cumbersome, heavy, costly, and suffer large attenuation. This paper offers a different system for long-distance RF transportation. The key is to use nonradiating electromagnetic surface waves that propagate along thin metallic strips. This means of moving RF energy between two points is simple, inexpensive, lightweight, and has low attenuation. For example, the attenuation is less than 2 dB/km for an Al foil 6-cm wide and 0.002-cm thick. Thus, efficient guidance of surface waves over distances of many kilometers requires neither large antennas, waveguides, nor coaxial lines. Moreover, electric interference with the surroundings is minimized due to the large reduction in the radial extension of the electric field, and the conversion of the radiating electromagnetic waves to surface waves and back is efficient (up to 90%).

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Analysis of cylindrical waveguide discontinuities using vectorial eigenmodes and perfectly matched layers

P. Bienstman, H. Derudder, R. Baets, F. Olyslager and D. De Zutter. "Analysis of cylindrical waveguide discontinuities using vectorial eigenmodes and perfectly matched layers." 2001 Transactions on Microwave Theory and Techniques 49.2 (Feb. 2001 [T-MTT]): 349-354.

In this paper, we analyze the scattering at discontinuities in cylindrical waveguides, starting from a vectorial eigenmode expansion and by introducing perfectly matched layer (PML) boundary conditions. The structure under study is enclosed in a metal cylinder to discretize the radiative mode spectrum, while the coating of this cylinder with PML vastly reduces the influence of parasitic reflections at the metal. This allows for a model that is both faster and more accurate than previous models.

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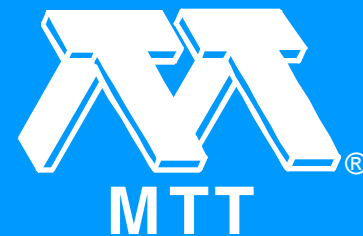


Abstracts

An approach to analysis of waveguide arrays with shaped dielectric inserts and protrusions

M. Davidovitz. "An approach to analysis of waveguide arrays with shaped dielectric inserts and protrusions." 2001 Transactions on Microwave Theory and Techniques 49.2 (Feb. 2001 [T-MTT]): 355-361.

The classical moment method solution of the waveguide-array problem is extended to allow for generally shaped dielectric matching inserts in the waveguide-to-free-space transition region. The aperture electric field is represented in terms of waveguide modes. To account for the presence of the matching inserts, the aperture fields are numerically propagated through the dielectric regions. Novel matching configurations, which extend the scanning range of waveguide elements or can be used to shape the element pattern in limited-scan applications, are proposed and analyzed.



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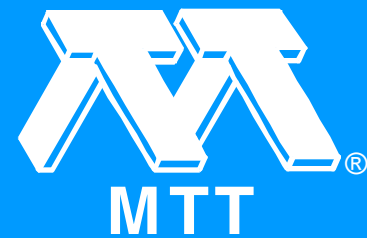
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Coplanar-waveguide dispersion characteristics including anisotropic substrates

Chung Jen Hsu. "Coplanar-waveguide dispersion characteristics including anisotropic substrates." 2001 Transactions on Microwave Theory and Techniques 49.2 (Feb. 2001 [T-MTT]): 362-368.

An efficient iterative method, based on potential theory, is developed to solve coplanar-waveguide (CPW) dispersion characteristics. In this method, a conformal mapping technique is used to derive the new general expressions for the charge and current sources applicable to both microstrip lines and CPWs. Excellent accuracy for the dispersion results obtained by this method is observed.

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A new numerical method for synthesis of arbitrarily terminated lossless nonuniform transmission lines

G. Xiao, K. Yashiro and S. Ohkawa. "A new numerical method for synthesis of arbitrarily terminated lossless nonuniform transmission lines." 2001 Transactions on Microwave Theory and Techniques 49.2 (Feb. 2001 [T-MTT]): 369-376.

In this paper, the synthesis of a nonuniform transmission line is treated by solving an inverse classical Sturm-Liouville problem, in which the boundary conditions are described by S-parameters. The related inverse problem is readily solvable if the terminated impedances and S-parameters satisfy some required conditions. This method can be used to design transmission-line filters and impedance transducers for almost arbitrarily provided source and load impedances.

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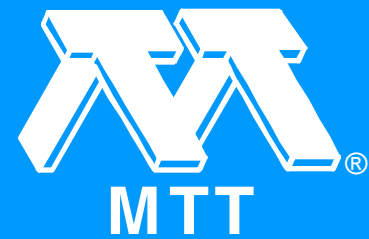
Analyzing the stability of the FDTD technique by combining the von Neumann method with the Routh-Hurwitz criterion

A. Pereda, L.A. Vielva, A. Vegas and A. Prieto. "Analyzing the stability of the FDTD technique by combining the von Neumann method with the Routh-Hurwitz criterion." 2001 Transactions on Microwave Theory and Techniques 49.2 (Feb. 2001 [T-MTT]): 377-381.

This paper addresses the problem of stability analysis of finite-difference time-domain (FDTD) approximations for Maxwell's equations. The combination of the von Neumann method with the Routh-Hurwitz criterion is proposed as an algebraic procedure for obtaining analytical closed-form stability expressions. This technique is applied to the problem of determining the stability conditions of an extension of the FDTD method to incorporate dispersive media previously reported in the literature. Both Debye and Lorentz dispersive media are considered. It is shown that, for the former case, the stability limit of the conventional FDTD method is preserved. However, for the latter case, a more restrictive stability limit is obtained. To overcome this drawback, a new scheme is presented, which allows the stability limit of the conventional FDTD method to be maintained.

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A sub-millimeter accurate microwave multilevel gauging system for liquids in tanks

M. Weiss and R. Knochel. "A sub-millimeter accurate microwave multilevel gauging system for liquids in tanks." 2001 Transactions on Microwave Theory and Techniques 49.2 (Feb. 2001 [T-MTT]): 381-384.

A microwave multilevel gauging system employing a frequency-stepped continuous-wave radar measurement technique is described in this paper. A conventional frequency-modulated continuous-wave radar technique is normally employed only to find the level of the liquid surface in storage tanks. The system described here also detects a second level, e.g., the tank floor or an impurity level. If this second reflection dominates, distance measurement with the inverse Fourier transform (IFT) results in poor resolution and shows a very high range error for small gaps between these two scatterers. For estimating the exact time delay and amplitude of the reflection from each scatterer, an optimal signal-processing algorithm is derived, based on a reference model. Performance of the multiple target-detection reference model is illustrated using measured data obtained with an HP-8510 network analyzer. It is demonstrated that the reference model offers a significant enhancement of resolution over the standard processing IFT algorithm and is insensitive to noise and clutter signals. The described system achieves a time-delay accuracy with a bandwidth of $\Delta f = 1$ GHz, which corresponds to a range error of ± 0.2 mm.

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Integrated self-biased hexaferrite microstrip circulators for millimeter-wavelength applications

S.A. Oliver, P. Shi, N.E. McGruer, C. Vittoria, W. Hu, H. How, S.W. McKnight and P.M. Zavracky. "Integrated self-biased hexaferrite microstrip circulators for millimeter-wavelength applications." 2001 Transactions on Microwave Theory and Techniques 49.2 (Feb. 2001 [T-MTT]): 385-387.

Planar microstrip Y-junction circulators have been fabricated from metallized 130-/spl mu/m-thick self-biased strontium hexaferrite ceramic die, and then bonded onto silicon die to yield integrated circulator circuits. The impedance matching networks needed to transform the low-impedance circulator outputs were deployed on low-loss alumina or glass dielectrics to minimize circuit losses. These magnetically self-biased circulators show a normalized isolation and insertion loss of 33 and 2.8 dB, respectively, and a 1% bandwidth for an isolation of 20 dB. Application of small ($H < 1.5$ kOe) magnetic bias fields improved the isolation and insertion loss values to 50 and 1.6 dB, respectively. This design may form the basis for future monolithic millimeter-wave integrated circulator circuits that do not require magnets.

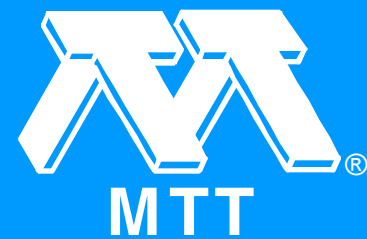
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Accurate RF large-signal model of LDMOSFETs including self-heating effect

Youngoo Yang, Jaehyok Yi and Bumman Kim. "Accurate RF large-signal model of LDMOSFETs including self-heating effect." 2001 Transactions on Microwave Theory and Techniques 49.2 (Feb. 2001 [T-MTT]): 387-390.

In this paper, we present a new silicon RF LDMOSFET large-signal model including a self-heating effect. A new empirical channel current model suited for accurately predicting intermodulation distortion is employed. The proposed channel current model can represent transconductance (gm) saturation and rolloff in the continuous manner. It has continuous higher order derivatives for accurate prediction of nonlinear microwave circuit behavior, such as power amplifiers, microwave mixers, oscillators, etc. Using the complete large-signal model, we have designed and implemented a 1.2 GHz power amplifier. The measured and simulated amplifier characteristics, especially the intermodulation and harmonic behaviors, are in good agreement.



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A low-cost uniplanar sampling down-converter with internal local oscillator, pulse generator, and IF amplifier

J.S. Lee and C. Nguyen. "A low-cost uniplanar sampling down-converter with internal local oscillator, pulse generator, and IF amplifier." 2001 Transactions on Microwave Theory and Techniques 49.2 (Feb. 2001 [T-MTT]): 390-392.

In this paper, we report on the development of a new integrated-circuit sampling down-converter having its own pulse generator, local oscillator (LO), and IF amplifier. The internal pulse generator uses a step recovery diode together with a unique ultra-wide-band hybrid junction to generate sub-nanosecond balanced pulses for gating the sampling diodes. The down-converter exhibits a conversion gain from 12 to 15.5 dB over an RF frequency of 0.01-3 GHz with 10-MHz LO and sampling pulses of about 100 ps. Return loss at the RF port is better than 15 dB over this RF bandwidth. The down-converter exhibits a good linearity and low harmonic levels. This down-converter employs a coplanar waveguide and slot line to make the entire circuit uniplanar and is, thus, suitable for low-cost production. In addition, it has an internal pulse generator, LO, and IF amplifier, making it a compact receiver subsystem, which can readily be used in many microwave systems.

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Modeling of monolithic RF spiral transmission-line balun

Y.J. Yoon, Y. Lu, R.C. Frye and P.R. Smith. "Modeling of monolithic RF spiral transmission-line balun." 2001 Transactions on Microwave Theory and Techniques 49.2 (Feb. 2001 [T-MTT]): 393-395.

This paper presents models for monolithic RF spiral transmission-line baluns. The balun consists of a pair of spiral transformers fabricated on high-resistivity silicon. The lumped-element equivalent models are developed. The second-order or higher order models are synthesized from the first-order lumped model. All lumped parameters for the models are extracted from the real physical structures. Simulated behaviors from the second-order models are in good agreement with the measured results within 10% difference.

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Transmission-line stabilized monolithic oscillators

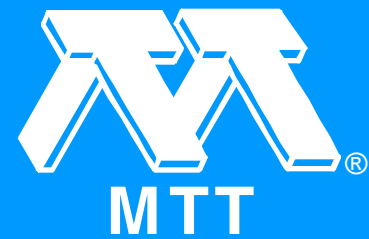
Kian Sen Ang, M.J. Underhill and I.D. Robertson. "Transmission-line stabilized monolithic oscillators." 2001 Transactions on Microwave Theory and Techniques 49.2 (Feb. 2001 [T-MTT]): 395-398.

A novel technique for frequency stabilization and phase-noise reduction of monolithic oscillators is presented in this paper. It employs simple transmission-line resonators, which are many wavelengths long to increase the oscillator quality factor. Monolithic oscillators at 20 and 40 GHz are realized for the application of this technique. Phase noise reduction of more than 20 dB was achieved for both oscillators. The single-sideband phase noise obtained was -100 dBc/Hz at 100-kHz offset for the 20-GHz oscillator and -90 dBc/Hz at 1-MHz offset for the 40-GHz oscillator. The approach is implemented by using readily available transmission lines, which are open- or short-circuited at one end and connected to the monolithic-microwave integrated-circuit (MMIC) oscillator at the other end. Thus, it presents significant potential in the development of low-cost MMIC oscillators with enhanced noise performance.

ALPS - A new fast frequency-sweep procedure for microwave devices

D.-K. Sun, Z. Cendes and J.-F. Lee. "ALPS - A new fast frequency-sweep procedure for microwave devices." 2001 Transactions on Microwave Theory and Techniques 49.2 (Feb. 2001 [T-MTT]): 398-402.

The discretization of Maxwell equations results in a polynomial matrix equation in frequency. In this paper, we present a robust and efficient algorithm for solving the polynomial matrix equation. To solve this equation for a broad bandwidth, one previously performs a discrete frequency sweep where the resulting matrix needs to be inverted at numerous frequencies, while current procedure requires only one matrix inversion. Speed improvements compared to the discrete sweep range from 10 to 100 times, depending on number of resonance peaks encountered.



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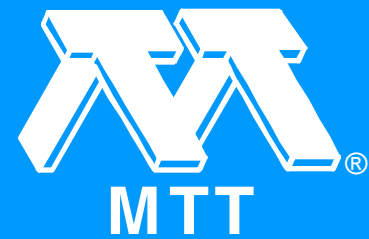
Analysis and design of impedance-transforming planar Marchand baluns

Kian Sen Ang and I.D. Robertson. "Analysis and design of impedance-transforming planar Marchand baluns." 2001 Transactions on Microwave Theory and Techniques 49.2 (Feb. 2001 [T-MTT]): 402-406.

A technique for designing impedance-transforming baluns is presented in this paper. It is based on the Marchand balun with two identical coupled lines. By varying the coupling factor of the coupled sections, a wide range of impedance transforming ratios can be achieved. In addition, a resistive network added between the balun outputs is proposed to achieve balun output matching and isolation. Microstrip baluns, matched at all ports, for transforming from a 50-/spl Omega/ source impedance to 40-/spl Omega/ as well as 160-/spl Omega/ load terminations are realized to demonstrate the technique.

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A novel interpretation of transistor S-parameters by poles and zeros for RF IC circuit design

S.-S. Lu, T.-W. Chen, H.-C. Chen and C.-C. Meng. "A novel interpretation of transistor S-parameters by poles and zeros for RF IC circuit design." 2001 Transactions on Microwave Theory and Techniques 49.2 (Feb. 2001 [T-MTT]): 406-409.

In this paper, we have developed an interpretation of transistor S-parameters by poles and zeros. The results from our proposed method agreed well with experimental data from GaAs FETs and Si MOSFETs. The concept of source-series feedback was employed to analyze a transistor circuit set up for the measurement of the S-parameters. Our method can describe the frequency responses of all transistor S-parameters very easily and the calculated S-parameters are scalable with device sizes. It was also found that the long-puzzled kink phenomenon of S_{22} observed in a Smith chart can be explained by the poles and zeros of S_{22} .

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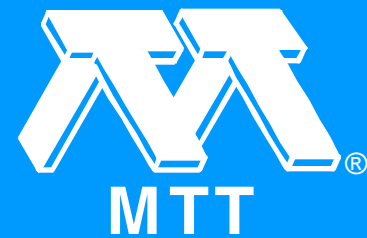


Abstracts

CAD models for asymmetrical, elliptical, cylindrical, and elliptical cone coplanar strip lines (Comments and reply)

A. Gorur, C. Karpuz, Zhengwei Du, Ke Gong, J.S. Fu, Zhenghe Feng and Baoxin Gao. "CAD models for asymmetrical, elliptical, cylindrical, and elliptical cone coplanar strip lines (Comments and reply)." 2001 Transactions on Microwave Theory and Techniques 49.2 (Feb. 2001 [T-MTT]): 410-411.

For original paper see Z.Du, K.Gong, J.S.Fu, Z.Feng and B.Gao, *ibid.*, vol.48, no.2, pp.312-6 (Feb 2000). In the original paper, Du et al. present analytical closed-form expressions for the quasi-TEM parameters for asymmetrical coplanar strip lines with a finite boundary substrate by using the conformal mapping technique. In this paper Gorur and Karpuz comment on their results. A reply to their comments by the original authors is included.



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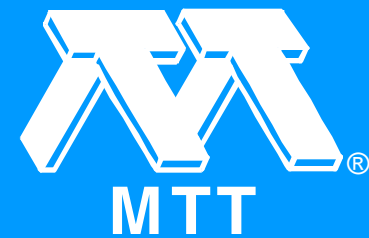
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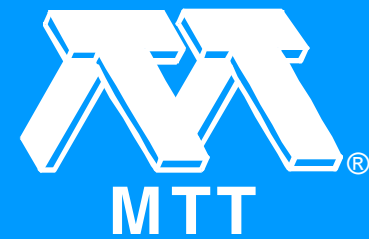
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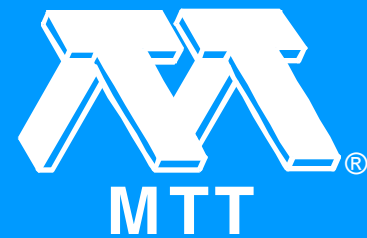
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Design and analysis of iris-coupled and dielectric-loaded 1/8-cut TE/sub 01/-mode microwave bandpass filters

S. Amari, J. Bornemann, A. Laisne and R. Vahldieck. "Design and analysis of iris-coupled and dielectric-loaded 1/8-cut TE/sub 01/-mode microwave bandpass filters." 2001 Transactions on Microwave Theory and Techniques 49.3 (Mar. 2001 [T-MTT]): 413-421.

The design and analysis of iris-coupled and dielectric-loaded 1/8-cut TE/sub 01/-mode filters is performed using globalized local solutions of Maxwell's equations as basis functions. It is found that this set of basis functions outperforms other edge-conditioned basis functions. To reduce the size of the filter and increase the Q factor of the resonators, dielectric rings with high dielectric constant are employed in the same design technique. The dimensions of the resonators are determined to accurately take into account the effect of coupling on their resonant frequencies, thereby reducing the need of tuning. Numerical results are compared with those obtained from the finite-element method (HP HFSS) and the mode-matching technique. Good agreement is demonstrated.

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A new 3D FDTD multigrid technique with dielectric traverse capabilities

M.J. White, Z. Yun and M.F. Iskander. "A new 3D FDTD multigrid technique with dielectric traverse capabilities." 2001 Transactions on Microwave Theory and Techniques 49.3 (Mar. 2001 [T-MTT]): 422-430.

The finite-difference time-domain (FDTD) technique has become increasingly popular and is being used to model extremely complex and electrically large structures. These simulations are computationally demanding and often exceed available limits on computer resources. In this paper, we present an FDTD sub-gridding technique that allows for increased resolution in regions of interest without increasing the overall computational requirements beyond the available resources. Furthermore, the formulation presented here allows for traversing dielectric boundaries using any integer refinement factor and the maximum Courant number. By allowing the coarse-/fine-grid boundary to traverse dielectric boundaries, numerical simulations that were previously either extremely difficult or impossible to perform are now possible. The technique presented here uses a weighted current value from the coarse region at the boundary between the fine- and coarse-grid regions to update the fine-region tangential fields on that boundary. The weighting function depends on the material properties and the relative position of the fine-region electric field within the current contour at the boundary. The complete formulation of this new technique is described and some results of simulation cases are presented to validate the accuracy and stability of the newly developed FDTD code. Simulations include simple cases where the analytical solution exists and more complex cases, which were impossible to model using a uniform-grid FDTD code. In some simulation examples, computer memory savings as high as 70 times what would have been necessary with a uniform-grid code were achieved. It is shown that errors of less than 2% are achievable with ratios of coarse-to-fine grid sizes exceeding ten. The new technique is expected to be used in simulating many electrically large and complex structures in the biomedical microwave processing of materials and the wireless communications areas.

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Design and characterization of single- and multiple-beam mm-wave circularly polarized substrate lens antennas for wireless communications

X. Wu, G.V. Eleftheriades and T.E. van Deventer-Perkins. "Design and characterization of single- and multiple-beam mm-wave circularly polarized substrate lens antennas for wireless communications." 2001 Transactions on Microwave Theory and Techniques 49.3 (Mar. 2001 [T-MTT]): 431-441.

Single- and multiple-beam circularly polarized ellipsoidal substrate lenses suitable for millimeter-wave wireless communications have been designed, implemented, and experimentally characterized at 30 GHz. The lenses are made out of low-cost low-permittivity Rexolite material. The single-beam lens achieves a directivity of 25.9 dB, a front-to-back ratio of 30 dB, and an axial ratio of 0.5 dB is maintained within the main lobe. The measured impedance bandwidth is 12.5% within a SWR/spl les/1.8:1. The single-beam antenna is well suited for broad-band wireless point-to-point links. On the other hand, the multiple-beam lens launches 31 beams with a minimum 3-dB overlapping level among adjacent beams. The coverage of the lens antenna system has been optimized through the utilization of a hexagonal patch arrangement leading to a scan coverage of 45.4/spl deg/ with a maximum loss in directivity of 1.8 dB due to multiple reflections. The multiple-beam lens antenna is suitable for indoor point-to-multipoint wireless communications such as a broad-band local area network or as a switched beam smart antenna. During the proposed design process, some fundamental issues pertaining to substrate lens antennas are discussed and clarified. This includes the depolarization properties of the lenses, the effect of multiple internal reflections on the far-field patterns and the directivity, the nature of the far-field patterns, the estimation of the lens system F/B ratio, and the off-axis characteristics of ellipsoidal lenses.

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A subharmonic self-oscillating mixer with integrated antenna for 60-GHz wireless applications

M. Sironen, Y. Qian and T. Itoh. "A subharmonic self-oscillating mixer with integrated antenna for 60-GHz wireless applications." 2001 Transactions on Microwave Theory and Techniques 49.3 (Mar. 2001 [T-MTT]): 442-450.

A balanced integrated-antenna self-oscillating mixer at 60 GHz is presented in this paper. The modal radiation characteristics of a dual-feed planar quasi-Yagi antenna are used to achieve RF-local oscillator (RF-LO) isolation between closely spaced frequencies. The balanced mixer is symmetric, inherently broad band, and does not need an RF balun. Pseudomorphic high electron-mobility transistors are used in a 30-GHz push-pull circuit to generate the second harmonic and a 30-GHz dielectric resonator was used to stabilize the fundamental oscillation frequency. This allows the possibility of building a balanced low-cost self-contained antenna integrated receiver with low LO leakage for short-range narrow-band communication. Phase locking can be done with half of the RF frequency. The circuit exhibits a conversion loss less than 15 dB from 60 to 61.5 GHz, radiation leakage of -26 dBm at 60 GHz, and IF phase noise of -95 dBc/Hz at 100-kHz offset.

Click on title for a complete paper.



Simulation and measurement of quasi-optical multipliers

M. Cryan, S. Helbing, F. Alimenti, P. Mezzanotte, L. Roselli and R. Sorrentino. "Simulation and measurement of quasi-optical multipliers." 2001 Transactions on Microwave Theory and Techniques 49.3 (Mar. 2001 [T-MTT]): 451-464.

The lumped-element finite-difference time-domain method is used to analyze quasi-optical multipliers based on diode loaded slot antennas. The method is validated firstly for a passive microstrip-fed structure then for the diode loaded case in both small- and large-signal regimes. The diode model is separately validated using a series diode mounted on a microstrip line. Input return loss and radiation patterns show good agreement with measurements and the concept of effective conversion loss is introduced and results show reasonable agreement between measurement and simulation. A new diode arrangement is introduced where dual offset diodes are placed in the slot instead of the conventional central diode. The diode position can then act as an extra design parameter. The performance of the two structures has been compared; currently best performance is still obtained for the central-diode structure. Finally, a fully quasi-optical structure is simulated with plane-wave excitation. Central and dual-diode structures are again compared and the diode position and input plane-wave field strengths are optimized. Slot voltage distributions, radiation patterns, and effective quasi-optical conversion losses are presented.



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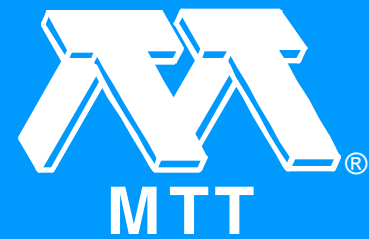
Balanced subharmonic mixers for retrodirective-array applications

T. Brabetz, V.F. Fusco and S. Karode. "Balanced subharmonic mixers for retrodirective-array applications." 2001 Transactions on Microwave Theory and Techniques 49.3 (Mar. 2001 [T-MTT]): 465-469.

The drawback of conventional Pon retrodirective antenna systems is the requirement of a local oscillator (LO) working at approximately twice the receive frequency. This limits the use of these systems to rather moderate frequencies where such an oscillator can be obtained. To overcome this problem, a new phase conjugate mixer topology is proposed, whereby the use of a harmonic mixer instead of the conventional fundamental type effectively halves the LO frequency requirement. Another significant problem of conventional Pon phase conjugate mixers is the small spacing in frequency, typically only a few 0.1% of the carrier frequency, between RF, IF, and LO frequency. In this paper, we have overcome this problem by introducing a double balanced structure with a novel phasing strategy. The phasing circuit automatically cancels the RF and LO signal at the system's output port, giving 36-dB RF/IF, and 34-dB LO/IF isolation for a 970-MHz IF and 990-MHz RF signal. The new mixer structure proposed here is an attractive proposition for use in retrodirective antenna arrays significantly enhancing their potential for application in the millimeter-wave frequency range.

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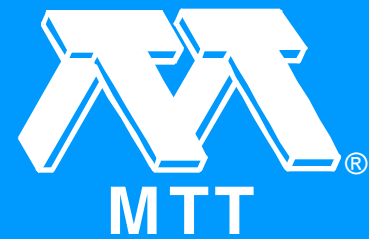
Transmit array of transistor amplifiers illuminated by a patch array in the reactive near-field region

H.J. Song and M.E. Bialkowski. "Transmit array of transistor amplifiers illuminated by a patch array in the reactive near-field region." 2001 Transactions on Microwave Theory and Techniques 49.3 (Mar. 2001 [T-MTT]): 470-475.

In this paper, a small transmit array of transistor amplifiers illuminated by a passive array of microstrip patches in the reactive near-field region is investigated as a power-combining structure. The two cases considered are when the transmit array radiates in a free space and when a passive array similar to the one used for illumination collects the radiated power. A comparison of the performance of the proposed structure against the alternative one, which uses a conventional horn antenna as a power-launching/receiving device, is also presented.

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Design of a wide-band lumped-element 3-dB quadrature coupler

Yi-Chyun Chiang and Chong-Yi Chen. "Design of a wide-band lumped-element 3-dB quadrature coupler." 2001 Transactions on Microwave Theory and Techniques 49.3 (Mar. 2001 [T-MTT]): 476-479.

Analysis and design techniques for designing a lumped-element 3-dB quadrature coupler with wide-band flat coupling are proposed for microwave integrated-circuit/monolithic-microwave integrated-circuit applications. The proposed design technique can produce a coupler with flat coupling over 50% fractional bandwidth, which is wider than the conventional lumped-element design methods. A prototype consisting of a capacitive coupled high-pass network is designed and fabricated to verify the design concept. Measurement and simulation results closely correspond to each other.

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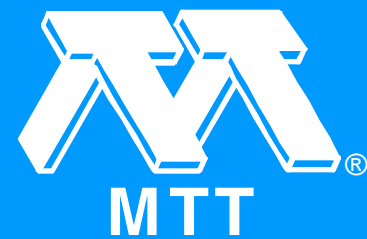


Abstracts

A fast multipole-method-based calculation of the capacitance matrix for multiple conductors above stratified dielectric media

Y.C. Pan, W.C. Chew and L.X. Wan. "A fast multipole-method-based calculation of the capacitance matrix for multiple conductors above stratified dielectric media." 2001 Transactions on Microwave Theory and Techniques 49.3 (Mar. 2001 [T-MTT]): 480-490.

An efficient static fast-multipole-method (FMM)-based algorithm is presented in this paper for the evaluation of the parasitic capacitance of three-dimensional microstrip signal lines above stratified dielectric media. The effect of dielectric interfaces on the capacitance matrix is included in the stage of FMM when outgoing multipole expansions are used to form local multipole expansions by the use of interpolated image outgoing-to-local multipole translation functions. The increase in computation time and memory usage, compared to the free-space case, is, therefore, small. The algorithm retains $O(N)$ computational and memory complexity of the free-space FMM, where N is the number of conductor patches.



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Scanning near-field millimeter-wave microscopy using a metal slit as a scanning probe

T. Nozokido, J. Bae and K. Mizuno. "Scanning near-field millimeter-wave microscopy using a metal slit as a scanning probe." 2001 Transactions on Microwave Theory and Techniques 49.3 (Mar. 2001 [T-MTT]): 491-499.

In this paper, a novel type of scanning near-field millimeter-wave microscopy using a metal slit-type probe is proposed. A tapered reduced-height rectangular waveguide forms the slit aperture, which has a width much smaller than one wavelength $/spl \lambda/$ and length of the order of $/spl \lambda/$. The slit probe can be operated in the TE/sub 10/ mode and, thus, results in high transmission efficiency, even when the width is exceedingly small. An image reconstruction algorithm based on computerized tomographic imaging is used to obtain two-dimensional near-field images. Experiments performed at 60 GHz ($/spl \lambda/=5$ mm) show that image resolution equal to the slit width ($/spl \sim/80 /spl \mu/m$) is achieved. As an application of this scanning slit microscopy, visualization of transition phenomena of photoexcited free carriers in silicon have been successfully demonstrated, yielding useful information on the dynamics of free carriers in semiconductor materials.

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Improving time-domain measurements with a network analyzer using a robust rational interpolation technique

W.T. Beyene. "Improving time-domain measurements with a network analyzer using a robust rational interpolation technique." 2001 Transactions on Microwave Theory and Techniques 49.3 (Mar. 2001 [T-MTT]): 500-508.

A method to efficiently and accurately compute a time-domain waveform from a network-analyzer frequency-domain measurement is presented in this paper. The method is based on a robust interpolation technique to construct a pole-residue representation of the response of the device-under-test. First, the rational function is expressed in terms of Chebyshev polynomials, instead of the usual power series, to accurately determine the poles of the network over a wide frequency range. The properties of a passive system are then utilized to efficiently calculate the residues. The resulting pole-residue model is analytically transformed to obtain the time-domain response in any time window, beyond the limitations of the discrete Fourier transform (DFT) technique. Unlike the DFT technique, the method does not require a large number of equally spaced harmonically related frequency points. The parametric model can also be used to economically store large measurement data. The proposed procedure is computationally inexpensive and less sensitive to numerical instability. To illustrate the validity of the method, examples of frequency- and time-domain measurements of a Beatty structure and simulation data of a low-pass Butterworth filter are given.

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SFELP-an efficient methodology for microwave circuit analysis

J. Rubio, J. Arroyo and J. Zapata. "SFELP-an efficient methodology for microwave circuit analysis." 2001 Transactions on Microwave Theory and Techniques 49.3 (Mar. 2001 [T-MTT]): 509-516.

A hybrid method based on the segmentation technique, the finite-element method, and a matrix Lanczos-Pade algorithm (SFELP) for the analysis of microwave circuits is introduced in this paper. This method computes symmetric matrix-Pade approximations of a matrix transfer function for any number of inputs and outputs via a Lanczos-type process (SyMPVL) for obtaining the generalized admittance matrix of a microwave circuit on a wide band of frequencies. The formulation that provides the three-dimensional finite-element/segmentation method is suitable for applying the symmetric Pade via Lanczos algorithm, except for the frequency dependence of the matrix of excitation vectors. In this paper, this problem is analytically overcome for the case in which excitation vectors correspond to modes of homogeneous waveguides or transmission lines. The accuracy and efficiency of the proposed method are shown by means of different examples.

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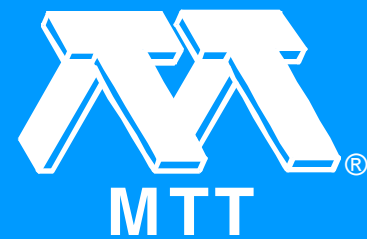
A quasi-one-dimensional integration technique for the analysis of planar microstrip circuits via MPIE/MoM

L. Tarricone, M. Mongiardo and F. Cervelli. "A quasi-one-dimensional integration technique for the analysis of planar microstrip circuits via MPIE/MoM." 2001 Transactions on Microwave Theory and Techniques 49.3 (Mar. 2001 [T-MTT]): 517-523.

The mixed-potential integral-equation approach, using spatial-domain closed-form Green's functions, and discretized with the method-of-moments, is a state-of-the-art method for the analysis of planar microstrip circuits. One of its most time-demanding tasks is the evaluation of the impedance matrix terms, which typically requires the numerical computation of two-dimensional integrals. A method based on suitable changes of coordinates and domains is introduced in this paper in order to reduce such integrals to a quasi-one-dimensional numerical integration, with a substantial enhancement in the efficiency of the analysis, without affecting the accuracy of the approach. Results are given demonstrating, for practical accuracy values, an improvement of typically one order of magnitude in simulation times.

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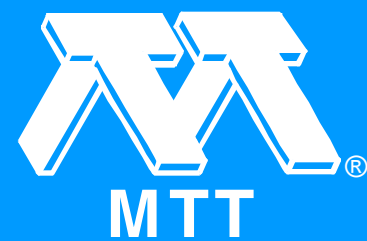
Complex resonance and radiation of hemispherical dielectric-resonator antenna with a concentric conductor

Kwok Wa Leung. "Complex resonance and radiation of hemispherical dielectric-resonator antenna with a concentric conductor." 2001 Transactions on Microwave Theory and Techniques 49.3 (Mar. 2001 [T-MTT]): 524-531.

The probe-fed hemispherical dielectric-resonator antenna (DRA) with a concentric conductor is studied theoretically in this paper. Using the mode-matching method, the exact Green's functions for evaluation of the input impedance and radiation patterns are found, with the functions presented in computationally efficient forms. The moment method is used to determine the probe current and, hence, the input impedance as well as the radiation patterns. The results are verified by special cases available in the literature. In this paper, the effects of the conductor radius, dielectric constant, probe length, and probe displacement on the input impedance are investigated. The theory is very general and, by taking appropriate limits, can be used to study the solid DRA and the conductor-loaded wire antenna. To aid the DRA design engineer, the TE/sub 111/-mode characteristic equation of the DRA is also studied, from which the simple formulas for the resonant frequency and Q-factor are obtained.

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Electromagnetic dyadic Green's functions for multilayered spheroidal structures. I: formulation

Le-Wei Li, Xiao-Kang Kang, Mook-Seng Leong, Pang-Shyan Kooi and Tat-Soon Yeo.

"Electromagnetic dyadic Green's functions for multilayered spheroidal structures. I: formulation."
2001 Transactions on Microwave Theory and Techniques 49.3 (Mar. 2001 [T-MTT]): 532-541.

Dyadic Green's functions (DGFs) and their scattering coefficients are formulated in this paper for defining the electromagnetic fields in multilayered spheroidal structures. The principle of scattering superposition is applied, in a similar form of the DGF in an unbounded medium under spheroidal coordinates, the scattering DGFs due to multiple spheroidal interfaces are expanded in terms of the spheroidal vector wave functions. For the lack of general orthogonality of the spheroidal radial and angular functions, the Green's dyadics are expressed in a different way where the coordinate unit vectors are also combined in the construction, as compared with the conventional form of vector wave eigenfunction expansion. The matrix equation systems satisfied by the coupled scattering (i.e., reflection and transmission) coefficients of the DGFs are obtained so that these coefficients can be solved uniquely. The DGFs can be employed to investigate effects of spheroidal radomes used to protect the airborne or satellite antenna systems and of handy phone radiation near the spheroid-shaped human head, and so forth. Numerical calculations about the applications of the formulated multilayered DGFs are presented in part II of this paper.

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A method for the 2.45-GHz magnetron output power control

D. Martin, A. Jianu and D. Ighigeanu. "A method for the 2.45-GHz magnetron output power control." 2001 Transactions on Microwave Theory and Techniques 49.3 (Mar. 2001 [T-MTT]): 542-545.

A new method that overcomes the disadvantages of the conventional magnetron output power (MOP) control is presented in this paper. The conventional LC single-phase half-wave doubler supply has been modified in order to allow the use of a manually controlled and/or PC-controlled electronic variator. Trains of high-voltage pulses followed by inhibited high-voltage pulses are periodically applied on the magnetron anode yielding a corresponding variation of the average MOP, with programmed steps, maintaining the advantage of peak microwave output power operation. The PC-controlled system provides a practically continuous variation of the magnetron average output power.



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Time-varying Volterra-series analysis of spectral regrowth and noise power ratio in FET mixers

J.A. Garcia, M.L. De la Fuente, J.C. Pedro, N.B. Carvalho, Y. Newport, A. Mediavilla and A. Tazon. "Time-varying Volterra-series analysis of spectral regrowth and noise power ratio in FET mixers." 2001 Transactions on Microwave Theory and Techniques 49.3 (Mar. 2001 [T-MTT]): 545-549.

This paper presents a direct and robust analysis technique for evaluating nonlinear distortion phenomena in FET mixers excited by multitone signals. Time-varying Volterra-series analysis has previously been proven to be appropriate for small-signal intermodulation-distortion calculations in mixers excited by simple RF signals. Spectral convolutions of the suitably mapped control voltages are introduced in this paper in order to solve the nonlinear current source calculations for narrow-band modulated or broad-band multicarrier RF signals. Simulations and measurements of a properly characterized resistive mixer validate the accuracy of this direct and noniterative analysis tool for spectral regrowth and noise-power-ratio prediction in such applications.





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Uniplanar one-dimensional photonic-bandgap structures and resonators

T.-Y. Yun and K. Chang. "Uniplanar one-dimensional photonic-bandgap structures and resonators." 2001 Transactions on Microwave Theory and Techniques 49.3 (Mar. 2001 [T-MTT]): 549-553.

This paper presents uniplanar one-dimensional (1-D) periodical structures, so-called photonic-bandgap (PBG) structures, and defect high-Q resonators for coplanar waveguide, coplanar strip line, and slot line. Proposed uniplanar PBG structures consist of 1-D periodically etched slots along a transmission line or alternating characteristic impedance series with wide band-stop filter characteristics. A stop bandwidth obtained is 2.8 GHz with a stopband rejection of 36.5 dB. This PBG performance can be easily improved if the number of cells or the filling factor is modified in a parametric analysis. Using uniplanar 1-D PBG structures, we demonstrate new high-Q defect resonators with full-wave simulation and measured results. These structures based on defect cavity or Fabry-Perot resonators consist of a center resonant line with two sides of PBG reflectors. They achieve a loaded Q of 247.3 and unloaded Q of 299.1. The proposed circuits should have many applications in monolithic and hybrid microwave integrated circuits.

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Improved tuning prediction for the microstrip coupled dielectric resonator using distributed coupling

X. Xu and R. Sloan. "Improved tuning prediction for the microstrip coupled dielectric resonator using distributed coupling." 2001 Transactions on Microwave Theory and Techniques 49.3 (Mar. 2001 [T-MTT]): 553-555.

In this paper, accurate modeling of the varactor-tuned dielectric resonator (DR) using distributed coupling between the DR and microstrip lines is investigated on the basis of three-dimensional electromagnetic study. The magnetic coupling between the DR and microstrip line is appreciable over a length greater than the diameter of the DR. The distribution of this coupling should be considered when calculating the electronic frequency tuning range. A novel circuit model is introduced to represent the coupling as distributed, with an integral method to calculate equivalent-circuit parameters efficiently. The distributed model provides much better accuracy than the conventional lumped model. A comparison is made between the calculated tuning range of 23 MHz achieved by the distributed model, which agrees closely with a measurement of 20.2 MHz, and that of 89 MHz predicted by the conventional lumped model. The circuit model of distributed coupling is, therefore, valuable in the design of DR oscillators.

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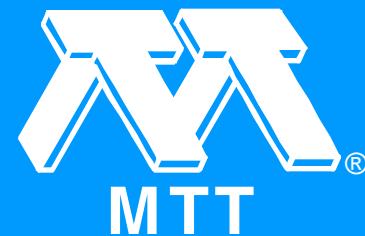


Abstracts

Rapidly converging direct singular integral-equation techniques in the analysis of open microstrip lines on layered substrates

J.L. Tsalamengas. "Rapidly converging direct singular integral-equation techniques in the analysis of open microstrip lines on layered substrates." 2001 Transactions on Microwave Theory and Techniques 49.3 (Mar. 2001 [T-MTT]): 555-559.

In this paper, moment-method-oriented direct singular integral-equation techniques are used for the exact analysis of planar layered microstrip lines. While these techniques retain the simplicity of the conventional method of moments, they optimize them by evaluating all matrix elements via rapidly converging real-axis spectral integrals. The proposed algorithms yield highly accurate results for the dispersion characteristics and for the modal currents both of the fundamental and higher order modes.



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MIM shunt-capacitor model using black boxes of EM-simulated critical parts

G. Gerhard and S. Koch. "MIM shunt-capacitor model using black boxes of EM-simulated critical parts." 2001 Transactions on Microwave Theory and Techniques 49.3 (Mar. 2001 [T-MTT]): 559-562.

A new model for metal-insulator-metal shunt capacitors is introduced in this paper. The main difference between the new model and known models is that critical parts of the capacitor's geometry are represented by black boxes. These boxes contain S-parameter files generated with an electromagnetic field solver. The capacitor parts, which depend on the capacitance value, are represented by microstrip and lumped elements. The new model combines the advantages of field simulations with those of lumped- or microstrip-based models. It can easily be used in circuit simulators utilizing their features for design development such as optimizations. The model is compared with two shunt capacitors on microwave monolithic integrated circuits to show the excellent fit.



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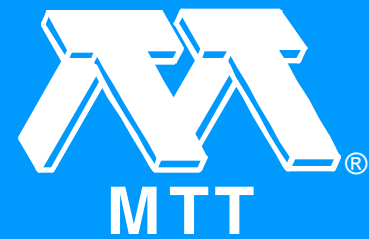
A simple procedure for impedance matching and tuning of microwave couplers for an electron linear accelerator

M.A.R. Franco, V.A. Serrao, C. Fuhrmann and S.B. Herdade. "A simple procedure for impedance matching and tuning of microwave couplers for an electron linear accelerator." 2001 Transactions on Microwave Theory and Techniques 49.3 (Mar. 2001 [T-MTT]): 562-564.

A simple experimental procedure to match and tune "door-knob"-type microwave couplers is presented in this paper. The procedure is suitable for accelerating structures with both input and output couplers and allows a fast convergence to the minimum reflection condition for a cavity coupler with fixed phase shift. The standing-wave ratio and the coupling cavity phase shift as functions of the coupler dimensions and frequency are also reported.

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Retro-transceiver array using monopole antennas

S. Karode and V. Fusco. "Retro-transceiver array using monopole antennas." 2001 Transactions on Microwave Theory and Techniques 49.3 (Mar. 2001 [T-MTT]): 565-568.

In this paper, we show how a self-tracking antenna array constructed using $\lambda/4$ monopoles can be constructed, which is capable of receiving with gain over an entire 360° azimuthal cut. It is also shown how the self-tracking receive unit can be used in conjunction with a self-phased transmitter so that self-steered spatially selective receive and transmit functions can be formed simultaneously. The resulting array is capable of maintaining spatially selective receive and transmit functions to a roaming target without prior knowledge of its physical location.

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Measurement of two-tone transfer characteristics of high-power amplifiers

Youngoo Yang, Jeahyok Yi, Joongjin Nam, Bumman Kim and Myungkyu Park. "Measurement of two-tone transfer characteristics of high-power amplifiers." 2001 Transactions on Microwave Theory and Techniques 49.3 (Mar. 2001 [T-MTT]): 568-571.

In this paper, we present an accurate measurement method for acquiring the two-tone transfer characteristics of high-power amplifiers. The measurement setup and sequence are described. The measured amplitude and phase data of the two-tone fundamental, third-order intermodulation, and fifth-order intermodulation components versus input power level are also presented. The measured two-tone transfer characteristics are very useful for the design of a predistortion linearizer or for nonlinear model extraction for high-power amplifiers.



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Integration equation analysis on resonant frequencies and quality factors of rectangular dielectric resonators

Shyh-Yeong Ke and Yuan-Tung Cheng. "Integration equation analysis on resonant frequencies and quality factors of rectangular dielectric resonators." 2001 Transactions on Microwave Theory and Techniques 49.3 (Mar. 2001 [T-MTT]): 571-574.

In this paper, the resonance problem of rectangular dielectric resonators (DRs) is analyzed by using the spectral dyadic Green's function and volume integral-equation formulation. The rectangular dielectric body is replaced by a set of entire-domain polarized volume current basis, and Galerkin's moment method is used to solve the resonant frequency and quality factor of the rectangular DR. The effects of electrical and geometrical parameters on the resonance of the TE/sub 111/ mode of isolated DRs are also presented. Additionally, the case of a rectangular DR with a ground plane is also discussed. Results are found to be in good agreement with the published experimental data.

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Synthesis of superwide-band matching adapters in round coaxial lines

B.M. Kats, V.P. Meschanov and A.L. Khvalin. "Synthesis of superwide-band matching adapters in round coaxial lines." 2001 Transactions on Microwave Theory and Techniques 49.3 (Mar. 2001 [T-MTT]): 575-579.

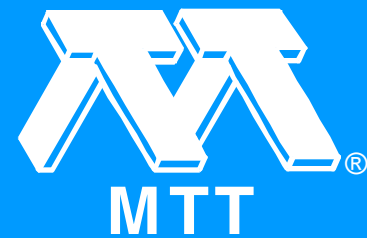
An algorithm for modeling stepped axially symmetrical discontinuities in round coaxial transmission lines (RCTLs) based on the numerical solution of an integral equation is proposed in this paper. The algorithm has been tested and the results of discontinuity parameter computations have been compared with those of the other researchers. High efficiency of the algorithm allowed us to realize the procedure of the numerical synthesis of the devices on RCTLs. The tabulated and graphical results of the synthesis of superwide-band adapters for 50-/spl Omega/-to-50-/spl Omega/ RCTLs with air medium are presented. The coaxial adapter for the line of 2.4/1.042 mm in cross section to that of 7.0/3.04 mm has been tested over the frequency range from dc to 50 GHz.

Abstracts

Internal impedance of conductors of rectangular cross section (Comments)

W. Heinrich. "Internal impedance of conductors of rectangular cross section (Comments)." 2001 Transactions on Microwave Theory and Techniques 49.3 (Mar. 2001 [T-MTT]): 580-581.

For rectangular conductors, as found in planar transmission lines, resistance and inductive reactance deviate by some 10%, in contrast to common approximations assuming equality of both quantities. This paper discusses this effect and presents quantitative data for the practical case of a monolithic-microwave integrated-circuit coplanar waveguide.



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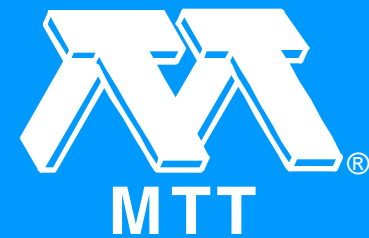
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"Table of Contents (Apr. 2001, Part I [T-MTT])." 2001 Transactions on Microwave Theory and Techniques 49.4 (Apr. 2001, Part I [T-MTT]): 0_1-0_2.



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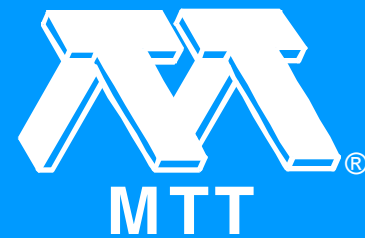
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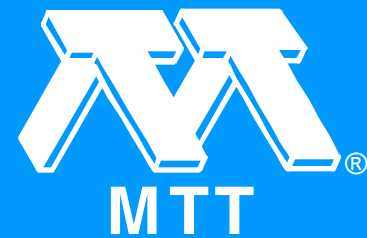
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A novel leaky NRD guide with a double-layer dielectric slab

Xiang-Yin Zeng, Kwai-Man Luk and Shan-Jia Xu. "A novel leaky NRD guide with a double-layer dielectric slab." 2001 Transactions on Microwave Theory and Techniques 49.4 (Apr. 2001, Part I [T-MTT]): 585-588.

A new leaky nonradiative dielectric guide with a double-layer dielectric slab is investigated in this paper by combining a multimode network theory with a mode-matching method. Numerical results show that proper selection of the permittivities can vary the leakage constant over a wide range. A leakage constant larger than 10% of free-space wavenumber can be obtained easily without entering the cutoff region. Leaky-wave antennas with shorter length and medium gain can thus be developed. In addition, the present leaky guide possesses the advantages of simple fabrication and physical stability. Extensive numerical results are provided to guide the antenna designs.

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Accurate modeling of high-Q spiral inductors in thin-film multilayer technology for wireless telecommunication applications

P. Pieters, K. Vaesen, S. Brebels, S.F. Mahmoud, W. De Raedt, E. Beyne and R.P. Mertens. "Accurate modeling of high-Q spiral inductors in thin-film multilayer technology for wireless telecommunication applications." 2001 Transactions on Microwave Theory and Techniques 49.4 (Apr. 2001, Part I [T-MTT]): 589-599.

In the current trend toward portable applications, high-Q integrated inductors are gaining a lot of importance. Using thin-film multilayer or multichip-module-deposition technology, high-Q circular inductors for RF and microwave applications may be integrated efficiently. Their quality factors may go up to over 100. In this paper, an accurate analytical model for such multiturn circular spiral inductors embedded in a thin-film multilayer topology is presented. Starting from the geometrical parameters, the model provides an accurate prediction of the inductance value, Q factor and frequency behavior of the inductor. This allows a "first-time-right?" realization of the integrated component and provides opportunities for fast optimization of the inductors. Finally, the presented high-Q inductors have been used in various integrated RF and microwave subsystems for wireless applications, of which a number are discussed at the end of this paper.

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RF W-band wafer-to-wafer transition

K.J. Herrick and L.P.B. Katehi. "RF W-band wafer-to-wafer transition." 2001 Transactions on Microwave Theory and Techniques 49.4 (Apr. 2001, Part I [T-MTT]): 600-608.

Multiwafer silicon designs must provide an avenue for electrical signals to flow from wafer to wafer. For this purpose, a two-layer electrical bond is proposed to provide electrical connection between two coplanar waveguides printed on the adjacent faces of two vertically stacked silicon wafers. In addition to serving as a versatile low-temperature thermocompression wafer bond, loss of approximately 0.1 dB is measured for this novel compact packaged wafer-to-wafer transition from 75 to 110 GHz.

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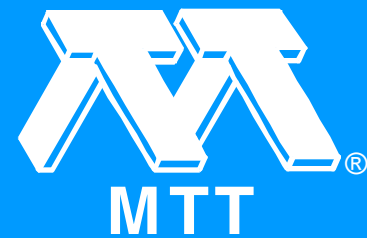
Design of waveguide finline arrays for spatial power combining

Pengcheng Jia, Lee-Yin Chen, Nai-Shuo Cheng and R.A. York. "Design of waveguide finline arrays for spatial power combining." 2001 Transactions on Microwave Theory and Techniques 49.4 (Apr. 2001, Part I [T-MTT]): 609-614.

Dense arrays of tapered-slot or finline transitions have proven useful in the design of compact spatial power combiners. In this paper, a design procedure is established for tapered finline arrays, providing a broad-band impedance match to a target load over the waveguide band. The procedure is based on an extension of the Klopfenstein optimal taper design to non-TEM waveguiding structures, and employs the spectral-domain method for the computation of propagation constants in the array structure. The method has been experimentally verified for a small X-band array. Data are also presented, which show that insertion loss in the finline arrays is independent of the number of array elements, assuming the designs are optimized for the desired return-loss characteristics in each case.

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Causality and waveguide circuit theory

D.F. Williams and B.K. Alpert. "Causality and waveguide circuit theory." 2001 Transactions on Microwave Theory and Techniques 49.4 (Apr. 2001, Part I [T-MTT]): 615-623.

We develop a new causal power-normalized waveguide equivalent-circuit theory that, unlike its predecessors, results in network parameters usable in both the frequency and time domains in a broad class of waveguides. Enforcing simultaneity of the voltages, currents, and fields and a power normalization fixes all of the parameters of the new theory within a single normalization factor, including both the magnitude and phase of the characteristic impedance of the waveguide. Enforcing simultaneity also ensures that the theory's voltages and currents do not start before their excitation, and that the network parameters of passive devices are causal, a necessary condition for stable time-domain simulations.

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A short-open deembedding technique for method-of-moments-based electromagnetic analyses

M. Farina and T. Rozzi. "A short-open deembedding technique for method-of-moments-based electromagnetic analyses." 2001 Transactions on Microwave Theory and Techniques 49.4 (Apr. 2001, Part 1 [T-MTT]): 624-628.

A short-open calibration (SOC) technique for deembedding structures with an arbitrary, possibly coupled, number of ports is introduced in this paper. While deembedding algorithms used in commercial software packages require the analysis of two "standard" structures for each set of ports, the proposed solution requires only one standard to be analyzed, with a significant reduction in the overall computation time. Moreover, unlike other deembedding techniques, the SOC technique does not rely on specific assumptions about the nature of the port discontinuities and of the feeding lines. This fact circumvents ambiguities linked to the definition of the characteristic impedance when hybrid modes are involved. Implementation-ready formulas are provided.



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Analysis and design of large leaky-mode array employing the coupled-mode approach

Cheng-Nan Hu and C.-K.C. Tzuang. "Analysis and design of large leaky-mode array employing the coupled-mode approach." 2001 Transactions on Microwave Theory and Techniques 49.4 (Apr. 2001, Part I [T-MTT]): 629-636.

This paper presents the coupled-mode approach to the analysis and design of a large leaky-mode array, in which an N-element microstrip array above a common ground plane supports N coupled leaky modes (leaky EH/sub 1/ modes) at the first higher order. Following a brief description of a conventional full-wave nonstandard eigenvalue problem for solving the complex propagation constants, we present the detailed formulation of the coupled-mode approach, clearly showing the transformation of the nonstandard eigenvalue problem into a standard one. Thus, all the eigenvalues (complex propagation constants) and eigenvectors (modal current distributions) are solved simultaneously, regardless of the size of the array (N). Two key issues pertinent to the successful implementation of the proposed coupled-mode approach are addressed: the determination of the coupling coefficients and the uniqueness of the isolated uncoupled leaky mode, which represents the leaky modal solution of a single microstrip, but is derived from a system of coupled leaky-mode solutions provided the coupled microstrips have equal width and spacing. Closed-form expressions for obtaining the coupling coefficients of orders two, three, and four are presented. Theoretical studies of closely coupled microstrip arrays of two, three, and four elements show that the magnitude of the coupling coefficient /sub i,i+j/ between elements i and i+ decreases at the order of 10/sup -j/. These theoretical case studies also lead to the same isolated uncoupled leaky-mode solution as predicted.

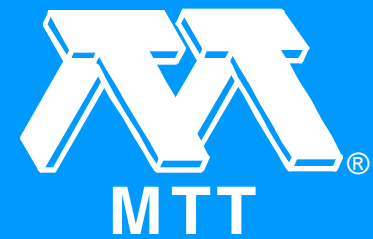
Furthermore, the dispersion characteristics of the microstrip array at the first higher order obtained by the coupled-mode approach and the full-wave approach agree excellently for all the case studies. Error analyses indicated that at least two coupling coefficients (C/sub i,i+1/ and C/sub i,i+2/) are required for obtaining accurate complex propagation constants with rms errors less than 1% for most of the leaky region of the particular array under investigation. An example of applying the proposed coupled-mode- approach for analyzing a corporate-fed leaky-mode array of eight elements is reported, revealing that only four out of the eight leaky modes are excited. The coupled-mode theory predicts the far-field radiation pattern in the main beam

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region in excellent agreement with the measured results.



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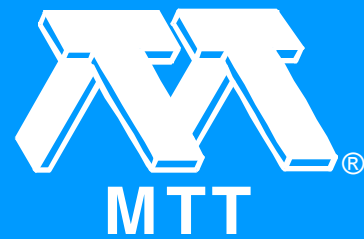


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Comparative analysis of mode reflection and transmission in presence of a cutoff cross section of nonuniform waveguide by using the cross section and the mode-matching and generalized scattering-matrix

I. Ederra, M.S. Ayza, M. Thumm and B.Z. Katsenelenbaum. "Comparative analysis of mode reflection and transmission in presence of a cutoff cross section of nonuniform waveguide by using the cross section and the mode-matching and generalized scattering-matrix." 2001 Transactions on Microwave Theory and Techniques 49.4 (Apr. 2001, Part I [T-MTT]): 637-645.

By using the cross-section method, waveguide transitions containing parts where modes are in cutoff are analyzed. The problem of infinite value of coupling coefficients for modes in cutoff has been solved. Formulas for the calculation of reflection coefficients are presented. The results have been compared with the mode-matching and generalized scattering matrix methods.



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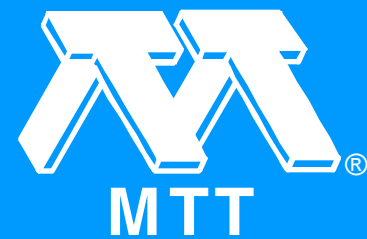
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Millimeter-wave radar sensing of airborne chemicals

N. Gopalsami and A.C. Raptis. "Millimeter-wave radar sensing of airborne chemicals." 2001 Transactions on Microwave Theory and Techniques 49.4 (Apr. 2001, Part I [T-MTT]): 646-653.

This paper discusses the development of a millimeter-wave radar chemical sensor for applications in environmental monitoring and arms-control treaty verification. The purpose of this paper is to investigate the use of fingerprint-type molecular rotational signatures in the millimeter-wave spectrum to sense airborne chemicals. The millimeter-wave sensor, operating in the frequency range of 225-315 GHz, can work under all weather conditions and in smoky and dusty environments. The basic configuration of the millimeter-wave sensor is a monostatic swept-frequency radar that consists of a millimeter-wave sweeper, a hot-electron bolometer or Schottky barrier detector, and a corner-cube reflector. The chemical plume to be detected is situated between the transmitter/detector and reflector. Millimeter-wave absorption spectra of chemicals in the plume are determined by measuring the swept-frequency radar return signals with and without the plume in the beam path. The problem of pressure broadening, which hampered open-path spectroscopy in the past, has been mitigated in this paper by designing a fast sweeping source over a broad frequency range. The heart of the system is a backward-wave oscillator (BWO) tube that can be tuned over 220-350 GHz. Using the BWO tube, we built a millimeter-wave radar system and field-tested it at the Department of Energy Nevada Test Site, Frenchman Flat, near Mercury, NV, at a standoff distance of 60 m. The millimeter-wave system detected chemical plumes very well; detection sensitivity for polar molecules such as methylchloride was down to 12 ppm for a 4-m two-way pathlength.

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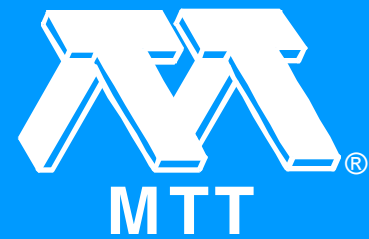
High-performance inductors

I.J. Bahl. "High-performance inductors." 2001 Transactions on Microwave Theory and Techniques 49.4 (Apr. 2001, Part I [T-MTT]): 654-664.

In this paper, we describe the design, test data, and analysis of several circular spiral inductors fabricated on GaAs substrates using the multifunction self-aligned gate multilayer process. Various factors such as high inductance, high-quality and, high current handling capacity, and compactness are studied. Several configurations for inductors were investigated to optimize the inductor geometry such as the linewidth, spacing between the turns, conductor thickness, and inner diameter. It includes measured effects of various parameters on inductor performance, such as linewidth, spacing, inner diameter, metal thickness, underlying dielectric, and dielectric thickness. It is shown experimentally that the Q factor of spiral inductors can be enhanced by using 9-/spl mu/m-thick metallization and placing inductors on a 10-/spl mu/m-thick polyimide layer, which is placed on top of the GaAs substrate. Using this technique, we have observed up to 93% improvement in the Q factor of circular spiral inductors, as compared to standard spiral inductors fabricated on GaAs substrates. Inductors having thick metallization can also handle dc currents as large as 0.6 A.

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Numerical simulation of microstrip resonators and filters using the ADI-FDTD method

T. Namiki and K. Ito. "Numerical simulation of microstrip resonators and filters using the ADI-FDTD method." 2001 Transactions on Microwave Theory and Techniques 49.4 (Apr. 2001, Part I [T-MTT]): 665-670.

In this paper, we derived the characteristics of typical and practical microstrip components such as microstrip linear resonators and microstrip low-pass filters using the alternating-direction-implicit-finite-difference-time-domain (ADI-FDTD) method to examine the calculation accuracy and efficiency of the method. The resonators and the filters included very narrow gaps and strips, respectively. In this case, very fine cells must be applied there for the finite-difference time-domain (FDTD) modeling. In the conventional FDTD method, fine cells cause a reduction of the time-step size because of the Courant-Friedrich-Levy (CFL) stability condition, which results in an increase in calculation time. In the ADI-FDTD method, on the other hand, a larger time-step size than the CFL stability condition limitation could be set. We compared the results of the ADI-FDTD method for various time-step sizes with the results of the conventional FDTD method and measured data.

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A fully integrated active inductor with independent voltage tunable inductance and series-loss resistance

C. Leifso and J.W. Haslett. "A fully integrated active inductor with independent voltage tunable inductance and series-loss resistance." 2001 Transactions on Microwave Theory and Techniques 49.4 (Apr. 2001, Part I [T-MTT]): 671-676.

A fully integrated GaAs MESFET active inductor is presented in this paper with independent voltage tunable inductance and series-loss resistance. The measured inductance is tunable from 65 to 110 nH in the frequency range from 100 MHz to 1.0 GHz. The measured loss resistance is independently tunable over a -5.6- to +20.8-/spl Omega/ range corresponding to a 0.26 and 0.65 V change in dc tuning voltages, respectively.

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Digital communications using self-phased arrays

L.D. DiDomenico and G.M. Rebeiz. "Digital communications using self-phased arrays." 2001 Transactions on Microwave Theory and Techniques 49.4 (Apr. 2001, Part I [T-MTT]): 677-684.

A new technique for full duplex digital communications using adaptive phase conjugation is presented in this paper. The technique is based on mixing the RF signal to an IF where it can be easily processed, and filtering the phase of the IF signal to separate the geometry phase and message phase. The retrodirective array automatically tracks communicating platforms and transmits a directive return signal without the use of phase shifters. A 6-GHz microstrip retrodirective antenna array was built, together with the signal IF processing needed for full duplex operation. The measured RCS values of a linear six-element array are in good agreement with theory and result in a 0- to -5-dB RCS for angles up to $\pm 60^\circ$. The measured RCS values of a circular array are much flatter and are 0 to -5 dB up to $\pm 80^\circ$. Two-way digital communications at a baud rate of 78 kb/s was also demonstrated with BER $< 10^{-6}$ for signal-to-noise ratios around 10 dB. The application areas are in high-performance digital mobile telecommunications for commercial and military applications.

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Field-singularity correction in 2-D time-domain Haar-wavelet modeling of waveguide components

M. Fujii and W.J.R. Hoefer. "Field-singularity correction in 2-D time-domain Haar-wavelet modeling of waveguide components." 2001 Transactions on Microwave Theory and Techniques 49.4 (Apr. 2001, Part I [T-MTT]): 685-691.

A time-domain Haar-wavelet-based modeling technique has been applied to two-dimensional waveguide problems including discontinuities. The field singularity at discontinuities such as edges and corners of conductors is corrected by quasi-static field approximation. Combination of quasi-static correction and wavelet modeling significantly improves the computational efficiency compared to conventional time-domain analysis techniques. The proposed technique was applied to waveguides perturbed by thin and thick irises and also iris-coupled waveguide filters. The computational efficiency of the technique is demonstrated by examining the convergence of the results obtained with different discretizations.

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Wide-band channel sounding at 24 GHz based on a novel fiber-optic synchronization concept

P. Truffer and P.E. Leuthold. "Wide-band channel sounding at 24 GHz based on a novel fiber-optic synchronization concept." 2001 Transactions on Microwave Theory and Techniques 49.4 (Apr. 2001, Part I [T-MTT]): 692-700.

This paper describes a novel fiber-optic synchronization concept used in a versatile channel sounding system called the ETH channel sounder operating at 24 GHz (ECHO 24). ECHO 24 achieves a 2-ns path delay resolution and allows the measurement of complex channel impulse responses with Doppler frequencies <200 kHz based on a correlation method. Moreover, an antenna array together with an appropriate signal-processing scheme yields the angle of arrival of the impinging waves at the receiver (Ex) site. The intolerable frequency offset due to the operation of locally separated oscillators in the transmitter (Tx) and Rx can be overcome by a remote Tx and Rx supply with a common carrier generated in a control unit. The problem of line attenuation in coaxial cables at millimeter-wave frequencies is circumvented by the generation of appropriate optical signals, which are fed to the Tx and Rx via thin and flexible fibers. The absence of mixers and frequency multipliers yields rather small Tx and Rx modules and, therefore, reduces the deformation of the electromagnetic field to be investigated. ECHO 24 exhibits a dynamic range of 55 dB. Measurements are presented to demonstrate the versatility and precision of ECHO 24.

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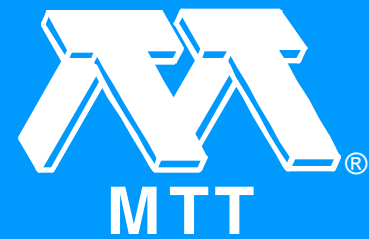
Analysis of shielded lossy multilayered-substrate microstrip discontinuities

E.S. Tony and S.K. Chaudhuri. "Analysis of shielded lossy multilayered-substrate microstrip discontinuities." 2001 Transactions on Microwave Theory and Techniques 49.4 (Apr. 2001, Part I [T-MTT]): 701-711.

The spatial Green's function for a rectangular cavity partially filled with multiple layers of lossy dielectrics has been derived. The Green's function is used to compute the fields around a discontinuity in a transmission line. To analyze a discontinuity, the unknown surface current maintained on the microstrip discontinuity is expanded in terms of known suitable basis functions. The electric-field components in the plane of the discontinuity region are then written in terms of this current. Imposing the boundary condition that the component of the electric-field tangential to the metallization is zero yields the electric-field integral equation (EFIE). The method of moments is applied to the EFIE to obtain a system of linear equations. The resultant semianalytical expressions were used to conduct accurate modeling of a variety of structures. The validity and accuracy of this method are established through comparison with other published results. Convergence considerations are outlined and verified.

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Berenger and leaky modes in microstrip substrates terminated by a perfectly matched layer

H. Rogier and D. De Zutter. "Berenger and leaky modes in microstrip substrates terminated by a perfectly matched layer." 2001 Transactions on Microwave Theory and Techniques 49.4 (Apr. 2001, Part I [T-MTT]): 712-715.

In this paper, it is shown that the dispersion relation of a microstrip substrate terminated by a perfectly matched layer (PML) allows two sets of zeros. For a strongly absorbing PML, the first set does not depend on the characteristics of that layer. Within a good approximation, it corresponds to the leaky modes of the microstrip substrate. The second set is not influenced by the microstrip substrate. Since it mainly depends on the characteristics of the PML, this set of modes are called the Berenger modes. Analytic expressions are derived for these two sets of zeros in the quasi-static limit.

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Wide-bandwidth millimeter-wave bond-wire interconnects

T.P. Budka. "Wide-bandwidth millimeter-wave bond-wire interconnects." 2001 Transactions on Microwave Theory and Techniques 49.4 (Apr. 2001, Part I [T-MTT]): 715-718.

A new type of interconnect has been developed that significantly extends the bandwidth of fixed-length bond-wire interconnects between microwave circuits. This interconnect maximizes bond-wire length, as well as landing pad size while simultaneously extending the cutoff frequency of the interconnect. The bond-wire interconnect is treated as a five-stage low-pass filter where basic filter theory is used to develop an interconnect prototype. Microstrip interconnects are designed using electromagnetic simulators, which match a specific low-pass filter response on a 5-mil thick (127 /spl mu/m) glass substrates. The measurements indicate a return loss greater than 12 dB and an insertion loss from 0.0 to 0.3 dB from DC to 80 GHz using two 17-mil-long (432 /spl mu/m) 1-mil-diameter (25 /spl mu/m) ball bonds with a tolerance of /spl plusmn/2 mil (50 /spl mu/m). For comparison, an uncompensated interconnect with two 17-mil-long (432 /spl mu/m) bond wires has 1-dB insertion loss and 10-dB return loss at 40 GHz and continues to degrade at higher frequencies.

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Branch-line couplers using unequal line lengths

C. Toker, M. Saglam, M. Ozme and N. Gunalp. "Branch-line couplers using unequal line lengths." 2001 Transactions on Microwave Theory and Techniques 49.4 (Apr. 2001, Part I [T-MTT]): 718-721.

General solutions for branch-line couplers using different line lengths are provided in this paper. Explicit expressions are derived with which a hybrid with any given power division ratio can be designed. In the design, one of the characteristic impedances or lengths of the branches can be chosen arbitrarily to suit a given design specification. This approach brings flexibility in choosing the characteristic impedances or the lengths of the branches, and is helpful especially in monolithic-microwave integrated-circuit applications where restrictions imposed on microstrip transmission lines do not allow the use of conventional branch-line couplers employing quarter-wave-long lines. However, the resultant bandwidth is narrower compared to that of the conventional coupler.

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A simple equation for analysis of nonuniform transmission lines

R. Nevels and J. Miller. "A simple equation for analysis of nonuniform transmission lines." 2001 Transactions on Microwave Theory and Techniques 49.4 (Apr. 2001, Part I [T-MTT]): 721-724.

The solution to the telegrapher equations is often presented as a D'Alembert expression for the voltage in terms of the voltage at a previous time or for the current in terms of the current at a previous time. In this paper, we present a complete solution for the coupled set of transmission-line equations such that the voltage or current is in terms of both the previous time voltage and current amplitudes. The key features of these equations are: they require only the initial voltage and current amplitudes, positive- and negative-direction traveling waves do not have to be identified, they are valid on a nonuniform transmission line, and they are related to the frequency-domain ABCD-parameter equations and the D'Alembert expressions for coupled functions. A method is presented for evaluating this set of equations numerically and results are given for a transmission-line filter and for a transmission line with a nonuniform section.

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Etched-silicon micromachined W-band waveguides and horn antennas

B.A. Shenouda, L.W. Pearson and J.E. Harriss. "Etched-silicon micromachined W-band waveguides and horn antennas." 2001 Transactions on Microwave Theory and Techniques 49.4 (Apr. 2001, Part I [T-MTT]): 724-727.

Micromachining of silicon is broadly proposed for the fabrication of substrates and waveguides at millimeter wavelengths. This paper presents the results of the fabrication of finned diamond-shaped waveguides and horn antennas by way of ethylene-diamene-pyrocatechol anisotropic etching of silicon. The structure is fabricated in two halves by etching V grooves in [100] silicon wafers. The etched faces of the wafers were metallized with gold. Metallic fins evaporated on a thin layer of Mylar and sandwiched between the two halves of the structure were used to improve the bandwidth of the waveguide. Measurements were taken of the dispersion curve of the waveguide with fins with different gap separations, and of the radiation patterns of the fabricated horns with different flare angles at different frequencies. Measurements showed a very good agreement with numerical calculations using the finite-element-method technique. Computed attenuation curves for the structure are provided as well.

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Improved design of broad-band latching ferrite phase shifter in a reduced-size grooved waveguide

Wenquan Che, Nai-Ning Yung, Wen Junding and Kan Sha. "Improved design of broad-band latching ferrite phase shifter in a reduced-size grooved waveguide." 2001 Transactions on Microwave Theory and Techniques 49.4 (Apr. 2001, Part I [T-MTT]): 727-730.

In this paper, an improved design of a broad-band latching ferrite phase shifter in grooved waveguide is discussed. The elimination technique for the insertion-loss peak is also introduced. The little gaps between the metal bars and waveguide wall are beneficial to suppress the high-order modes caused by the filling of high constant dielectric in the ferrite toroid. The theoretical and measured results have shown that the changes in differential phase shift with frequency remains less than 2.2%; the insertion loss and voltage standing-wave ratio of the device are good over the band 2/spl sim/4 GHz.

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A general approach to edge singularity extraction near composed wedges in boundary-element method

P. Cecchini, F. Bardati and R. Ravanelli. "A general approach to edge singularity extraction near composed wedges in boundary-element method." 2001 Transactions on Microwave Theory and Techniques 49.4 (Apr. 2001, Part I [T-MTT]): 730-733.

A general approach, based on the two-dimensional boundary-element method (BEM), has been proposed to extract the electromagnetic-field singularities in the presence of composed wedges, i.e., those formed by adjacent dielectric and conducting bodies. The method requires the knowledge of the field singularity order and is based on solution factorization into both a regular part and a singular one. Only the regular part has to be determined after extraction. No restrictions are imposed on position and order of singularities since each edge is treated independently of the others. Moreover, the method does not require the solution of further equations or use of special basis functions. It naturally extends the conventional BEM approach, improving its accuracy and convergence performances. Examples are given for a microstrip transmission line with a strip of finite thickness. The results show practicability and advantages of the new approach.

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Electric current and electric field induced in the human body when exposed to an incident electric field near the resonant frequency" and "Electric fields induced in cells..." (Comments)

G.D. Lapin and A.W. Guy. "Electric current and electric field induced in the human body when exposed to an incident electric field near the resonant frequency" and "Electric fields induced in cells..." (Comments)." 2001 Transactions on Microwave Theory and Techniques 49.4 (Apr. 2001, Part I [T-MTT]): 734-736.

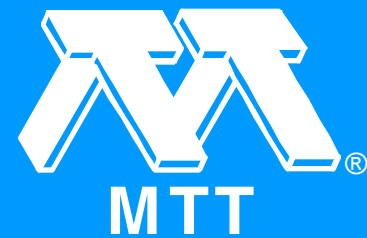
The authors comment on the work of R.W.P. King (ibid. vol. 48, pp. 1537-1543 & 2155-2159, 2000). Using a cylindrical model of the human body, King has performed a relatively accurate analysis of the electromagnetic fields within the adult human body due to incident radio frequency energy at 60 MHz. The development of this model is well reasoned and produces results that are believable, though limited in accuracy and precision by the choice of method. However, the conclusions about biological effects due to this analysis are unsupported and flawed. King is perhaps unaware of the extensive work that has been done in this collateral field over the last two decades. His choice of five references from a field of over 1000 independent studies misrepresents the consensus of the scientific community with regard to the potential for RF energy to cause disease. Thus, the message imparted by these papers can easily be misinterpreted to imply that an imminent danger exists, where one does not.



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Electric current and electric field induced in the human body when exposed to an incident electric field near the resonant frequency" and "Electric fields induced in cells..." (Author's Reply)

R.W.P. King. "Electric current and electric field induced in the human body when exposed to an incident electric field near the resonant frequency" and "Electric fields induced in cells..." (Author's Reply)." 2001 Transactions on Microwave Theory and Techniques 49.4 (Apr. 2001, Part I [T-MTT]): 736-736.



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Electric current and electric field induced in a human body when exposed to an incident electric field near the resonant frequency (Comments)

W.B. Bridges. "Electric current and electric field induced in a human body when exposed to an incident electric field near the resonant frequency (Comments)." 2001 Transactions on Microwave Theory and Techniques 49.4 (Apr. 2001, Part I [T-MTT]): 736-738.

For original paper see *ibid.*, vol. 48, no. 9, p. 147-53 (2000). The author makes two observations on the original article. The commentator questions whether a seated person is well modeled as a right circular cylinder. The second observation is that King cites only microwave studies on mice to show that electromagnetic radiation causes malignancies. These studies themselves are widely disputed. He then uses simple dimensional scaling to show that 2.45 GHz for a mouse scales to 100 MHz for a man. Such a scaling law may be useful in calculating the resonant frequency for a human subject versus a mouse when treated as antennas, but such scaling is meaningless when the physics of a hypothetical carcinogenic process are unknown.

Click on title for a complete paper.



Abstracts

Electric current and electric field induced in a human body when exposed to an incident electric field near the resonant frequency (Author's reply)

R.W.P. King. "Electric current and electric field induced in a human body when exposed to an incident electric field near the resonant frequency (Author's reply)." 2001 Transactions on Microwave Theory and Techniques 49.4 (Apr. 2001, Part I [T-MTT]): 737-738.



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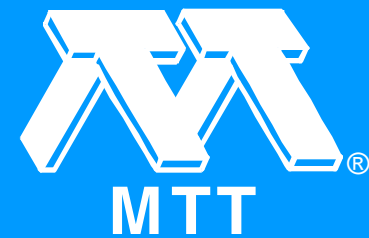
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"Table of Contents (Apr. 2001, Part II [T-MTT])." 2001 Transactions on Microwave Theory and Techniques 49.4 (Apr. 2001, Part II [T-MTT] (Special Issue on Microwave Acoustic Wave Devices for Wireless Communications and Sensing)): 0_1-0_1.



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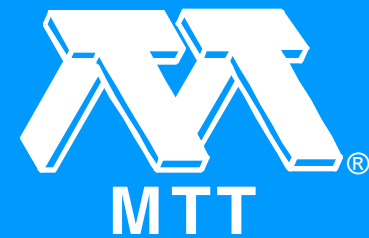
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Inside Cover (Apr. 2001, Part II [T-MTT])

"Inside Cover (Apr. 2001, Part II [T-MTT])." 2001 Transactions on Microwave Theory and Techniques 49.4 (Apr. 2001, Part II [T-MTT] (Special Issue on Microwave Acoustic Wave Devices for Wireless Communications and Sensing)): 0_2-0_3.



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Guest Editorial (Apr. 2001 [T-MTT])

R. Weigel and K.-Y. Hashimoto. "Guest Editorial (Apr. 2001 [T-MTT])." 2001 Transactions on Microwave Theory and Techniques 49.4 (Apr. 2001, Part II [T-MTT] (Special Issue on Microwave Acoustic Wave Devices for Wireless Communications and Sensing)): 741-742.



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Miniaturization and advanced functionalities of SAW devices

H. Meier, T. Baier and G. Riha. "Miniaturization and advanced functionalities of SAW devices." 2001 Transactions on Microwave Theory and Techniques 49.4 (Apr. 2001, Part II [T-MTT] (Special Issue on Microwave Acoustic Wave Devices for Wireless Communications and Sensing)): 743-748.

Apart from the active semiconductor chips a multitude of surface acoustic wave (SAW) filters are the key components that make modern RF circuits for mobile telecommunication and multimedia applications work. The latter are the most sophisticated and delicate species of passive components of which today's RF applications contain several hundred. While active integration has led to decreasing numbers of semiconductors inside a phone, for the time being, the passive components outnumber the actives. Obviously, the highest potential for further miniaturization lies in the passive components, As the market asks for further miniaturized mobile phones and digital tuners EPCOS AG, Munich, Germany, tackles this challenge not only by further shrinking the SAW filters, but also by integrating additional functions into the SAW filters, which were originally not SAW related at all. This paper briefly presents several applications for such highly miniaturized SAW filters offering superior filter performance combined with additional features like impedance transformation, balun functionality, or double balanced operation, allowing for smaller and cheaper designs by effectively reducing printed-circuit-board space, as well as component count.

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New SAW-convolver demodulation technique using Costas-loop synchronization for high-speed spread-spectrum signal

M. Hikita, C. Takubo and K. Asai. "New SAW-convolver demodulation technique using Costas-loop synchronization for high-speed spread-spectrum signal." 2001 Transactions on Microwave Theory and Techniques 49.4 (Apr. 2001, Part II [T-MTT] (Special Issue on Microwave Acoustic Wave Devices for Wireless Communications and Sensing)): 749-753.

A new synchronous-demodulation method for a high-speed spread-spectrum (SS) signal, which combines a surface acoustic wave convolver with a Costas-loop circuit has been proposed. From the convolver, in-phase and quadrature-phase components of the correlated signal can be directly derived. A control voltage obtained by a Costas-loop circuit adjusts the frequency and phase of a local-oscillation (LO) signal to those of the SS signal. Thus, in the receiver, synchronization of the LO signal and the received signal can be carried out independently of the transmitter. A quadrature phase-shift keying SS signal with 9 Mb/s and 60 Mc/s has been successfully demodulated using this method.

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A wireless spread-spectrum communication system using SAW chirped delay lines

A. Springer, W. Gugler, M. Huemer, R. Koller and R. Weigel. "A wireless spread-spectrum communication system using SAW chirped delay lines." 2001 Transactions on Microwave Theory and Techniques 49.4 (Apr. 2001, Part II [T-MTT] (Special Issue on Microwave Acoustic Wave Devices for Wireless Communications and Sensing)): 754-760.

We report on the use of broad-band chirp signals for spread-spectrum communications in indoor and industrial environments. The well-known pulse compression technique associated with chirp signals is exploited to achieve a highly robust communication system. For the generation and compression of the chirp signals, surface acoustic wave delay lines fabricated from an LiTaO/sub 3/-X112rotY substrate are used. Center frequency, bandwidth, chirp duration, and chirp rate are 348.8 MHz, 80 MHz, 500 ns, and /spl plusmn/40 MHz//spl mu/s, respectively. Different modulation schemes for chirp signals are introduced, the effects of nonlinearities, frequency drift, and temperature drift are addressed, and simulations and measurement results from a hardware demonstrator are presented for the use of /spl pi/4-differential quadrature phase-shift keying (DQPSK) modulation. A data rate of up to 40 Mb/s has been achieved experimentally and shows that the proposed system is highly robust against multipath effects.





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A new design concept for low-loss SAW filters based on different-width split-finger SPUDT

H. Nakamura, T. Yamada, T. Ishizaki and K. Nishimura. "A new design concept for low-loss SAW filters based on different-width split-finger SPUDT." 2001 Transactions on Microwave Theory and Techniques 49.4 (Apr. 2001, Part II [T-MTT] (Special Issue on Microwave Acoustic Wave Devices for Wireless Communications and Sensing)): 761-768.

A new design concept of a single-phase unidirectional transducer (SPUDT) has been investigated in this paper. The concept has been realized by using a newly developed different-width split-finger-SPUDT structure, in which the adjacent electrode fingers are given different widths. A symmetrical radiation conductance is obtained by adjusting the electrode finger positions. Computer simulations have confirmed that the electrical $1/Q$ factor and the directivity have a tradeoff relationship with regard to the finger-width ratio, depending on the metallization thickness used. From the simulation results, the optimum finger-width ratio for achieving a low insertion loss has been obtained. An experimental filter was constructed, which shows good performance, with the insertion loss improved by 1 dB when compared to a conventional electrode-width-controlled-SPUDT filter on an ST-cut quartz substrate.

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Thin-film bulk acoustic resonators and filters using ZnO and lead-zirconium-titanate thin films

Q.-X. Su, P. Kirby, E. Komuro, M. Imura, Q. Zhang and R. Whatmore. "Thin-film bulk acoustic resonators and filters using ZnO and lead-zirconium-titanate thin films." 2001 Transactions on Microwave Theory and Techniques 49.4 (Apr. 2001, Part II [T-MTT] (Special Issue on Microwave Acoustic Wave Devices for Wireless Communications and Sensing)): 769-778.

This paper presents the findings of a design, modeling, and fabrication study of ZnO and PbZr/sub 0.3/Ti/sub 0.7/O/sub 3/ thin-film bulk acoustic resonators and filters. Measurements of the high-frequency responses of ZnO resonators having different area are used to develop an acoustic model that accurately represents resonator impedance data. The models are also used to interpret S-parameter measurements on thin-film PbZr/sub 0.3/Ti/sub 0.7/O/sub 3/-based resonators and a value for the effective coupling coefficient deduced. ZnO and PbZr/sub 0.3/Ti/sub 0.7/O/sub 3/ ladder filters were designed based on measured impedance data from single resonators. Ladder filters based on PbZr/sub 0.3/Ti/sub 0.7/O/sub 3/ have been fabricated for the first time. It is shown that the high coupling coefficient in PbZr/sub 0.3/Ti/sub 0.7/O/sub 3/ leads to bandwidths in the range 100/spl sim/120 MHz at a center frequency of 1.6 GHz, larger than the bandwidths of ZnO-based filters.

Click on title for a complete paper.



On the noise behavior of a SAW convolver used as a matched filter

G. Ostermayer. "On the noise behavior of a SAW convolver used as a matched filter." 2001 Transactions on Microwave Theory and Techniques 49.4 (Apr. 2001, Part II [T-MTT] (Special Issue on Microwave Acoustic Wave Devices for Wireless Communications and Sensing)): 779-786.

The noise behavior of a surface acoustic wave convolver used as an analog matched filter is investigated in this paper. In contrast to the existing literature, the influence of noise processes with squared amplitudes is not neglected. It is shown that these quadratic noise contributions have a significant influence on the output signal-to-noise ratio (SNR) of the convolver for values of input SNR lower than 10 dB. The calculation is done for on-off keying coded signals but the results are also valid for other modulation schemes, e.g., phase shift keying.



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Design, fabrication, and application of precise SAW delay lines used in an FMCW radar system

L. Reindl, C.C.W. Ruppel, S. Berek, U. Knauer, M. Vossiek, P. Heide and L. Oreans. "Design, fabrication, and application of precise SAW delay lines used in an FMCW radar system." 2001 Transactions on Microwave Theory and Techniques 49.4 (Apr. 2001, Part II [T-MTT] (Special Issue on Microwave Acoustic Wave Devices for Wireless Communications and Sensing)): 787-794.

An inexpensive frequency-modulated continuous-wave (FMCW) radar system is presented in this paper, which, nevertheless, meets all industrial requirements. The FMCW radar uses a low-cost nonlinear voltage-controlled oscillator (VCO), operating at an IF of 2.45 GHz to generate the frequency modulation of the radar system. This VCO signal is applied twice, first to generate the radar transmitter signal at 24 GHz, and then it is fed to a surface acoustic wave (SAW) delay line. The SAW delay line generates a fixed delay time, which corresponds with a fixed radar distance. Thus, all systematic nonlinearities and stochastic phase errors of the FMCW system can be monitored and, afterwards, can be compensated for in real time. This linearization technique leads to a significant enhancement in dynamic range for a FMCW radar system. For this FMCW system, SAW delay lines with a linear phase characteristic have been designed using a linear optimization program. The delay line consists of two chirped and weighted interdigital transducers. For high volume, low-cost, and high-yield production of the required SAW structures, with linewidths down to 0.3 μm , technological improvements had to be achieved, especially in photolithography. Based on these design and fabrication techniques, delay lines at 2.45 GHz operating at the fundamental and third harmonic with bandwidths up to 800 MHz have been realized.

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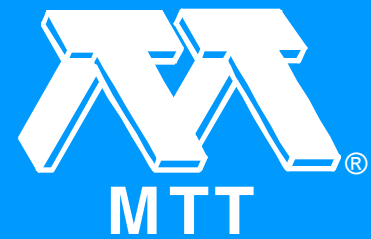


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Acoustic wave technology sensors

B. Drafts. "Acoustic wave technology sensors." 2001 Transactions on Microwave Theory and Techniques 49.4 (Apr. 2001, Part II [T-MTT] (Special Issue on Microwave Acoustic Wave Devices for Wireless Communications and Sensing)): 795-802.

A brief overview of acoustic wave sensor physics, materials, sensor types, and applications is presented in this paper. Emphasis is placed on the different types of acoustic wave sensors, their respective advantages, and their specific applications in industry.



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Radio-requestable passive SAW water-content sensor

L. Reindl, C.C.W. Ruppel, A. Kirmayr, N. Stockhausen, M.A. Hilhorst and J. Balendonck. "Radio-requestable passive SAW water-content sensor." 2001 Transactions on Microwave Theory and Techniques 49.4 (Apr. 2001, Part II [T-MTT] (Special Issue on Microwave Acoustic Wave Devices for Wireless Communications and Sensing)): 803-808.

A new passive sensor for remote measurement of water content in sandy soil was designed, using a surface acoustic wave (SAW) reflective delay line. Information from this sensor can be obtained by an interrogation device via a radio link operating in the European 434-MHz industrial-scientific-medical band. The SAW device, manufactured on the YZ cut of LiNbO₃, is mounted and sealed in a standard dual in line 16 package and contains four electroacoustic transducers. One transducer is connected to an external antenna to pick up an RF request signal from the interrogation device and to send back an RF response. The second transducer operates as a reflector. The bus bars of this transducer are connected with two measuring rods through an electrical transmission line. These rods can be inserted into sandy soil. The final two transducers operate as reflectors and are included for reference purposes. The transmission line and the two rods spanning the sand-water mixture have a characteristic impedance Z_{load} , which loads the second transducer. Changes in the soil water content are observed as a change of the total permittivity due to the high permittivity of free water, which, in turn, affects Z_{load} , as well. The amplitude and phase of the acoustic reflection at the second transducer changes due to a variation of the terminating Z_{load} . This then results in a difference in attenuation and phase of the corresponding peak in the time domain. Thus, the RF response of the sensor carries information about the water content between the rods, which, therefore, can be detected by and evaluated in the interrogation unit.

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Correlative signal processing in wireless SAW sensor applications to provide multiple-access capability

G. Ostermayer. "Correlative signal processing in wireless SAW sensor applications to provide multiple-access capability." 2001 Transactions on Microwave Theory and Techniques 49.4 (Apr. 2001, Part II [T-MTT] (Special Issue on Microwave Acoustic Wave Devices for Wireless Communications and Sensing)): 809-816.

We present a new method of evaluating the information of interest in the output response of surface acoustic wave (SAW) sensors. A well-known spread-spectrum technique is used to get the sensor information from an individually addressed SAW sensor. On-off keying-coded SAW sensors are picked out of a number of sensors by correlating the sensor response signal with a replica of the known response signal of a particular sensor. The influence of a measurement quantity (e.g., temperature, pressure, current, voltage,...) on a SAW sensor can be observed as a scaling of time and shape of the sensor response signal. This scaling factor is evaluated by use of correlative signal processing techniques. A main advantage of this method is the capability of multiple access, i.e., to distinguish different sensors in the range of a single interrogation system. Since this technique makes it possible to deal with sensor response signals overlapping in the time domain, sensors can remain short and, therefore, cheap. The principle of operation, limits of the method, and experimental results for temperature measurements are also presented.

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Cordless batteryless wheel mouse application utilizing radio requestable SAW devices in combination with the giant magneto-impedance effect

C. Hausleitner, R. Steindl, A. Pohl, H. Hauser, A.M.J. Goiser and F. Siefert. "Cordless batteryless wheel mouse application utilizing radio requestable SAW devices in combination with the giant magneto-impedance effect." 2001 Transactions on Microwave Theory and Techniques 49.4 (Apr. 2001, Part II [T-MTT] (Special Issue on Microwave Acoustic Wave Devices for Wireless Communications and Sensing)): 817-822.

Surface acoustic wave devices for wireless identification (ID) systems, the so-called ID tags, can be turned into novel sensor elements (transponders) for impedance sensors by making use of magnetic-field variations caused by the wheel rotation and key-click functionality of a personal computer (PC) mouse. This kind of sensor does not need any power supply and may be interrogated wirelessly. Interdigital transducers are used as loadable reflectors, while another fixed reflector is used as reference to compensate cross sensitivity for temperature, mechanical stress, etc. The load of the reflectors influences amplitude and phase of the reflected wave. The load's impedance is changed utilizing the giant magneto-impedance (GMI) effect in a 30-/spl mu/m-diameter amorphous FeCoSiNd wire of zero magnetostriction. The measurand, represented by the PC-mouse key clicks and wheel rotation, influences a magnetic field, which varies the impedance of the GMI wire. Consequently, the load of the reflector influences the reflected acoustic wave and the response signal of the radio sensor. The operating principle of such a magnetic-field sensor is discussed, and the tuning for an application in a passive and cordless PC mouse is presented.

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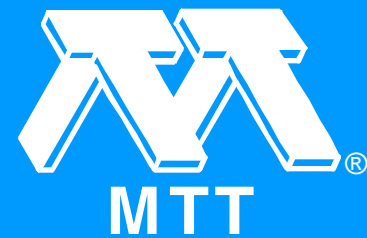


Abstracts

Theory and implementation of wireless transponders

D. Enguang. "Theory and implementation of wireless transponders." 2001 Transactions on Microwave Theory and Techniques 49.4 (Apr. 2001, Part II [T-MTT] (Special Issue on Microwave Acoustic Wave Devices for Wireless Communications and Sensing)): 823-826.

A theoretical analysis for the surface-acoustic-wave-based wireless transponder in a wireless system has been proposed in this paper. Radio transponders were also implemented based upon the theory of coupling of modes. The proposed theory can be employed in the simulation of amplitude- and phase-coded devices with different segments,.



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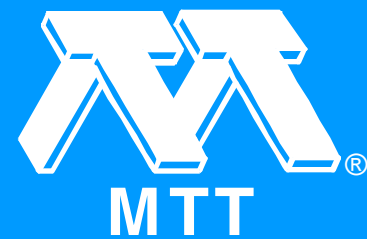
Investigations on plasma-polymer-coated SAW and STW resonators for chemical gas-sensing applications

I.D. Avramov, S. Kurosawa, M. Rapp, P. Krawczak and E.I. Radeva. "Investigations on plasma-polymer-coated SAW and STW resonators for chemical gas-sensing applications." 2001 Transactions on Microwave Theory and Techniques 49.4 (Apr. 2001, Part II [T-MTT] (Special Issue on Microwave Acoustic Wave Devices for Wireless Communications and Sensing)): 827-837.

Results from gas probing with various analyte vapors on high-Q low-loss surface transverse wave (STW) and surface acoustic wave (SAW) resonators coated with thin plasma-polymer films of hexamethyldisiloxane (HMDSO), styrene, and allyl alcohol at different polymerization conditions are presented in this paper. At the same acoustic wavelength of 7.22 μm and identical film thicknesses, HMDSO-coated STW devices feature substantially higher relative sensitivities to all analytes compared to their SAW counterparts. When operated in a microwave oscillator loop, plasma-poly-styrene and allyl-alcohol-coated STW devices generate strong sensor signals, even at low analyte concentrations, retaining an oscillator short-term stability in the $1/\text{spl times}/10/\text{sup } -9//\text{s}$ to $1/\text{spl times}/10/\text{sup } -8//\text{s}$ range. A 250 kHz sensor signal with $7/\text{spl times}/10/\text{sup } -9//\text{s}$ stability was obtained from a styrene coated 700 MHz STW resonator oscillator at a 1400 parts per million concentration of xylene vapor, which results in a measurement resolution of less than 40 parts per billion for xylene in the ambient air. It is shown that, with respect to sensitivity and stability over long probing periods, plasma-polymer films may become a serious competitor to the more or less unstable soft polymer coatings currently used in SAW-based gas sensors for applications in wireless systems for environmental control and protection.

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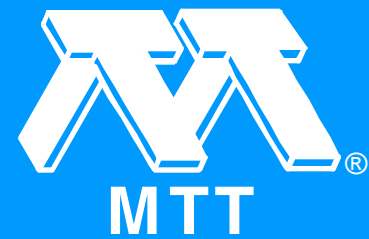
Diffraction analysis of slanted-finger interdigital transducers

G. Martin and D. Chen. "Diffraction analysis of slanted-finger interdigital transducers." 2001 Transactions on Microwave Theory and Techniques 49.4 (Apr. 2001, Part II [T-MTT] (Special Issue on Microwave Acoustic Wave Devices for Wireless Communications and Sensing)): 838-843.

For analysis, slanted-finger interdigital transducers (SFITs) are usually divided into many channels in parallel to the propagation direction. Every channel is considered to be a subfilter. This procedure neglects the diffraction completely. This paper introduces the diffraction in the SFIT analysis by use of the angular spectrum of plane waves (ASPW) approach. The analysis is based on a one-component bulk-wave model. The integrals of an ASPW are carried out by summing up M wave components with various wave vectors. Two wave modes propagating toward both forward and backward directions within SFIT are assumed to take the coupling effect into account. The amplitudes of both wave modes are expressed by M -dimensional vectors. By means of the boundary conditions at every finger edge, the transfer matrix and transduction vector are found. As a result, coupling-of-modes-like equations that link wave components at adjacent finger and gap regions are obtained. By matrix-matrix and matrix-vector multiplication, the complex amplitudes of all the wave components in all the finger and gap regions are calculated. These amplitudes yield the total wave field including reflection at all fingers. The wave field yields the piezoelectric part of the input and output transducer currents as functions of the filter input and output voltages representing the piezoelectric part of the Y matrix. The model is used for analyzing a unidirectional SFIT filter, the transducers of which are composed of SPUDT cells on 37/spl deg/ YX quartz. The simulated transmission behavior is compared with experimental results. Good agreement is found. Especially for the case of a large slanted angle, the profound deformation appearing within the passband and the high-frequency transition band can be clearly identified as the most important influence of the diffraction on the transmission behavior.

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Quasi-static discrete Green's function for SAW devices

D.P. Morgan. "Quasi-static discrete Green's function for SAW devices." 2001 Transactions on Microwave Theory and Techniques 49.4 (Apr. 2001, Part II [T-MTT] (Special Issue on Microwave Acoustic Wave Devices for Wireless Communications and Sensing)): 844-847.

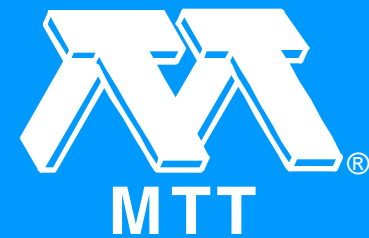
A discrete Green's function is derived for surface acoustic wave device analysis, giving the currents in an infinite array of regular electrodes when a voltage is applied to one electrode. Simple formulas are obtained by using the quasi-static approximation, which assumes the frequency to be such that electrode reflections are insignificant. The function exhibits distortion associated with the nonuniform charge distribution, and is shown to be causal.



Abstracts

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"Information for Authors (Apr. 2001 [T-MTT])." 2001 Transactions on Microwave Theory and Techniques 49.4 (Apr. 2001, Part II [T-MTT] (Special Issue on Microwave Acoustic Wave Devices for Wireless Communications and Sensing)): 0_4-0_4.



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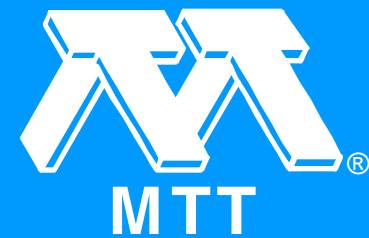
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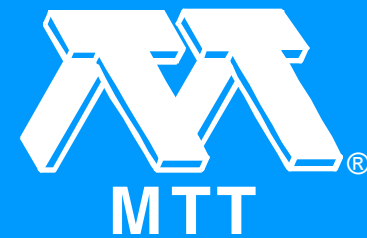
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Active-amplifier-array diagnostics using high-resolution electrooptic field mapping

K. Yang, T. Marshall, M. Forman, J. Hubert, L. Mirth, Z. Popovic, L.P.B. Katehi and J.F. Whitaker. "Active-amplifier-array diagnostics using high-resolution electrooptic field mapping." 2001 Transactions on Microwave Theory and Techniques 49.5 (May 2001 [T-MTT]): 849-857.

Several Ka-band spatial-amplifier power combiners and their free-space feeds were characterized using a high-resolution extreme-near-field electrooptic measurement technique. The two-dimensional electric-field amplitude and phase maps obtained from several arrays are presented. The usefulness of the technique for diagnostic purposes during the design and prototyping stages of the active arrays is discussed. In particular, the electrooptic maps were shown to be valuable for making improvements in the bias line design in one case, and for isolating faulty unit cells in another case.

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A series of InGaP/InGaAs HBT oscillators up to D-band

K. Uchida, H. Matsuura, T. Yakhara, S. Kobayashi, S. Oka, T. Fujita and A. Miura. "A series of InGaP/InGaAs HBT oscillators up to D-band." 2001 Transactions on Microwave Theory and Techniques 49.5 (May 2001 [T-MTT]): 858-865.

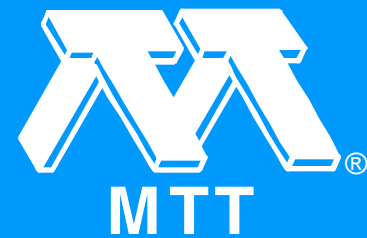
In this paper, the development of a series of fixed-frequency heterojunction bipolar transistor (HBT) oscillators from the W- to D-bands is reported. The oscillators are designed based on feedback theory with a small-signal equivalent circuit. This design method enables the achievement of high-output-power oscillators for the management of the power that is generated at the current source inside the HBT. We use a 1 /spl mu/m/spl times/10 /spl mu/m single-emitter InGaP/InGaAs HBT as an active device for each oscillator, and 50-/spl Omega/ coplanar waveguides as transmission lines and resonators. Emitter output topology is adopted to reduce the chip size. The series of oscillators achieve the oscillation frequency of 74.8-146.7 GHz. To our knowledge, the 146.7-GHz fundamental oscillation frequency is the highest oscillation frequency achieved thus far using InGaP/InGaAs HBT technology. The output power of the 146.7-GHz oscillator is -18.4 dBm. The chip size of the oscillator is 731 /spl mu/m/spl times/411 /spl mu/m.

Abstracts

Low-loss CPW on low-resistivity Si substrates with a micromachined polyimide interface layer for RFIC interconnects

G.E. Ponchak, A. Margomenos and L.P.B. Katehi. "Low-loss CPW on low-resistivity Si substrates with a micromachined polyimide interface layer for RFIC interconnects." 2001 Transactions on Microwave Theory and Techniques 49.5 (May 2001 [T-MTT]): 866-870.

The measured and calculated propagation constant of coplanar waveguide (CPW) on low-resistivity silicon ($1 \times 10^{-4} \Omega\cdot\text{cm}$) with a micromachined polyimide interface layer is presented in this paper. With this new structure, the attenuation (decibels per centimeter) of narrow CPW lines on low-resistivity silicon is comparable to the attenuation of narrow CPW lines on high-resistivity silicon. To achieve these results, a $20\text{-}\mu\text{m}$ -thick polyimide interface layer is used between the CPW and the Si substrate with the polyimide etched from the CPW slots. Only a single thin-film metal layer is used in this paper, but the technology supports multiple thick metal layers that will further lower the attenuation. These new micromachined CPW lines have a measured effective permittivity of 1.3. Design rules are presented from measured characteristics and finite-element method analysis to estimate the required polyimide thickness for a given CPW geometry.



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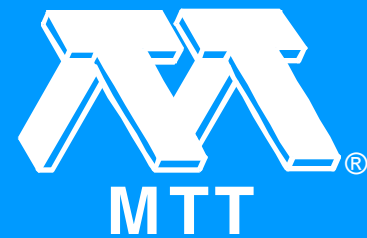
Theory and measurements of flip-chip interconnects for frequencies up to 100 GHz

A. Jentzsch and W. Heinrich. "Theory and measurements of flip-chip interconnects for frequencies up to 100 GHz." 2001 Transactions on Microwave Theory and Techniques 49.5 (May 2001 [T-MTT]): 871-878.

A detailed investigation of flip-chip interconnects up to W-band frequencies is presented in this paper. In a coplanar 50-/spl Omega/ environment, different test structures were fabricated and measured to determine the electromagnetic characteristics of flip-chip multichip modules, such as detuning, reflection at the interconnect, and parasitic coupling. Electromagnetic simulation is used to explain the details behind the measured results. Key to high return loss at the interconnect is a small bump-pad area. Applying simple compensation structures, the frequency range of operation can be further extended. It is shown that a return loss beyond 20 dB in the frequency range up to 80 GHz is achievable along with excellent reproducibility. Measurements on detuning and isolation are also presented.

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A miniaturized double-surface CPW bandpass filter improved spurious responses

T. Tsujiguchi, H. Matsumoto and T. Nishikawa. "A miniaturized double-surface CPW bandpass filter improved spurious responses." 2001 Transactions on Microwave Theory and Techniques 49.5 (May 2001 [T-MTT]): 879-885.

A novel miniaturized double-surface coplanar waveguide (CPW) filter has been developed. The filter is constructed by an electrode pattern of half-wavelength resonators on a double-sided circuit board with a high dielectric constant. A miniaturized pattern can be obtained by optimization of the electrode layout without any deterioration in unloaded Q . We use a particular pattern of via holes to reduce spurious responses. The filter is 38% smaller in size than the conventional $\lambda/4$ CPW filter. Spurious responses up to the third harmonic are suppressed by 13 dB, and satisfy the performance level required for industrial-scientific-medical band equipment. The measurement results agree well with the results of simulation.

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Time-domain wavelet Galerkin modeling of two-dimensional electrically large dielectric waveguides

M. Fujii and W.J.R. Hoefer. "Time-domain wavelet Galerkin modeling of two-dimensional electrically large dielectric waveguides." 2001 Transactions on Microwave Theory and Techniques 49.5 (May 2001 [T-MTT]): 886-892.

The time-domain wavelet-Galerkin method based on Daubechies' compactly supported scaling functions of high regularity has been applied to the analysis of two-dimensional dielectric slab waveguides that have typical dimensions and material parameters of optical integrated waveguide components, and the results are compared with those obtained with the conventional finite-difference time-domain method. It has been found that the proposed method allows discretization with a much coarser grid than the conventional time-domain analysis techniques due to its local sampling and highly linear numerical dispersion properties. A series of numerical experiments demonstrates the capability of the method to simulate the wave propagation of electrically large inhomogeneous media with reduced computational expenditure.

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A rigorous modal analysis of H-plane waveguide T-junction loaded with a partial-height post for wide-band applications

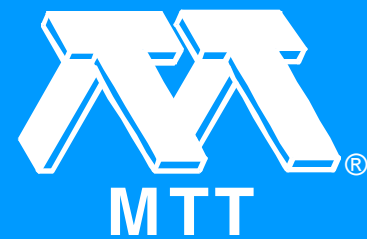
K.-L. Wu and H. Wang. "A rigorous modal analysis of H-plane waveguide T-junction loaded with a partial-height post for wide-band applications." 2001 Transactions on Microwave Theory and Techniques 49.5 (May 2001 [T-MTT]): 893-901.

A rigorous modal analysis (MA) for the H-plane waveguide T-junction loaded with a partial-height conducting post is presented in this paper. The analysis is based on the classical resonator mode-matching technique for waveguide junction problems and a novel concept called extended eigenmode functions. The new concept can be used for constructing eigenmode functions of a complex resonator region as long as the modal solution for a subproblem is available.

Particularly for the T-junction problem, the modal solution for the two-port in-line waveguide loaded with the post is used. The proposed MA has been extensively verified by a finite-element method software package. Excellent agreement can be observed. Numerical results obtained by the analysis reveal that by adjusting the dimension of the loading post, the usable band width of the T-junction for constructing a diplexer can be significantly expanded. Since the generalized scattering matrix is obtained, the proposed analysis can be integrated with other available waveguide key building-block models for system analysis.

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Multiresolution time-domain algorithm using CDF biorthogonal wavelets

T. Dogaru and L. Carin. "Multiresolution time-domain algorithm using CDF biorthogonal wavelets." 2001 Transactions on Microwave Theory and Techniques 49.5 (May 2001 [T-MTT]): 902-912.

A new approach to the multiresolution time-domain (MRTD) algorithm is presented in this paper by introducing a field expansion in terms of biorthogonal scaling and wavelet functions. Particular focus is placed on the Cohen-Daubechies-Feauveau (CDF) biorthogonal-wavelet class, although the methodology is appropriate for general biorthogonal wavelets. The computational efficiency and numerical dispersion of the MRTD algorithm are addressed, considering several CDF biorthogonal wavelets, as well as other wavelet families. The advantages of the biorthogonal MRTD method are presented, with emphasis on numerical issues.

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Compact reflective-type phase-shifter MMIC for C-band using a lumped-element coupler

F. Ellinger, R. Vogt and W. Bachtold. "Compact reflective-type phase-shifter MMIC for C-band using a lumped-element coupler." 2001 Transactions on Microwave Theory and Techniques 49.5 (May 2001 [T-MTT]): 913-917.

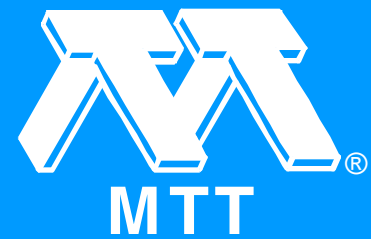
The design and results of an ultra-compact single-load reflective-type monolithic-microwave integrated-circuit phase shifter at 6.2 GHz for a satellite radar system is presented in this paper, which has been fabricated using a commercial 0.6- μm GaAs MESFET process. A 3-dB 90/spl deg/ coupler with lumped elements enables significant circuit size reduction in comparison to former approaches applying microstrip branch line or Lange couplers. Phase control is enabled using MESFET varactors with capacitance control ratios ($C_{\text{sub max}}/C_{\text{sub min}}$) of only four. Equations are derived to precisely describe the phase control ranges versus capacitance control ratios for different load configurations to allow efficient optimizations. Furthermore, the design tradeoff between low loss and high phase control range is discussed. Within a phase control range of 210/spl deg/, a loss of 4.9 dB/spl plusmn/0.9 dB and a 1-dB input compression point of higher than 5 dBm was measured for the designed phase shifter. The circuit size is less than 0.5 mm/sup 2/, which, to our knowledge, is the smallest reflective-type phase-shifter size reported to date.

Abstracts

Accuracy of microwave cavity perturbation measurements

R.G. Carter. "Accuracy of microwave cavity perturbation measurements." 2001 Transactions on Microwave Theory and Techniques 49.5 (May 2001 [T-MTT]): 918-923.

Techniques based on the perturbation of cavity resonators are commonly used to measure the permittivity and permeability of samples of dielectric and ferrite materials at microwave frequencies. They are also used to measure the local electric- and magnetic-field strengths in microwave structures including the shunt impedances of cavity resonators and the coupling impedances of slow-wave structures. This paper reexamines the assumptions made in the theory of these techniques and provides estimates of the errors of measurement arising from them.



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Noise performance of negative-resistance compensated microwave bandpass filters. Theory and experiments

L.-K.M. Cheng and Hil-Yee Chan. "Noise performance of negative-resistance compensated microwave bandpass filters. Theory and experiments." 2001 Transactions on Microwave Theory and Techniques 49.5 (May 2001 [T-MTT]): 924-927.

This paper examines both theoretically and experimentally the dependency of in-band noise performance upon circuit and device parameters of microwave filters employing negative-resistance compensation. By neglecting the influence of the induced gate noise source, a general expression for evaluating the noise figure of a second-order active filter is derived as a function of design parameters such as the transistor's noise figure, inductor's quality factor, and filter's bandwidth. In addition, factors affecting the optimization of the overall noise figure of these filters are discussed. For verification, the measured performance of two 900-MHz experimental MESFET filters are included.

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An efficient method to analyze the H-plane waveguide junction circulator with a ferrite sphere

Ru-Shan Chen and Edward Kai-Ning Yung. "An efficient method to analyze the H-plane waveguide junction circulator with a ferrite sphere." 2001 Transactions on Microwave Theory and Techniques 49.5 (May 2001 [T-MTT]): 928-937.

This paper presents an approximate, but efficient field treatment of the new easy-to-fabricate ferrite-sphere-based H-plane waveguide circulator for potentially low-cost millimeter-wave communication systems. A new three-dimensional modeling strategy using a self-inconsistent mixed-coordinates-based mode-matching technique is developed, i.e., the solutions of the Helmholtz wave equations in the ferrite sphere and in the surrounding areas are deduced in the form of infinite summation of spherical, cylindrical, and general Cartesian modes, respectively. The point-matching method is then used on the interface between the ferrite sphere and air within the cylindrical junction, as well as the interface between the junction and waveguides to numerically obtain the coefficients of different orders of basis functions of the field. Therefore, the field distributions, as well as the characteristics of the circulator, are numerically calculated and good agreement is observed between the numerical results and measured data.

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Prediction of a CDMA output spectrum based on intermodulation products of two-tone test

Seung-June Yi, Sangwook Nam, Sung-Hoon Oh and Jae-Hee Han. "Prediction of a CDMA output spectrum based on intermodulation products of two-tone test." 2001 Transactions on Microwave Theory and Techniques 49.5 (May 2001 [T-MTT]): 938-946.

A prediction method of a code-division multiple-access (CDMA) output spectrum based on intermodulation (IM) products of a two-tone test is proposed in this paper. An RF power amplifier is mathematically modeled by a complex envelope transfer function and, using this model, analytical expressions of IM products and a CDMA output spectrum are derived, respectively. By combining these two expressions, we finally derive an analytical expression that relates IM products to a CDMA output spectrum. It is shown in this expression that not only AM-AM, but also AM-PM distortion affects the CDMA output spectrum. Comparison between the measured and predicted results shows that the output spectrum predicted by this method agrees well with the measured spectrum.



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Formulas of microstrip with a truncated substrate by synthetic asymptotes: a novel analysis technique

Y.L. Chow and W.C. Tang. "Formulas of microstrip with a truncated substrate by synthetic asymptotes: a novel analysis technique." 2001 Transactions on Microwave Theory and Techniques 49.5 (May 2001 [T-MTT]): 947-953.

A substrate is usually truncated far enough to avoid disturbing the microstrip-line characteristics. Such uneconomical practice is not necessary if the disturbances as a function of truncation are known in formulas and, therefore, are easily compensated. This paper derives the desired formulas from the novel technique of synthetic asymptotes. Truncation at both sides of a line is derived here with 3% average error. For the practical one-sided truncation at the edge of a chip or circuit board, the average error is only half at 1.5%.

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On the convergence of the classical symmetrical condensed node-TLM scheme

J.N. Rebel, M. Aidam and P. Russer. "On the convergence of the classical symmetrical condensed node-TLM scheme." 2001 Transactions on Microwave Theory and Techniques 49.5 (May 2001 [T-MTT]): 954-963.

This paper presents a proof of convergence of the transmission-line matrix (TLM) method with a symmetrical condensed node (SCN) in the classical formulation of Johns (1987). It is shown that the convergence order of the SCN-TLM method cannot simply be derived from observing the dispersion characteristics of the TLM mesh. The mapping between the discretized electromagnetic field and TLM wave amplitudes plays a decisive role. Although second-order convergence is observed for coarse discretizations, which are usually used in practice due to the limitations of memory resources, it is shown and numerically verified that the asymptotic convergence reduces to order $O(\sqrt{\Delta t})$. Only using a bijective field mapping defined at the cell boundaries yields second-order convergence.

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An antenna diversity MMIC vector modulator for HIPERLAN with low power consumption and calibration capability

F. Ellinger, U. Lott and W. Bachtold. "An antenna diversity MMIC vector modulator for HIPERLAN with low power consumption and calibration capability." 2001 Transactions on Microwave Theory and Techniques 49.5 (May 2001 [T-MTT]): 964-969.

The design and performance of a vector-modulator-based phase shifter for high-performance radio local area networks at 5.2 GHz is presented in this paper. Low power consumption is achieved using a 0.6- μm GaAs MESFET process. At a voltage supply of 1.4 V and with a current consumption between 3.5-7 mA, the gain is 0.6 dB and the 1-dB input compression point is -9 dBm. A full 360° phase control range is achieved by combining two of the three vectors, which have phase offsets of 120°, with variable amplitude. Chip size is only 1.3 mm². The proposed vector modulator applies a new circuit configuration of variable-gain amplifiers to compensate their transmission phase errors. Within a gain control range of 20 dB, the phase error can be reduced to $\pm 3^\circ$, which is about a factor of eight better than the results obtained by single FET amplifiers. A simple calibration procedure for the proposed vector modulators is presented to improve the manufacturing yield and to decrease the impact due to temperature changes and aging. A maximum gain error of ± 0.8 dB and a maximum phase error of $\pm 7^\circ$ have been measured after applying this calibration to the designed vector modulator.

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Tapered stripline embedded in inhomogeneous media as microwave matching line

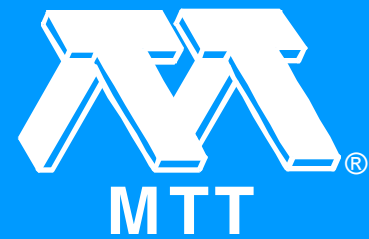
L. Vegni, A. Toscano and F. Bilotti. "Tapered stripline embedded in inhomogeneous media as microwave matching line." 2001 Transactions on Microwave Theory and Techniques 49.5 (May 2001 [T-MTT]): 970-978.

A novel design method for a stripline microwave matching line is developed in this paper. Striplines considered have a tapered inner conductor embedded in an inhomogeneous dielectric material with continuous spatial variation of the relative permittivity. The employment of this kind of waveguide, as it is shown in this paper, ensures good matching properties in a wide frequency range. These matching properties can be controlled by means of two different factors: the taper of the stripline inner conductor and the relative permittivity spatial variation of the dielectric material filling the stripline. Starting from the nonuniform transmission-line theory, a novel closed analytical form for the input reflection coefficient of such lines is derived, and design formulas for the matching line are carried out. Finally, several applications that show the capability, flexibility, and fastness of the developed synthesis method are presented.

Design and implementation of filters using transfer functions in the Z domain

Da-Chiang Chang and Ching-Wen Hsue. "Design and implementation of filters using transfer functions in the Z domain." 2001 Transactions on Microwave Theory and Techniques 49.5 (May 2001 [T-MTT]): 979-985.

In this paper, a novel approach composed of digital signal-processing techniques and optimization algorithms is developed to design and implement filters at microwave frequencies. The design phase begins with the adoption of digital filter prototypes and the implementation phase is facilitated by using both parametric modeling techniques and optimization algorithms. All the zeros of digital filter prototypes are removed first; the remaining part of the prototypes is then transformed to an autoregressive (AR) process by parametric modeling techniques. The values of characteristic impedances of transmission lines synthesizing the filters are adjusted according to the AR process by optimization algorithms. Both low-pass and bandpass filters are designed and then implemented in the form of a microstrip line, and their frequency responses are measured to validate the novel approach.



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Full-wave CAD of a rectangular waveguide filter with integrated coaxial excitation

G. Gerini and M. Guglielmi. "Full-wave CAD of a rectangular waveguide filter with integrated coaxial excitation." 2001 Transactions on Microwave Theory and Techniques 49.5 (May 2001 [T-MTT]): 986-989.

Coaxial waveguides are very commonly used in many microwave subsystems for the connection of various components. Significant size reduction could, therefore, be achieved by integrating the design of the coaxial transition in the computer-aided design (CAD) of microwave filters. In this context, we first discuss in this paper a coaxial transition, which can be efficiently designed interactively using an accurate and efficient CAD procedure. The key elements of the CAD tool developed are then described and a specific example of a microwave filter is discussed. In addition to theory, measured results are also presented, thereby fully validating both the CAD tool and the structures proposed.

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Single-ended HEMT multiplier design using reflector networks

D.G. Thomas, Jr. and G.R. Branner. "Single-ended HEMT multiplier design using reflector networks." 2001 Transactions on Microwave Theory and Techniques 49.5 (May 2001 [T-MTT]): 990-993.

Microwave and RF frequency multipliers are employed in a large number of communications, radar, civilian, and military systems. This paper presents the development of active doublers operating in S and C frequency bands. These devices are unique in that high electron-mobility transistors (Fujitsu FHX35LG) are employed in an unbalanced configuration utilizing "reflector" networks simultaneously on the input and output to reflect the second harmonic signal into the gate of the device and the fundamental signal into the drain simultaneously at appropriate phase angles to optimize performance. Measured and simulated results are presented on over 20 multiplier designs to verify the design philosophy. Conversion gains of approximately 7 dB are presented for narrow-band designs (5% bandwidth), 5 dB for medium-bandwidth designs (15%), and 4 dB for wide-bandwidth designs (35%). The fundamental and third harmonic rejection is approximately 40 dBc for the narrow-band designs and greater than 50 dBc for the medium and wide-band designs.

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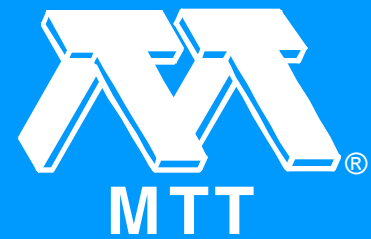


Abstracts

High-power vacuum window in WR10

M.E. Hill, R.S. Callin and D.H. Whittum. "High-power vacuum window in WR10." 2001 Transactions on Microwave Theory and Techniques 49.5 (May 2001 [T-MTT]): 994-995.

Results are presented in this paper for fabrication and test of a WR10 waveguide window for use in ultrahigh vacuum at 91.4 GHz. Low-power bench measurements are compared with analytic and simulation results. Operation at ~ 4 -kW peak power, duty factor 10 μ s/6 μ s, and 10 μ s/9 μ s-scale vacuum is noted.



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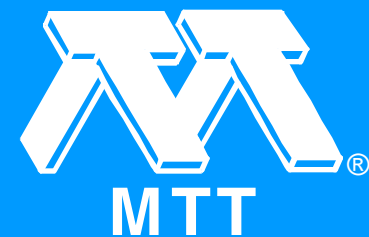


Abstracts

A technique for determining the normalized impedance of slots in the image plane of the image NRDG

L.C. Chirwa, M. Yamamoto, M. Omiya and K. Itoh. "A technique for determining the normalized impedance of slots in the image plane of the image NRDG." 2001 Transactions on Microwave Theory and Techniques 49.5 (May 2001 [T-MTT]): 995-997.

This paper presents a method for determining the normalized impedance of a transverse slot in the image plane of the image nonradiative dielectric guide using measurements of the standing wave. The method overcomes the problem of distortion caused by the scattered evanescent fields that are present in the vicinity of the slot. The measurement equipment, its optimum parameters, and aspects necessary for accurate measurements are also discussed. Moreover, the finite-difference time-domain technique is employed to determine the normalized slot impedance, and good agreement is obtained with measured results, confirming the reliability of the method.



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Beam-cavity interaction circuit at W-band

M.E. Hill, W.R. Fowkes, X.E. Lin and D.H. Whittum. "Beam-cavity interaction circuit at W-band." 2001 Transactions on Microwave Theory and Techniques 49.5 (May 2001 [T-MTT]): 998-1000.

In this paper, we describe the design, fabrication, and bench study of a millimeter-wave cavity employed as a relativistic klystron output structure. The oxygen-free electronic-grade copper cavity was prepared by electro-discharge machining and diffusion bonding, and cleaned and tuned to 91.4 GHz. Measured cavity characteristics are presented and compared with theory, including quality factor Q , coupling parameter β , scattering matrix S_{11} , and axial electric field profile E_z . This paper provides the basis for an understanding of the cavity as a transfer structure.

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Design of a low-cost 2-D beam-steering antenna using ferroelectric material and CTS technology

M.F. Iskander, Z. Yun, Z. Zhang, R. Jensen and S. Redd. "Design of a low-cost 2-D beam-steering antenna using ferroelectric material and CTS technology." 2001 Transactions on Microwave Theory and Techniques 49.5 (May 2001 [T-MTT]): 1000-1003.

The design of a new low-cost antenna array with two-dimensional beam-scanning capability is presented in this paper. The design procedure is based on the continuous transverse stub (CTS) technology and the use of ferroelectric material. With the application of a low-loss ferroelectric material barium strontium titanium oxide with 40% oxide III, beam-scan capability from -60/spl deg/ to 60/spl deg/ was achieved. The tradeoffs in selecting the ferroelectric material and between losses and bias voltage in the CTS design were also examined.

Furthermore, it was found necessary to adjust the dimensions of the radiating stubs, as well as the connecting sections of the feed waveguide so as to eliminate reflections between the stubs and, hence, maintain the desirable radiation pattern. It is shown that the use of an average height for the feed waveguide will result in deterioration in the radiation pattern.

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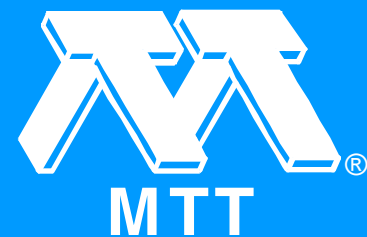


Abstracts

A general noise and S-parameter deembedding procedure for on-wafer high-frequency noise measurements of MOSFETs

C.-H. Chen and M.J. Deen. "A general noise and S-parameter deembedding procedure for on-wafer high-frequency noise measurements of MOSFETs." 2001 Transactions on Microwave Theory and Techniques 49.5 (May 2001 [T-MTT]): 1004-1005.

A general deembedding procedure using one "OPEN" and two "THRU" dummy structures for noise and scattering parameter deembedding based on cascade configurations is presented in this paper. This technique does not require any equivalent-circuit modeling of probe pads or interconnections. This deembedding procedure is valid for designs having interconnections with any kinds of geometries and for devices operated at frequencies of several tens of gigahertz.



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Numerical dispersion analysis of the unconditionally stable 3-D ADI-FDTD method

F. Zheng and Z. Chen. "Numerical dispersion analysis of the unconditionally stable 3-D ADI-FDTD method." 2001 Transactions on Microwave Theory and Techniques 49.5 (May 2001 [T-MTT]): 1006-1009.

This paper presents a comprehensive analysis of numerical dispersion of the recently developed unconditionally stable three-dimensional finite-difference time-domain (FDTD) method where the alternating-direction-implicit technique is applied. The dispersion relation is derived analytically and the effects of spatial and temporal steps on the numerical dispersion are investigated. It is found that the unconditionally stable FDTD scheme has advantages over the conventional FDTD of the Yee's scheme in modeling structures of fine geometry where a graded mesh is required. The unconditionally stable FDTD allows the use of a large time step in a region of fine meshes while maintaining numerical dispersion errors smaller than those associated with the region of coarse meshes.

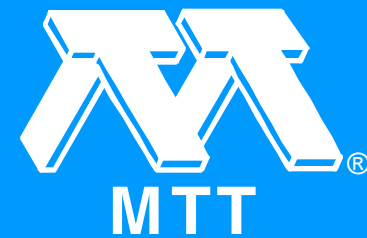
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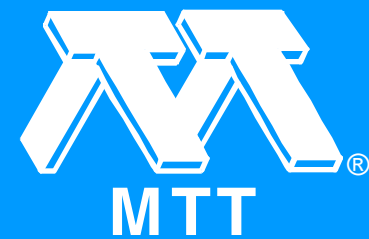
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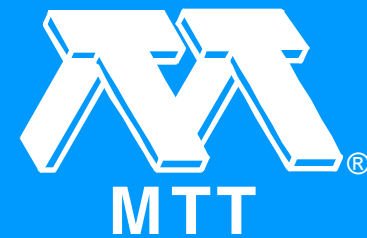
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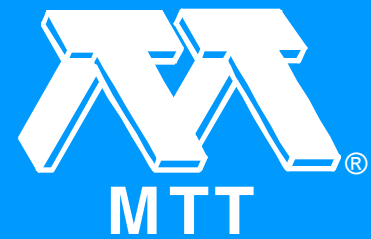


Abstracts

Analytic sampling-circuit model

D.F. Williams and K.A. Remley. "Analytic sampling-circuit model." 2001 Transactions on Microwave Theory and Techniques 49.6 (Jun. 2001, Part I [T-MTT]): 1013-1019.

We develop analytic expressions for the impulse response and kickout pulses of a simple sampling circuit that incorporate the nonlinear junction capacitance of the sampling diode. We examine the effects of both the time-varying junction capacitance and conductance on the impulse response and kickout pulses, and discuss their impact on the accuracy of the nose-to-nose calibration technique.



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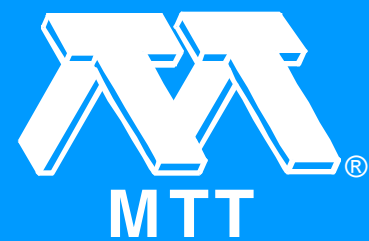
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Frequency-tunable microwave dielectric resonator

Yu.M. Poplavko, Yu.V. Prokopenko, V.I. Molchanov and A. Dogan. "Frequency-tunable microwave dielectric resonator." 2001 Transactions on Microwave Theory and Techniques 49.6 (Jun. 2001, Part I [T-MTT]): 1020-1026.

A new type of tunable composite dielectric resonator (DR) has been designed, In the structure of this DR, a controllable insert was used to change the resonance frequency ($f_{\text{sub } 0}$) in a wide spectral range, while preserving a high quality factor. The simplest of proposed resonance systems for obtaining $f_{\text{sub } 0}$ control is a microwave DR crossed by an air slot, which is controlled by fast piezoelectric actuator. Analytical and experimental techniques were employed for optimization of the composite DR structure. It has been observed that this device can create a change up to 20%-25% in its resonance frequency.



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An effective method for designing nonuniformly coupled transmission-line filters

Gaobiao Xiao, K. Yashiro, Ning Guan and S. Ohkawa. "An effective method for designing nonuniformly coupled transmission-line filters." 2001 Transactions on Microwave Theory and Techniques 49.6 (Jun. 2001, Part I [T-MTT]): 1027-1031.

An effective method is presented in this paper to design nonuniformly coupled transmission-line filters. This kind of filter can be used to realize almost an arbitrary filter characteristics as nonuniform transmission-line filters do. They can be cascaded directly, and no directional coupler is needed. This method begins with calculating characteristic impedance of a nonuniform transmission line by those techniques already established for designing nonuniform transmission-line filters, then determining the even- and odd-mode impedances of a nonuniformly coupled transmission line by a simple transformation. A first-order solution to the related nonlinear equations is especially proposed to calculate effective dielectric constants and line dimensions from the obtained characteristic impedances simultaneously. A device was built and tested, and the measured results verify that the proposed method is of practical use.

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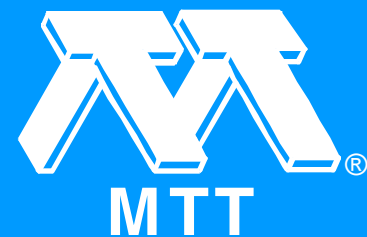


Abstracts

Accurate modeling of dual dipole and slot elements used with photomixers for coherent terahertz output power

S.M. Duffy, S. Verghese, A. McIntosh, A. Jackson, A.C. Gossard and S. Matsuura. "Accurate modeling of dual dipole and slot elements used with photomixers for coherent terahertz output power." 2001 Transactions on Microwave Theory and Techniques 49.6 (Jun. 2001, Part I [T-MTT]): 1032-1038.

Accurate circuit models derived from electromagnetic simulations have been used to fabricate photomixer sources with optimized high-impedance antennas. Output powers on the order of 1 /spl mu/W were measured for various designs spanning 0.6-2.7 THz. The improvement in output power ranged from 3 to 10 dB over more conventionally designed photomixers using broad-band log-spiral antennas. Measured data on single dipoles, twin dipoles, and twin slots are in good agreement with the characteristics predicted by the design simulations.



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Shield-based microwave on-wafer device measurements

T.E. Kolding. "Shield-based microwave on-wafer device measurements." 2001 Transactions on Microwave Theory and Techniques 49.6 (Jun. 2001, Part I [T-MTT]): 1039-1044.

This paper introduces a shielding technique for use with microwave on-wafer device characterization. This results in a shield-based test fixture, which offers many advantages compared to conventional structures. Among others, the test fixture offers full scalability and very low cost, high measuring accuracy, mitigation of leakage problems associated with lossy substrates, and a large measuring realism. The performance of the shield-based method is demonstrated with measurements on test structures fabricated in low-cost silicon processes.

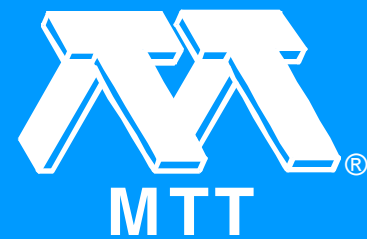
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Design of asymmetric filters with requirements in two bands of finite extension

S.C. D'Oro and G. Macchiarella. "Design of asymmetric filters with requirements in two bands of finite extension." 2001 Transactions on Microwave Theory and Techniques 49.6 (Jun. 2001, Part I [T-MTT]): 1045-1049.

In this paper, a general design procedure is presented for a class of filters characterized by requirements in two frequency bands, both of finite extension (one passband and one stopband). The filter structure is formed of suitable series resonators coupled through impedance inverters. The resonators also exhibit, in addition to the series resonance in the passband, a parallel resonance in the stopband. The procedure derives a suitable pole-zero distribution for the overall transfer function and determines the parameters of the equivalent resonators in order to obtain a quasi-equiripple response, both in the passband and stopband of the filter. The procedure has been implemented to design filters in rectangular waveguide; a pair of identical filters to be used in a diplexer have been designed through the procedure and fabricated in order to validate the theory.



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On the application of the microgenetic algorithm to the design of broad-band microwave absorbers comprising frequency-selective surfaces embedded in multilayered dielectric media

S. Chakravarty, R. Mittra and N.R. Williams. "On the application of the microgenetic algorithm to the design of broad-band microwave absorbers comprising frequency-selective surfaces embedded in multilayered dielectric media." 2001 Transactions on Microwave Theory and Techniques 49.6 (Jun. 2001, Part I [T-MTT]): 1050-1059.

In this paper, we present a procedure for synthesizing broad-band microwave absorbers incorporating frequency-selective surface (FSS) screens embedded in dielectric media using a binary coded genetic algorithm (GA). The GA simultaneously and optimally chooses the material in each layer, thickness of each layer, FSS screen periodicity in the z- and y-directions, its placement within the dielectric composite, and the FSS screen material. Additionally, the GA generates the cell structure of the FSS screen. The result is a multilayer composite that provides maximum absorption of both TE and TM waves for a prescribed range of frequencies and incident angles. This technique automatically places an upper bound on the total thickness of the composite.

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Numerical simulation using ADI-FDTD method to estimate shielding effectiveness of thin conductive enclosures

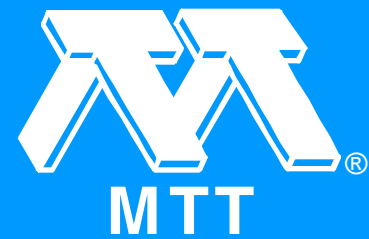
T. Namiki and K. Ito. "Numerical simulation using ADI-FDTD method to estimate shielding effectiveness of thin conductive enclosures." 2001 Transactions on Microwave Theory and Techniques 49.6 (Jun. 2001, Part I [T-MTT]): 1060-1066.

Numerical simulations were run using the alternating-direction implicit-finite-difference time-domain (ADI-FDTD) method to calculate the shielding effectiveness of various enclosures. The enclosures were composed of very thin conductive sheets, which are generally fabricated using conductive paints or electroless plating techniques on plastic surfaces. In this case, very fine cells must be used for finite-difference time-domain (FDTD) modeling. In the conventional FDTD method, fine cells reduce the time-step size because of the Courant-Friedrich-Levy (CFL) stability condition, which results in an increase in computational effort, such as the central processing unit (CPU) time. In the ADT-FDTD method, on the other hand, a larger time-step size than allowed by the CFL stability condition limitation can be set because the algorithm of this method is unconditionally stable. Consequently, an increase in computational efforts caused by fine cells can be prevented. The results from the ADI-FDTD method were compared with results from the conventional FDTD method, analytical solutions, and experimental data. These results clearly agree quite well, and the required CPU time for the ADI-FDTD method can be much shorter than that for the FDTD method.

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Reduction of substrate-mode effects in power-combining arrays

A. Al-Zayed, R.R. Swisher, F. Lecuyer, A.C. Guyette, Qi Sun and M.P. De Lisio. "Reduction of substrate-mode effects in power-combining arrays." 2001 Transactions on Microwave Theory and Techniques 49.6 (Jun. 2001, Part I [T-MTT]): 1067-1072.

We report a simple theory for the reduction of substrate modes in quasi-optical power-combining arrays. This qualitative theory predicts that detrimental substrate-mode effects can be greatly reduced through a judicious choice of the array unit cell size. Experimental evidence from quasi-optical tripler grids is presented to confirm the theory. Measured results show a dramatic improvement in the radiation pattern and effective radiated power of arrays with both grounded and ungrounded substrates.

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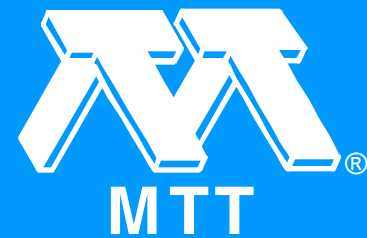
New simple proofs of the two-port stability criterium in terms of the single stability parameter $|\mu|$ ($|\mu|$)

P. Bianco, G. Ghione and M. Pirola. "New simple proofs of the two-port stability criterium in terms of the single stability parameter $|\mu|$ ($|\mu|$)." 2001 Transactions on Microwave Theory and Techniques 49.6 (Jun. 2001, Part I [T-MTT]): 1073-1076.

The classical scattering-parameter stability criterium for a linear two-port makes use of two conditions involving the Rollet parameter K plus one additional parameter. A new stability criterium was developed by Edwards and Sinsky [1992] on the basis of a condition on a single parameter, i.e., $|\mu|$ or $|\mu|$. This paper presents a new, simpler, and more straightforward set of proofs of the single-parameter stability criterium for a linear two-port. The first proof is algebraic and shows the equivalence of the conditions $K > 1$, $|b| > 1$ with the condition $|\mu| > 1$ ($i=1, 2$). The second proof, which is geometrical, relies only on the classical stability circle concepts in an improved way with respect to the treatment by Edwards and Sinsky.

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Ultra-broad-band doubly balanced star mixers using planar Mouw's hybrid junction

Chi-Yang Chang, Ching-Wen Tang and Dow-Chih Niu. "Ultra-broad-band doubly balanced star mixers using planar Mouw's hybrid junction." 2001 Transactions on Microwave Theory and Techniques 49.6 (Jun. 2001, Part I [T-MTT]): 1077-1085.

The planar Mouw's hybrid junction is realized by coplanar waveguide (CPW) to coplanar strip (CPS) or CPW to CPW T-junctions. A new explanation of Mouw's theory based on coupled transmission lines and including the transmission line losses is presented. The modified theory is more suitable for ultra-broad-band mixer design. Some prototype mixers with CPW to CPS or CPW to CPW T-junctions are fabricated with Al/sub 2/O/sub 3/ substrate. The prototype mixers show a bandwidth of greater than 20:1 if the even-mode resonance has been damped out. A method for damping out the even-mode resonance is also presented. All of the prototype circuits show much broader bandwidth than that of conventional star mixer.

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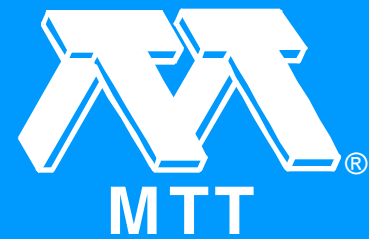
Subjects

Performance of Ku-band on-chip matched Si monolithic amplifiers using 0.18-/spl mu/m-gatelength MOSFETs

H. Yano, Y. Nakahara, T. Hirayama, Y. Suzuki and A. Furukawa. "Performance of Ku-band on-chip matched Si monolithic amplifiers using 0.18-/spl mu/m-gatelength MOSFETs." 2001 Transactions on Microwave Theory and Techniques 49.6 (Jun. 2001, Part I [T-MTT]): 1086-1093.

We demonstrated Ku-band (12-20 GHz) Si MOSFET monolithic amplifiers with on-chip matching networks. In these amplifiers, we used 3-/spl mu/m-thick Al-metal transmission lines on 8-/spl mu/m-thick polyimide-SiON-SiO/sub 2/ isolation layers for the matching networks. The amplifier showed a gain of 6-10 dB and a noise figure (NF) of 3.5-4 dB up to about 20 GHz, the highest gain and lowest NF yet reported for MOSFET amplifiers at this frequency. We also clarified the lossy on-chip inductor effect on the gain and noise performance of the amplifiers.





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General oscillator characterization using linear open-loop S-parameters

M. Randall and T. Hock. "General oscillator characterization using linear open-loop S-parameters." 2001 Transactions on Microwave Theory and Techniques 49.6 (Jun. 2001, Part I [T-MTT]): 1094-1100.

From a practical standpoint, oscillator design using linear open-loop S-parameters is attractive to designers due to the ease of use and widespread availability of linear S-parameter-based analysis software. However, the easiest and, therefore, most common approach is based on intuition and rules of thumb. The intent of this paper is to obtain quantitative expressions that characterize oscillator performance in terms of the linear open-loop S-parameters. A characteristic equation is derived that determines oscillator stability. The Nyquist stability criteria can be applied to this equation directly from the open-loop Bode plot. A closed-loop gain parameter is derived, which describes how the open-loop circuit self-connects. From this parameter, the startup time, oscillation frequency, and loaded Q can be predicted. A prediction of actual oscillation frequency can be made based on a simple oscillator model with known saturation characteristics. It will be shown under what conditions these expressions simplify to more readily applicable forms. In many cases, the designer can adjust analysis parameters to allow the use of the simplified expressions.

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A Ka-band indium-antimonide junction circulator

C.K. Yong, R. Sloan and L.E. Davis. "A Ka-band indium-antimonide junction circulator." 2001 Transactions on Microwave Theory and Techniques 49.6 (Jun. 2001, Part I [T-MTT]): 1101-1106.

Following a brief overview of the underlying theory, experimental results are presented for the first time showing circulator action in a semiconductor junction structure. An axially magnetized indium-antimonide disc fixed in a three-port finline structure and cooled to the temperature of boiling nitrogen, 77 K gives circulation across K/spl alpha/-band. For a dc magnetic bias of 0.73 T, a 15-dB isolation is recorded from 28 to 40 GHz, or a fractional bandwidth of at least 35%. Typical insertion loss is less than 1.5 dB from the WG22 reference plane at the test fixture ports. Continued operation above 40 GHz is predicted, but has not yet been measured. Measurement suggests that circulation is evident even where the effective propagation constant is imaginary, although better theoretical agreement is achieved when this is a real quantity. This new device makes millimeter-wave broad-band circulation a possibility and confirms the current model based upon the Drude-Zener approximation. A theoretical example is then given for a design operating to 140 GHz, yielding a fractional bandwidth of 110%.

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Optimum design of very high-efficiency microwave power amplifiers based on time-domain harmonic load-pull measurements

D. Barataud, M. Campovecchio and J.-M. Nebus. "Optimum design of very high-efficiency microwave power amplifiers based on time-domain harmonic load-pull measurements." 2001 Transactions on Microwave Theory and Techniques 49.6 (Jun. 2001, Part I [T-MTT]): 1107-1112.

Due to the large expansion of wireless communications, the need for high-efficiency power amplifiers has emerged. In mobile communication systems, power amplifiers are the most critical elements for the power-dissipation budget. Thus, the operating conditions of active devices have to be optimized using accurate and complementary computer-aided design (CAD) and experimental tools. This paper reports two design methods of high-efficiency power amplifiers. The first one is CAD oriented and based on the substitute generator technique using the nonlinear model of transistors. The second one is based on a specific measurement system of time-domain waveforms using a modified vector network analyzer, coupled with harmonic active load-pull techniques (three active loops). This new setup enables the measurement and optimization of time-domain waveforms at both ports of transistors driven by constant-wave test signals. These two design methodologies are applied to the optimization of an S-band 1-W class-F GaInP/GaAs heterojunction-bipolar-transistor power amplifier.

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Control of attenuation pole frequency of a dual-mode microstrip ring resonator bandpass filter

A.C. Kundu and I. Awai. "Control of attenuation pole frequency of a dual-mode microstrip ring resonator bandpass filter." 2001 Transactions on Microwave Theory and Techniques 49.6 (Jun. 2001, Part I [T-MTT]): 1113-1117.

A novel method is proposed to control the attenuation pole frequency of a dual-mode circular microstrip ring resonator bandpass filter, keeping the bandwidth constant. In this paper, the coupling between the dual modes is provided as the total effect of stub perturbation at the end of symmetry plane, and the angle between input/output ports. By making a various combinations of these two parameters, it is possible to control the attenuation pole frequency. An additional small coupling induced by excitation capacitance is also considered. Filters are simulated using the calculated coupling constant, and then the attenuation pole frequencies and bandwidth of the simulated filters are verified by experiment. Theoretical expressions are further devised to calculate the attenuation pole frequencies.

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Effect of internal reflections on the radiation properties and input impedance of integrated lens antennas-comparison between theory and measurements

M.J.M. van der Vorst, P.J.I. de Maagt, A. Neto, A.L. Reynolds, R.M. Heeres, W. Luinge and M.H.A.J. Herben. "Effect of internal reflections on the radiation properties and input impedance of integrated lens antennas-comparison between theory and measurements." 2001 Transactions on Microwave Theory and Techniques 49.6 (Jun. 2001, Part I [T-MTT]): 1118-1125.

This paper presents the effect of internal reflections on the beam pattern and input impedance of integrated lens antennas. A silicon lens was designed and manufactured, and measurements were conducted at a frequency of 100 (impedance) and 500 GHz (beam pattern). A frequency-dependence characterization of the beam pattern clearly showed the existence and impact of internal reflections. The measurements confirmed that most of the frequency variations of the beam pattern could be attributed to internal reflections, as predicted by the model. An on-wafer measurement strategy for determining the antenna impedance at millimeter-wave frequencies is presented. The validity of the model was also proven by an excellent match of the input impedance measurements and predictions. Not only the level, but also the oscillation on the impedance curve was predicted accurately. Initial space qualification was performed in the form of thermal cycling.

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New uniplanar subnanosecond monocycle pulse generator and transformer for time-domain microwave applications

Jeong Soo Lee, C. Nguyen and T. Scullion. "New uniplanar subnanosecond monocycle pulse generator and transformer for time-domain microwave applications." 2001 Transactions on Microwave Theory and Techniques 49.6 (Jun. 2001, Part I [T-MTT]): 1126-1129.

This paper presents the development of a new monocycle pulse generator and pulse-to-monocycle-pulse transformer operating in the subnanosecond regime. These circuits employ Schottky diodes, step recovery diodes, and simple charging and discharging circuitry, and are completely fabricated using coplanar waveguides. Simple transient analysis and design of the circuits are presented along with their operating principles. The pulse-to-monocycle-pulse transformer converts a 1 V 300 ps pulse into a 0.7-V 350 ps monocycle pulse. The monocycle pulse generator produces a monocycle pulse having 333 ps pulsewidth and more than 2 V from an input square wave of 10 MHz repetition rate. The generated monocycle pulses have very symmetrical positive and negative portions and low ringing level.

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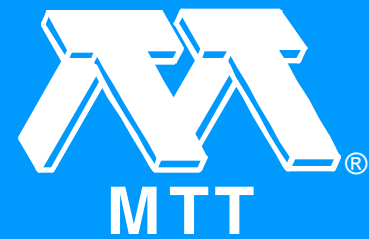


An inverse technique to evaluate permittivity of material in a cavity

K.P. Thakur and W.S. Holmes. "An inverse technique to evaluate permittivity of material in a cavity." 2001 Transactions on Microwave Theory and Techniques 49.6 (Jun. 2001, Part I [T-MTT]): 1129-1132.

A numerical technique to estimate the dielectric constant and loss factor of a homogeneous dielectric material placed in an arbitrary shaped cavity has been developed. The values of S-parameters are measured experimentally by placing the sample in the cavity. Starting with a trial set of permittivity values, the computation is carried out using the finite-element method (FEM) to match the S-parameters around the fundamental resonance frequency. The FEM routine is run several times while optimizing the values of dielectric constant and conductivity of the sample. During the process of optimization, eight different measures of error between computed and experimental values of complex S-parameters are examined. It is found that there is no single measure of error, which can be minimized to estimate two parameters (dielectric constant and the loss factor), but the combination of errors has to be minimized to get the exact solution. The computer program can generate the solution with an accuracy of less than 0.01% in a few hours on a Pentium-based personal computer.

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A full-wave modal analysis of inhomogeneous waveguide discontinuities with both planar and circular cylindrical boundaries

R.H. MacPhie and Ke-Li Wu. "A full-wave modal analysis of inhomogeneous waveguide discontinuities with both planar and circular cylindrical boundaries." 2001 Transactions on Microwave Theory and Techniques 49.6 (Jun. 2001, Part I [T-MTT]): 1132-1136.

A full-wave analysis of an inhomogeneous waveguide region with both planar and circular cylindrical boundaries is presented in this paper. Circular cylindrical modal functions are used to represent the fields. Field matching on the planar walls and apertures is rigorously achieved by the finite plane-wave series expansion of each modal field, whereas the addition theorem for cylindrical waves is used for rigorous field matching on the circular cylindrical boundaries. Numerical results are given for rectangular waveguides with 90/spl deg/ bends and rounded outer corners.

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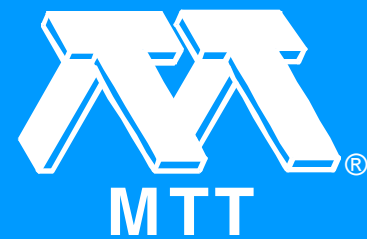


Abstracts

Analysis of metallic waveguides of a large class of cross sections using polynomial approximation and superquadric functions

Sheng-Li Lin, Le-Wei Li, Tat-Soon Yeo and Mook-Seng Leong. "Analysis of metallic waveguides of a large class of cross sections using polynomial approximation and superquadric functions." 2001 Transactions on Microwave Theory and Techniques 49.6 (Jun. 2001, Part I [T-MTT]): 1136-1139.

By using the polynomial approximation and superquadric functions in the Rayleigh-Ritz procedure, a unified method has been proposed to analyze conducting hollow waveguides of a large class of cross sections in our previous paper. Some useful and complicated cross-sectional waveguides in the microwave system, namely, eccentric annular, pentagonal, L-shaped, single-ridged, and double-ridged waveguides are analyzed in this paper. Compared with other numerical methods, this method has the advantages of being straightforward, accurate, and computational effective.



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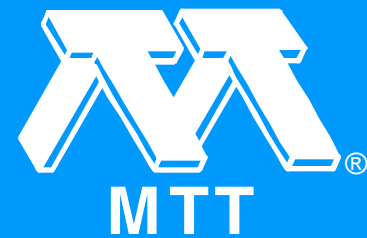


Abstracts

On the computation of the complete spectral Green's dyadic for layered bianisotropic structures (Comments and reply)

E.L. Tan, F. Mesa and R. Marques. "On the computation of the complete spectral Green's dyadic for layered bianisotropic structures (Comments and reply)." 2001 Transactions on Microwave Theory and Techniques 49.6 (Jun. 2001, Part I [T-MTT]): 1140-1142.

For original paper see F.L.Mesa, R.Marques and M.Horno, *ibid.*, vol.46, no.8, pp.1158-64 (Aug. 1998). In the above paper the authors have shown how to compute their complete spectral Green's dyadic (CSGD) for multilayered bianisotropic planar structures. This paper comments on their results, and includes their reply to the comments.



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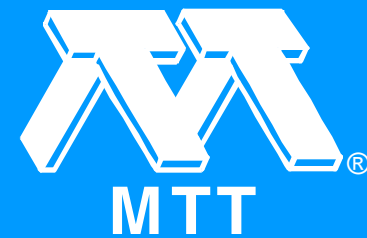
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Information for Authors (Jun. 2001, Part I [T-MTT])

"Information for Authors (Jun. 2001, Part I [T-MTT])." 2001 Transactions on Microwave Theory and Techniques 49.6 (Jun. 2001, Part I [T-MTT]): 0_5-0_5.



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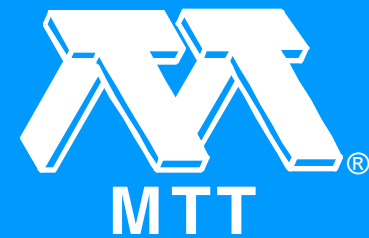
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"Table of Contents (Jun. 2001, Part II [T-MTT])." 2001 Transactions on Microwave Theory and Techniques 49.6 (Jun. 2001, Part II [T-MTT] (Special Issue on RF Power Amplification)): 0_1-0_1.



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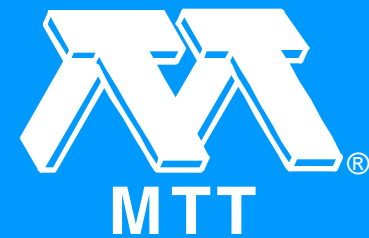
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"Inside Cover (Jun. 2001, Part II [T-MTT])." 2001 Transactions on Microwave Theory and Techniques 49.6 (Jun. 2001, Part II [T-MTT] (Special Issue on RF Power Amplification)): 0_2-0_3.



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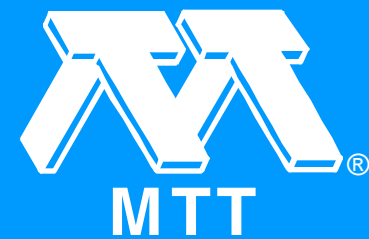
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Editorial (Jun. 2001, Part II [T-MTT])

M. Steer, J. Sevic and B.D. Geller. "Editorial (Jun. 2001, Part II [T-MTT])." 2001 Transactions on Microwave Theory and Techniques 49.6 (Jun. 2001, Part II [T-MTT] (Special Issue on RF Power Amplification)): 1145-1147.



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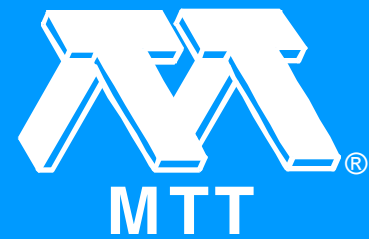
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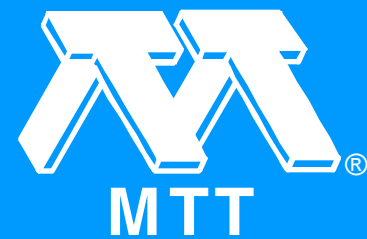
Improvement of third-order intermodulation product of RF and microwave amplifiers by injection

C.S. Aitchison, M. Mbabele, M.R. Moazzam, D. Budimir and F. Ali. "Improvement of third-order intermodulation product of RF and microwave amplifiers by injection." 2001 Transactions on Microwave Theory and Techniques 49.6 (Jun. 2001, Part II [T-MTT] (Special Issue on RF Power Amplification)): 1148-1154.

This paper discusses the improvement in the third-order intermodulation product (IM3) performance obtainable from RF and microwave amplifiers by two alternative injection techniques. The first is the addition to the amplifier input of the second harmonics of the input spectrum and the second is the addition to the amplifier input of the difference frequencies between the spectral components of the input signal. Both techniques are considered in theory, by simulation and in practice. Both techniques give useful improvements in two-tone IM3 performance. The second harmonic technique reduced the IM3 level by 43 dB in an amplifier at 835 MHz. The difference-frequency technique gave a reduction of 48 dB in an amplifier at 880 MHz. The difference-frequency technique also gives a greater improvement for complex spectra signals.

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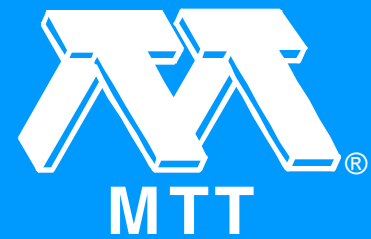
High-efficiency push-pull power amplifier integrated with quasi-Yagi antenna

C.Y. Hang, W.R. Deal, Yongxi Qian and T. Itoh. "High-efficiency push-pull power amplifier integrated with quasi-Yagi antenna." 2001 Transactions on Microwave Theory and Techniques 49.6 (Jun. 2001, Part II [T-MTT] (Special Issue on RF Power Amplification)): 1155-1161.

This paper presents a C-band push-pull power amplifier integrated with a modified uniplanar quasi-Yagi antenna. In this circuit, corrugation is added to the truncated ground plane of the antenna so that it can be used for both out-of-phase power combining and second harmonic tuning. By using the active integrated antenna concept, this novel circuit eliminates the usage of an ordinary 180/spl deg/ hybrid at the power-amplifier output stage, therefore eliminating the losses associated with the hybrid, resulting in a compact and high-efficiency power-amplifier design with intrinsic second harmonic suppression. At an operating frequency of 4.15 GHz, a maximum measured power-added efficiency (PAE) of 60.9% at an output power of 28.2 dBm has been achieved. The measured PAE is above 50% over a 260-MHz bandwidth. Additionally, the second harmonic radiation is found to be 30 dB below the fundamental in both E- and H-planes. When the circuit is subjected to a two-tone test, the measured third-order intercept point is 37 dBm, about 10 dB above the P/sub 1 dB/ point.

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Maximum efficiency and output of class-F power amplifiers

F.H. Raab. "Maximum efficiency and output of class-F power amplifiers." 2001 Transactions on Microwave Theory and Techniques 49.6 (Jun. 2001, Part II [T-MTT] (Special Issue on RF Power Amplification)): 1162-1166.

A class-F power amplifier (PA) improves efficiency and power-output capability (over that of class A) by using selected harmonics to shape its drain-voltage and drain-current waveforms. Typically, one waveform (e.g., voltage) approximates a square wave, while the other (e.g., current) approximates a half sine wave. The output power and efficiency of an ideal class-F PA can be related to the Fourier coefficients of the waveforms, and Fourier coefficients for maximally flat waveforms have been determined. This paper extends that theory by determining the coefficients for the maximum power and efficiency possible in a class-F PA with a given set of controlled harmonics.

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Efficient transmission-power-control scheme for Ku-band high-power amplifiers in portable user earth terminals

H. Okazaki, T. Ohira and K. Araki. "Efficient transmission-power-control scheme for Ku-band high-power amplifiers in portable user earth terminals." 2001 Transactions on Microwave Theory and Techniques 49.6 (Jun. 2001, Part II [T-MTT] (Special Issue on RF Power Amplification)): 1167-1173.

A novel power-amplifier scheme is presented in this paper that realizes highly efficient transmission power control (TPC). The output power is controlled without sacrificing high power-added efficiency by combining multiple amplifiers with different power levels. Unique switching and impedance matching techniques make it possible to eliminate RF switching circuits and their associated power losses. This direct coupled architecture is called the "switchless amplifier-switching scheme." The requirements for realizing the novel power amplifiers used in this scheme are estimated, and Ku-band amplifier monolithic microwave integrated circuits (MMICs) that follow this scheme are fabricated. The capabilities of the scheme are confirmed by testing these MMICs. Finally, a novel power amplifier incorporating the developed MMICs is constructed to demonstrate its performance. Experimental results show that the amplifier can achieve a significant reduction in DC power at low output power levels under TPC.

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Linearity of X-band class-F power amplifiers in high-efficiency transmitters

M.D. Weiss, F.H. Raab and Z. Popovic. "Linearity of X-band class-F power amplifiers in high-efficiency transmitters." 2001 Transactions on Microwave Theory and Techniques 49.6 (Jun. 2001, Part II [T-MTT] (Special Issue on RF Power Amplification)): 1174-1179.

Modern communication signals have time-varying envelopes with significant peak-to-average ratios, resulting in low average efficiency when amplified by commonly used linear power amplifiers (PAs). For linear amplification with increased average efficiency, the Kahn envelope-elimination-and-restoration method uses a highly efficient saturated PA. In this paper, an 8.4 GHz class-F PA with 55% maximum instantaneous efficiency at 610 mW output power, is experimentally characterized in several different biasing modes. Operated in linear mode with constant drain bias, this PA has 10% average efficiency. The suppression of two-tone intermodulation products is 27 dBc when operated at about 0.7 times the peak output power. For the same PA operated in a modified Kahn mode with drive and bias control, a comparable linearity (27.7 dBc) can be obtained at peak output power. Furthermore, the average efficiency increased to 44%, a factor of 4.4 over the linear fixed bias mode.

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A phenomenologically based transient SPICE model for digitally modulated RF performance characteristics of GaAs MESFETs

R.E. Leoni, III, M.S. Shirokov, Jianwen Bao and J.C.M. Hwang. "A phenomenologically based transient SPICE model for digitally modulated RF performance characteristics of GaAs MESFETs." 2001 Transactions on Microwave Theory and Techniques 49.6 (Jun. 2001, Part II [T-MTT] (Special Issue on RF Power Amplification)): 1180-1186.

A phenomenologically based transient SPICE model was developed for GaAs MESFETs. The model accounts for both trapping and detrapping effects; hence, it can simultaneously simulate low-frequency dispersion and gate-lag characteristics. This is different from conventional models, which can simulate either effect, but not both. The present model has been used to describe both surface- and substrate-related trapping phenomena in epitaxial or ion-implanted MESFETs. The model was experimentally verified in terms of pulsed I-V characteristics and pulsed AC response.

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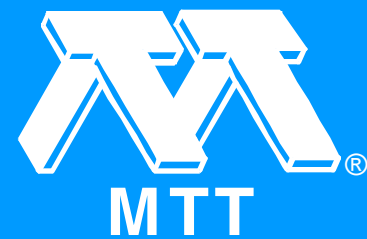
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A novel configuration for 1:N multiport power dividers using series/parallel transmission-line division and a polyimide/alumina-ceramic structure for HPA module implementation

M. Nakatsugawa and K. Nishikawa. "A novel configuration for 1:N multiport power dividers using series/parallel transmission-line division and a polyimide/alumina-ceramic structure for HPA module implementation." 2001 Transactions on Microwave Theory and Techniques 49.6 (Jun. 2001, Part II [T-MTT] (Special Issue on RF Power Amplification)): 1187-1193.

A novel configuration for 1:N multiport power dividers using series and parallel division of the transmission lines with a polyimide/alumina-ceramic structure is proposed and successfully demonstrated. Since these circuits need only line divisions and mode transitions to function as power dividers, they inherently possess an extremely flat frequency response. The polyimide/alumina-ceramic substrate suits the three-dimensional arrangement of various kinds of transmission lines and their transitions. It is also useful in implementing high power amplifier multichip modules because the alumina substrate can hold all active devices or monolithic microwave integrated circuits and provides convenient interfaces between them and the power dividers. The line divisions and mode transitions are analyzed by a commercial electromagnetic simulator. Two types of 1:4 power dividers, which are series/parallel and parallel/series configurations, are fabricated. No peculiar resonance was observed over the frequency range of 1-8 GHz. The amplitude deviation over this range was less than 3.2 dB.





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A highly efficient linearized wide-band CDMA handset power amplifier based on predistortion under various bias conditions

G. Hau, T.B. Nishimura and N. Iwata. "A highly efficient linearized wide-band CDMA handset power amplifier based on predistortion under various bias conditions." 2001 Transactions on Microwave Theory and Techniques 49.6 (Jun. 2001, Part II [T-MTT] (Special Issue on RF Power Amplification)): 1194-1201.

This paper investigates the use of amplifier linearization for performance improvement on a power amplifier developed for a wide-band CDMA (W-CDMA) system. A predistortion technique was chosen due to its compact size, which is suitable to implement in handsets. A predistorter (PD) monolithic-microwave integrated-circuit based on a heterojunction FET (HJFET) was designed and fabricated. Depending on the control voltage, the PD achieves both gain expansion and compression characteristics, which is shown to be important for compensating various amplifier nonlinearities. The power performances of an HJFET amplifier with and without a PD are compared. Due to the variation of the amplifier's responses under high and low quiescent current levels, the PD response required for optimum distortion cancellation in each case is examined. The linearized amplifier demonstrates a state-of-the-art power-added efficiency (PAE) of 57.4% under W-CDMA criteria, resulting from a 5-dB reduction in adjacent channel leakage power ratio. In addition, the use of power control in a W-CDMA system requires amplifiers with good efficiency over a wide range of output power. By combining a bias control scheme with predistortion, it is shown that a high PAE of over 40% can also be achieved for a 20 dB output power range. The improvements achieved are attributed to the alleviation of amplifier's nonlinearities after linearization.

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Transmission-line load-network topology for class-E power amplifiers

A.J. Wilkinson and J.K.A. Everard. "Transmission-line load-network topology for class-E power amplifiers." 2001 Transactions on Microwave Theory and Techniques 49.6 (Jun. 2001, Part II [T-MTT] (Special Issue on RF Power Amplification)): 1202-1210.

Class-E amplifiers are a type of switching amplifier offering very high efficiency approaching 100%. In this paper, a topology and design methodology, which could be used for a transmission-line implementation of a class-E power amplifier, is presented. A simple transmission-line class-E load network is proposed that offers combined transformation of the load resistance down to a suitable level, as well as simultaneous suppression of harmonics in the load. The load network was developed and tested with the aid of a time-domain simulator (i.e., SPICE). A microstrip layout was designed and a first prototype was built operating at 1 GHz utilizing a field-effect transistor as the switching device. A drain efficiency of 72% was measured for our prototype after tuning, although better performance can be expected with an improved switching transistor and careful tuning of the load network.

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Millimeter-wave monolithic power amplifier for mobile broad-band systems

J.C. Vaz and J.C. Freire. "Millimeter-wave monolithic power amplifier for mobile broad-band systems." 2001 Transactions on Microwave Theory and Techniques 49.6 (Jun. 2001, Part II [T-MTT] (Special Issue on RF Power Amplification)): 1211-1215.

For personal communication systems, the highest possible integration into monolithic technology of all RF functions are desirable. A frequency band around 60 GHz is assigned for future mobile communication fourth-generation systems (i.e., mobile broad-band systems concept). In this paper, the design and test of two monolithic class-A power amplifiers with 0.15 /spl mu/m pseudomorphic heterojunction FET (PMHFET) technology is presented. One of the amplifiers is a three-stage cascade 50 /spl Omega/ amplifier and the second is a balanced amplifier based on the previous one, but matched for integration on a waveguide carrier. A study on the accuracy of the passive elements and discontinuities models at 60 GHz was performed. Models for the microstrip discontinuities were obtained from electromagnetic simulation. In order to choose the best FET bias, a nonlinear model for the PMHFETs devices, based on continuous DC and AC measurements, were derived. For comparison purposes, the FET simulation results with a nonlinear model based on pulsed measurements are also presented. To avoid stability problems, at the device level an RC feedback network was introduced. A 1-dB compression point of 18 dBm was measured on-wafer for both amplifiers at 62 GHz with $V_{DS}/V_{bias}=3.5$. The three-stage and balanced amplifiers chip sizes are 3 mm/spl times/1.5 mm and 3 mm/spl times/4 mm, respectively.





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A second harmonic class-F power amplifier in standard CMOS technology

F. Fortes and M.J. do Rosario. "A second harmonic class-F power amplifier in standard CMOS technology." 2001 Transactions on Microwave Theory and Techniques 49.6 (Jun. 2001, Part II [T-MTT] (Special Issue on RF Power Amplification)): 1216-1220.

For personal communications systems, the highest possible integration on monolithic technology of all RF functions is desirable. The most difficult component to be monolithically integrated with all other functions is the output power amplifier. This paper describes the design and test of an integrated class-F power amplifier with 200-mW output power at 1.9 GHz and a 3 V power supply based on a 0.6 μm CMOS standard technology. A theoretical study of class-F operation that highlights the influence of nonideal active devices and output network topology on the circuit behavior was performed to have guidelines for amplifier optimization.

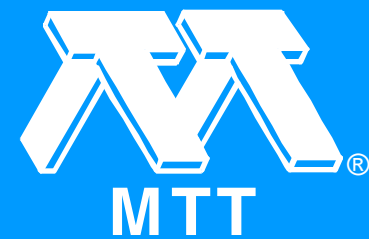
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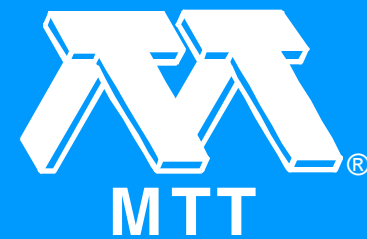
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"Inside Cover (Jul. 2001 [T-MTT])." 2001 Transactions on Microwave Theory and Techniques 49.7 (Jul. 2001 [T-MTT]): 0_3-0_4.



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A sparse-matrix/canonical grid method for analyzing densely packed interconnects

S.-Q. Li, Y. Yu, C.H. Chan, K.F. Chan and L. Tsang. "A sparse-matrix/canonical grid method for analyzing densely packed interconnects." 2001 Transactions on Microwave Theory and Techniques 49.7 (Jul. 2001 [T-MTT]): 1221-1228.

In this paper, a fast numerical method called the sparse-matrix/canonical-grid (SM/CG) method is employed to analyze densely packed microstrip interconnects that involve a large number of unknowns. The mixed-potential integral equation is solved by using the method of moments in the spatial domain. The closed-form expressions of the spatial Green's functions of microstrip structures are obtained from the combination of the fast Hankel transform and the matrix pencil method. The Rao-Wilton-Glisson triangular basis functions are used to convert the integral equation into a matrix equation. The matrix equation is then solved by using the SM/CG method, in which the far-interaction portion of the matrix-vector multiplication in the iterative solution is performed by the fast Fourier transforms (FFTs). This is achieved by the Taylor series expansions of the spatial Green's functions about the uniformly spaced canonical grid points overlaying the triangular discretization. Numerical examples are presented to illustrate the accuracy and efficiency of the proposed method. The SM/CG method has computational complexity of $O(N \log N)$. Furthermore, being FFT-based facilitates the implementation for parallel computation.

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Wide-band MMIC Kowari mixer/phase shifters

S.J. Mahon, J.T. Harvey and A.C. Young. "Wide-band MMIC Kowari mixer/phase shifters." 2001 Transactions on Microwave Theory and Techniques 49.7 (Jul. 2001 [T-MTT]): 1229-1234.

A series of wide-band image-reject monolithic-microwave integrated-circuit mixer/phase shifters were designed, fabricated, and tested for operation in the microwave and millimeter-wave bands. Mixers based on diode and resistive-high electron-mobility transistor (HEMT) nonlinear elements are presented and compared in this paper. The diode-based Kowari mixers have a bandwidth of approximately 45%, with up- and down-conversion loss [RF to/from IF (in this paper, we use "IF," "LO," and "RF" to label the ports associated with particular signals, not necessarily to describe the nature of the signals themselves)] less than 10 dB and up-conversion output power greater than 0 dBm. At band center, the down-conversion loss is approximately 7 dB. The novel resistive-HEMT-based Kowari mixers have a measured IF-to-RF up-conversion loss of approximately 2 dB and LO-to-RF conversion loss of approximately 13 dB over 17-25.5 GHz. While both circuit types realize wide-band 360/spl deg/ phase shifters when appropriate control voltages are applied, the resistive-HEMT-based Kowari has better linearity and a smaller insertion loss.

Dual-mode stepped-impedance ring resonator for bandpass filter applications

M. Matsuo, H. Yabuki and M. Makimoto. "Dual-mode stepped-impedance ring resonator for bandpass filter applications." 2001 Transactions on Microwave Theory and Techniques 49.7 (Jul. 2001 [T-MTT]): 1235-1240.

It is well known that two orthogonal resonant modes exist within a one-wavelength ring resonator. In this paper, we focus on a ring resonator possessing an impedance step as a form of perturbation. A convenient analyzing method for obtaining the resonance characteristics of this resonator structure is presented. Furthermore, generation of attenuation poles obtained by the dual-mode ring resonator is discussed. In addition, a filter design method based on this resonator is explained, followed by experimental results, which prove the validity of the proposed design method.



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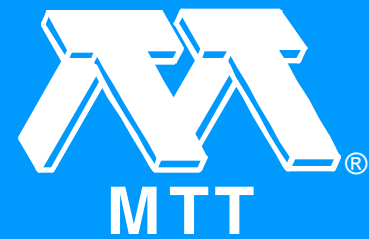
An analytic method to determine GaAs FET parasitic inductances and drain resistance under active bias conditions

C.F. Campbell and S.A. Brown. "An analytic method to determine GaAs FET parasitic inductances and drain resistance under active bias conditions." 2001 Transactions on Microwave Theory and Techniques 49.7 (Jul. 2001 [T-MTT]): 1241-1247.

An analytic technique to determine the parasitic inductances, source resistance, and drain resistance of the FET equivalent circuit is presented in this paper. The method exploits the frequency dependence of the extracted circuit parameters to determine the parasitic inductances and drain resistance from S-parameters measured over frequency for one active bias condition. Given a value for the parasitic gate resistance $R_{\text{sub } g}$, all of the other equivalent-circuit parameters are uniquely extracted. The method is fast and robust, making it suitable for in-line statistical process tracking, as well as device modeling. A process tracking example for a 12-wafer 1864-device sample and FET modeling results up to 40 GHz are also presented.

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Ultrawide-band fiber-optic control of a millimeter-wave transmit beamformer

D.A. Tulchinsky and P.J. Matthews. "Ultrawide-band fiber-optic control of a millimeter-wave transmit beamformer." 2001 Transactions on Microwave Theory and Techniques 49.7 (Jul. 2001 [T-MTT]): 1248-1253.

An ultrawide-band fiber-optic true time-delay millimeter-wave array transmitter is fully characterized and demonstrated in this paper. The beamformer is based on dispersive-prism optical-delay lines and exhibits squint-free $\pm 60^\circ$ steering in azimuth across the entire Ka-band (26.5-40 GHz). This is believed to be the first fully functioning demonstration of a photonically controlled wide-band millimeter-wave transmitter system.

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Analysis of membrane support structures for integrated antenna usage on two-dimensional photonic-bandgap structures

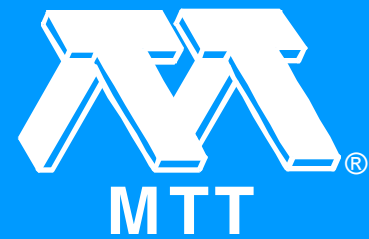
A.L. Reynolds, H.M.H. Chong, I.G. Thayne, J.M. Arnold and P. De Maagt. "Analysis of membrane support structures for integrated antenna usage on two-dimensional photonic-bandgap structures." 2001 Transactions on Microwave Theory and Techniques 49.7 (Jul. 2001 [T-MTT]): 1254-1261.

The study of the transmission of electromagnetic waves through a photonic crystal with various membranes placed over the surface is presented in this paper. A difference in performance is observed even for a membrane thickness that is unable to support guided substrate modes through total internal reflection. The transmittance has been investigated for two crystal orientations, assuming normally incident external plane waves on a finite thickness two-dimensional (2-D) photonic crystals both with and without a membrane. The angular transmission response is characterized by scanning the incidence angle of the impinging plane wave to cover all available angles within the 2D periodic plane of the structure.

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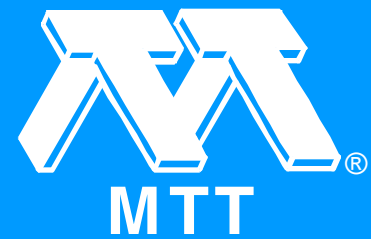
A high-impedance ground plane applied to a cellphone handset geometry

R.F.J. Broas, D.F. Sievenpiper and E. Yablonovitch. "A high-impedance ground plane applied to a cellphone handset geometry." 2001 Transactions on Microwave Theory and Techniques 49.7 (Jul. 2001 [T-MTT]): 1262-1265.

A high-impedance electromagnetic surface is a new type of metallic structure exhibiting high surface impedance and the suppression of propagating surface currents at a particular frequency band. We experimentally characterize such a high-impedance surface designed near 2.4 GHz. We describe an antenna built on such a surface, integrated into a printed circuit board that was designed for the form factor of a portable handset. Measurement shows high radiation efficiency near 2.4 GHz.

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Theoretical and experimental waveguide characterization of small wire scatterers

J. Reinert and A.F. Jacob. "Theoretical and experimental waveguide characterization of small wire scatterers." 2001 Transactions on Microwave Theory and Techniques 49.7 (Jul. 2001 [T-MTT]): 1266-1269.

A simple method is presented in this paper that allows us to verify numerically obtained polarizability tensors of electrically small scatterers by waveguide measurements. To this end, a model of the scattering process within the waveguide is developed. Measurements performed on a small helix in two different waveguide setups are compared to the theoretical data obtained from the model. A good agreement is demonstrated. Furthermore, the measured data are highly sensitive to the orientation of the scatterer within the waveguide. Thus, the polarizability tensors can be verified.

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The effects of C_{bc} on the linearity of AlGaAs/GaAs power HBTs

Woonyun Kim, Sanghoon Kang, Kyungho Lee, Minchul Chung, Youngoo Yang and Bumman Kim. "The effects of C_{bc} on the linearity of AlGaAs/GaAs power HBTs." 2001 Transactions on Microwave Theory and Techniques 49.7 (Jul. 2001 [T-MTT]): 1270-1276.

It is well known that C_{bc} is the dominant nonlinear element in heterojunction bipolar transistors (HBTs). To study its behavior, an analytical nonlinear HBT equivalent-circuit model has been developed. The present model includes the effect of the ionized donor charge in the depleted collector region compensated by the injected mobile charge. The model-based simulation shows that, at a small-signal range, the third-order intermodulation (IM3) of the normal HBT has the normal 3:1 gain slope generated by the nonlinearity of C_{bc} . At a large-signal level, the load line passes through some regions with constant C_{bc} because its collector is fully depleted by the injected free carriers, and the growth rate of the IM3 is decreased. The punch-through collector HBT has constant C_{bc} during the whole RF cycle, and the IM3, which is generated by g_m nonlinearity, has the normal 3:1 gain slope for the all input signal level. Therefore, the IM3 level is significantly lower for the punch-through HBT at a low-power level, but the IM3s of both devices are comparable at a high-power level. The experiment supports our proposed model.

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General design equations, small-sized impedance transformers, and their application to small-sized three-port 3-dB power dividers

H.-R. Ahn and I. Wolff. "General design equations, small-sized impedance transformers, and their application to small-sized three-port 3-dB power dividers." 2001 Transactions on Microwave Theory and Techniques 49.7 (Jul. 2001 [T-MTT]): 1277-1288.

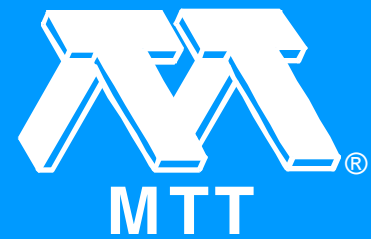
In this paper, design equations for three-port power dividers have been derived. These design equations are available for both arbitrary power divisions and arbitrary termination impedances, and many sets of design equations are possible. Therefore, the design equations may be called general design equations and an arbitrary design impedance A is introduced to describe them. On the basis of the derived general design equations, a coplanar three-port power divider with a power split ratio (3 dB) terminated by 50, 60, and 70 Ω is designed with $A=33.33 \Omega$, so that a commercially available resistor 100 Ω can be used for the isolation resistance. Additionally, to reduce the size of transmission-line impedance transformers, two types of small-sized impedance transformers are designed, named a constant VSWR-type transmission-line impedance transformer (CVT) and a constant conductance-type transmission-line impedance transformer (CCT) and compared with conventional reduced-sized impedance transformers. These impedance transformers are designed in the low-Q region on the Smith chart. Therefore, they show wide-band properties. To make sure that the derived design equations of CVTs and CCTs are reasonable, four 1:6:1 impedance transformers, CVT 20 dB, CVT 30 dB, CCT 15 dB, and CCT 20 dB have been fabricated in microstrip technology and measured. The measured results show the expected tendency. Based on the CVTs and CCTs, small-sized three-port 3-dB power dividers are constructed and named a constant VSWR-type three-port 3-dB power divider (CVT3PD) and a constant conductance-type three-port 3-dB power divider (CCT3PD). For the CVT3PD and CCT3PD, perfect isolation conditions are derived, and it is shown that the perfect isolation circuit (I.C) must be composed of resistance combined with capacitance or inductance in the case that the length of transmission lines is not $\lambda/4$. These I.Cs are quite different from conventional ones composed of only resistance. Finally, on the basis of the derived perfect isolation impedance,

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CVT3PD and CCT3PD are designed and simulated, giving the possibility that a CCT3PD can be realized with the electrical length $15.30/\text{spl deg/}$ of the transmission lines.



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AlGaAs/GaAs HBT model estimation through the generalized pencil-of-function method

B.L. Ooi, T.S. Zhou and P.S. Kooi. "AlGaAs/GaAs HBT model estimation through the generalized pencil-of-function method." 2001 Transactions on Microwave Theory and Techniques 49.7 (Jul. 2001 [T-MTT]): 1289-1294.

An efficient technique of extracting the small-signal model parameters of the heterojunction bipolar transistor (HBT) is proposed in this paper. The relation between the extrinsic and intrinsic model parameters, which can be employed to drastically reduce the search space, is studied in depth. For the first time, the HBT transistor is characterized by describing S-parameters with a set of complex exponentials using the generalized pencil-of-function method. The reliable initial values of some extrinsic elements can be determined from the set of complex exponentials. This novel approach can yield a good fit between measured and simulated S-parameters.



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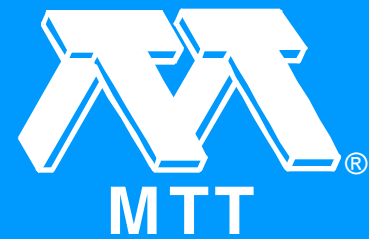
High-order mixed RWG basis functions for electromagnetic applications

W. Cai, T. Yu, H. Wang and Y. Yu. "High-order mixed RWG basis functions for electromagnetic applications." 2001 Transactions on Microwave Theory and Techniques 49.7 (Jul. 2001 [T-MTT]): 1295-1303.

In this paper, we present an explicit form of high-order mixed Rao-Wilton-Glisson basis functions for electromagnetic (EM) simulation of curved conductor surfaces. Basis functions for combinations of curved triangular and quadrilateral patches can be used. Several applications of EM simulations in multilayered media, such as three-dimensional discontinuities in very large scale integration design, multilayered RF components, and multilayered antennas, are provided to show the feasibility and efficiency of the mixed basis functions.

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Efficient and accurate full-wave analysis of the open-ended coaxial cable

G. Panariello, L. Verolino and G. Vitolo. "Efficient and accurate full-wave analysis of the open-ended coaxial cable." 2001 Transactions on Microwave Theory and Techniques 49.7 (Jul. 2001 [T-MTT]): 1304-1309.

An efficient implementation of the full-wave open-ended-coaxial-line analysis is presented in this paper. The involved integrals are approached in such a way that the admittance is accurately calculated. Moreover, the calculus time is noticeably reduced. This technique is particularly useful when repeated analysis are performed as occurs, e.g., when measuring permittivity.

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A memory-efficient formulation of the finite-difference time-domain method for the solution of Maxwell equations

G.D. Kondylis, F. De Flaviis, G.J. Pottie and T. Itoh. "A memory-efficient formulation of the finite-difference time-domain method for the solution of Maxwell equations." 2001 Transactions on Microwave Theory and Techniques 49.7 (Jul. 2001 [T-MTT]): 1310-1320.

With the increase in speed and memory storage in modern computer systems, the finite-difference time-domain (FDTD) method for the solution of electromagnetic problems is rapidly becoming an attractive choice due to its programming simplicity and flexibility in the analysis of a wide range of structures. However, this technique has the drawback of high computer memory requirements and computational power, when analyzing large geometries. In this paper, a modified version of the FDTD method with increased memory efficiency is presented and applied to the calculation of the resonant frequencies of a dielectric resonator coupled to a microstrip line. In this novel approach, the divergence relationship, which spatially links the three electric-field and three magnetic-field components, is used to eliminate one component each of E and H. This leads to a more memory-efficient formulation, where only four field components are stored in the whole domain, with a direct memory reduction of 33% in the storage of the fields.

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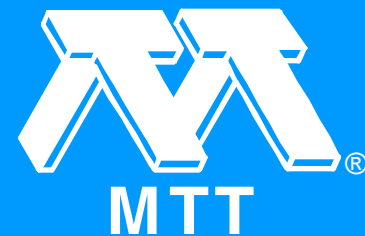


Abstracts

Time-domain macromodel of planar microwave devices by FDTD and moment expansion

G. Marrocco and F. Bardati. "Time-domain macromodel of planar microwave devices by FDTD and moment expansion." 2001 Transactions on Microwave Theory and Techniques 49.7 (Jul. 2001 [T-MTT]): 1321-1328.

The microwave design of highly complex systems can be addressed by segmentation techniques. To this purpose, a subsystem macromodel, such as the impulse response matrix, needs to be computed in an accurate and efficient way. In this paper, we present a combined procedure, based on finite-difference time-domain and a moment-expansion deconvolution by which the impulse response matrix is obtained via time-domain processing only. The algorithm has been tested on microwave planar devices with satisfactory accuracy.



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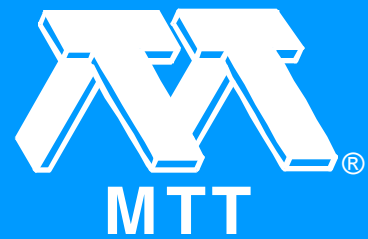


Abstracts

Analysis of coupled inset dielectric guide structure

Y.H. Cho and H.J. Eom. "Analysis of coupled inset dielectric guide structure." 2001 Transactions on Microwave Theory and Techniques 49.7 (Jul. 2001 [T-MTT]): 1329-1332.

The propagation and coupling characteristics of the inset dielectric guide coupler are theoretically considered in this paper. Rigorous solutions for the dispersion relation and the coupling coefficient are presented in a rapidly convergent series. Numerical computations illustrate the behaviors of dispersion, coupling, and field distribution in terms of frequency and coupler geometry.



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Investigation of FECTED performance for millimeter-wave applications

F. Driouch and C. Dalle. "Investigation of FECTED performance for millimeter-wave applications." 2001 Transactions on Microwave Theory and Techniques 49.7 (Jul. 2001 [T-MTT]): 1333-1341.

The potential of GaAs, Ga/sub 0.47/In/sub 0.53/As, and InP field-effect cathode transferred-electron device (FECTED) oscillators is theoretically investigated at millimeter wave. The modeling relies on a general time-domain electronic circuit simulator including a quasi-two-dimensional bipolar hydrodynamic FECTED model. Pure sine simulations have been performed to optimize the device structure and performance at various typical frequencies in a self-consistent manner, together with thermal and electronic limitations. The optimization is focused on a reliable and high negative resistance level device based on a dipolar-layer single transit mode. By means of transient simulations, we next demonstrate the feasibility of simple front-end FECTED circuits for short-range pulsed and frequency-modulation continuous-wave millimeter-wave radars.

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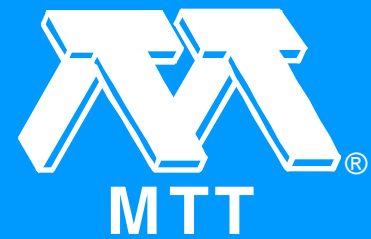


Abstracts

Effect of reflection on gyrotron operation

E. Borie. "Effect of reflection on gyrotron operation." 2001 Transactions on Microwave Theory and Techniques 49.7 (Jul. 2001 [T-MTT]): 1342-1345.

The effect of wave reflection on the single-mode operation of a gyrotron is investigated with the help of Rieke diagrams. For this purpose, a set of self-consistent equations describing the beam-field interaction is solved, taking into account the effect of the electron beam and the reflection coefficient on the frequency and RF field profile.



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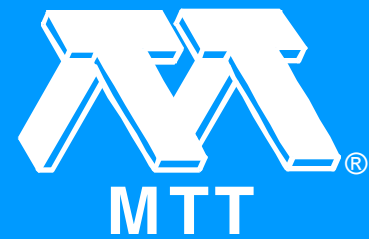
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An efficient Krylov-subspace-based algorithm to solve the dielectric-waveguide problem

K. Radhakrishnan and W.C. Chew. "An efficient Krylov-subspace-based algorithm to solve the dielectric-waveguide problem." 2001 Transactions on Microwave Theory and Techniques 49.7 (Jul. 2001 [T-MTT]): 1345-1348.

An efficient scheme based on the bi-Lanczos algorithm has been developed for analysis of the dielectric-waveguide problem. A two-dimensional finite-difference scheme in the frequency domain is used to discretize the waveguide cross section. The resulting sparse eigenvalue problem is solved efficiently using the bi-Lanczos algorithm. Apart from solving the modes of the dielectric waveguide, a scheme to solve for the fields in the presence of a localized source is also described. Numerical results are also included to confirm the validity of the method.

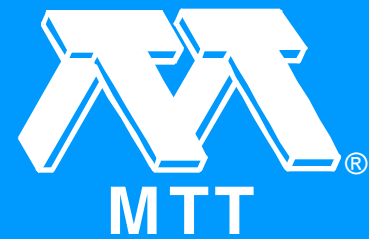
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A low-power-consuming SOM for wireless communications

M. Ghanevati and A.S. Daryoush. "A low-power-consuming SOM for wireless communications." 2001 Transactions on Microwave Theory and Techniques 49.7 (Jul. 2001 [T-MTT]): 1348-1351.

This paper presents theoretical and experimental results of a low-power-consuming hybrid push-pull self-oscillating mixer (SOM) circuit at the UHF frequency band. The frequency-stable SOM circuit is designed and fabricated using matched-pair Si bipolar junction transistors and high-Q resonators, where measured phase noise of this free-running voltage-controlled oscillator is -101.2 dBc/Hz at 100-kHz offset. A 20-dB up-conversion gain, a compression dynamic range (CDR) of 65 dB/spl middot/MHz, and a spurious-free dynamic range of 50 dB/spl middot/MHz/sup 2/3/ are also measured for the mixer portion of this SOM. Moreover, a down-conversion gain of /spl ap/-2 dB with a CDR of 100 dB/spl middot/MHz is also measured.



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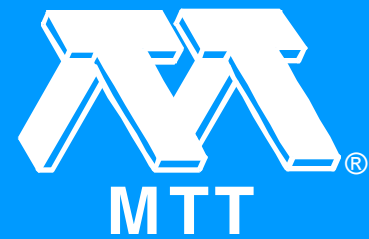
Characterization of thermal and frequency-dispersion effects in GaAs MESFET devices

J. Rodriguez-Tellez, T. Fernandez, A. Mediavilla and A. Tazon. "Characterization of thermal and frequency-dispersion effects in GaAs MESFET devices." 2001 Transactions on Microwave Theory and Techniques 49.7 (Jul. 2001 [T-MTT]): 1352-1355.

New simple and accurate measurement procedures that enable the dispersion and thermal effects in GaAs MESFETs to be observed independently are presented in this paper. The results indicate that the differences observed between the static and pulsed characteristics of the device are not solely due to thermal effects, as is sometimes thought. Electrical and thermal measurements also show the GaAs MESFET to take a relatively long time before the effect of self-heating manifests itself on the IV characteristics of the device.

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Numerical investigation of the field and current behavior near lossy edges

M. Farina and T. Rozzi. "Numerical investigation of the field and current behavior near lossy edges." 2001 Transactions on Microwave Theory and Techniques 49.7 (Jul. 2001 [T-MTT]): 1355-1358.

Real circuits involve metallic edges with finite conductivity and nonideal dielectrics. Usually it is more or less implicitly assumed that fields and induced currents behave as if conductors and dielectrics were ideal. In this paper, we show that this assumption is partially erroneous and that the presence of real conductors and dielectrics seems to lead to a simpler and more physical picture, where longitudinal currents are shown to be nonsingular.

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Wide-band balanced active HEMT mixer

A.S. Yanev, B.N. Todorov and V.Z. Ranev. "Wide-band balanced active HEMT mixer." 2001 Transactions on Microwave Theory and Techniques 49.7 (Jul. 2001 [T-MTT]): 1359-1361.

The design and characteristics of a balanced active high electron-mobility transistor (HEMT) mixer operating in the 4.5-10-GHz frequency band are described in this paper. It consists of two parts implemented as independent hybrid circuits, namely, an microwave part fabricated by using a uniplanar technology and comprising a 180/spl deg/ hybrid ring coupler, HEMTs, and input-output matching circuits, and a low-frequency part consisting of an L-C balun and a low-pass filter built of discrete elements. The design of the microwave part of the mixer ensures a high degree of isolation between the signal and local-oscillator (LO) inputs within a wide frequency band at low IF. The measurements show a conversion gain of 5-7 dB, noise figure of 5-7.5 dB, and isolation between the signal and LO ports greater than 20 dB within the 4.5-10-GHz range.



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Circular cylindrical waveguide filled with uniaxial anisotropic media electromagnetic fields and dyadic Green's functions

Le-Wei Li, Shenghong Liu, Mook-Seng Leong and Tat-Soon Yeo. "Circular cylindrical waveguide filled with uniaxial anisotropic media electromagnetic fields and dyadic Green's functions." 2001 Transactions on Microwave Theory and Techniques 49.7 (Jul. 2001 [T-MTT]): 1361-1364.

Electromagnetic fields in a circular cylindrical conducting waveguide filled with uniaxial anisotropic media are formulated in this paper by using Fourier transformations. These fields are obtained as a superposition of the TE (or ordinary) and TM (or extraordinary) modes satisfying, respectively, different characteristic equations. Lastly, the dyadic Green's function is derived using the Ohm-Rayleigh method and represented by vector wave functions expansion.





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On the use of SDA for the analysis of boxed planar lines with complex media

G. Plaza, F. Mesa and F. Medina. "On the use of SDA for the analysis of boxed planar lines with complex media." 2001 Transactions on Microwave Theory and Techniques 49.7 (Jul. 2001 [T-MTT]): 1365-1368.

This paper discusses the conditions under which the spectral-domain approach (SDA) can be applied to the analysis of boxed planar lines when complex materials (anisotropic dielectrics, ferrites, magnetoplasmons, chiral media, and so on) are used as substrates. It will be shown that whereas SDA can always be efficiently applied to study laterally open structures, the simultaneous presence of lateral boundary conditions and nonisotropic materials requires further study. Thus, the symmetry properties of the constitutive dyadics that makes possible a rigorous application of the SDA to those kinds of structures will be reported in this paper.

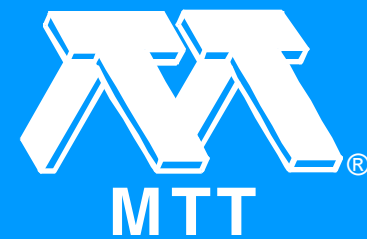
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Table of Contents (Aug. 2001 [T-MTT])

"Table of Contents (Aug. 2001 [T-MTT])." 2001 Transactions on Microwave Theory and Techniques 49.8 (Aug. 2001 [T-MTT] (Mini-Special Issue on the 2000 IEEE Radio and Wireless Conference (RAWCON))): 0_1-0_2.



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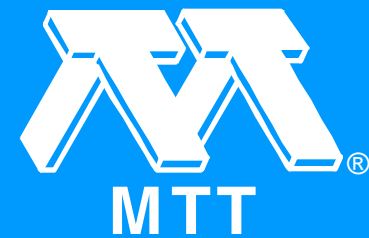
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Guest Editorial (Aug. 2001 [T-MTT])

S. Maas. "Guest Editorial (Aug. 2001 [T-MTT])." 2001 Transactions on Microwave Theory and Techniques 49.8 (Aug. 2001 [T-MTT] (Mini-Special Issue on the 2000 IEEE Radio and Wireless Conference (RAWCON))): 1369-1369.



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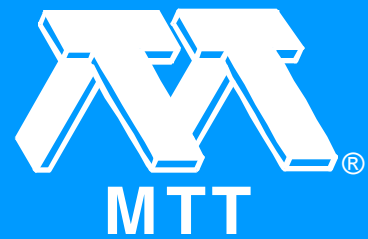


Abstracts

RF and microwave frequency properties of a reverse-biased thick switching p-i-n diode

L. Drozdovskaia. "RF and microwave frequency properties of a reverse-biased thick switching p-i-n diode." 2001 Transactions on Microwave Theory and Techniques 49.8 (Aug. 2001 [T-MTT] (Mini-Special Issue on the 2000 IEEE Radio and Wireless Conference (RAWCON))): 1370-1373.

The frequency response of the dc reverse-bias voltage keeping high-impedance p-i-n diode in low-distortion state is studied using different mathematical and theoretical models. This paper discusses the comparison between the theoretical and experimental results.



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A direct Ku-band linear subharmonically pumped BPSK and I/Q vector modulator in multilayer thin-film MCM-D (Aug. 2001 [T-MTT])

G.J. Carchon, D.M.M.-P. Schreurs, W. De Raedt, P. Van Loock and B.K.J.C. Nauwelaers. "A direct Ku-band linear subharmonically pumped BPSK and I/Q vector modulator in multilayer thin-film MCM-D (Aug. 2001 [T-MTT])." 2001 Transactions on Microwave Theory and Techniques 49.8 (Aug. 2001 [T-MTT] (Mini-Special Issue on the 2000 IEEE Radio and Wireless Conference (RAWCON))): 1374-1382.

A direct Ku-band linear subharmonically pumped binary phase-shift keying (BPSK) and in-phase/quadrature (I/Q) vector modulator have been developed using multilayer thin-film multichip module (MCM-D) technology. All passives are integrated in the low cost MCM-D substrate. To the authors knowledge, this is the first modulator based on thin-film integrated passive components. The subharmonic mixing is performed using a beam-lead antiparallel diode pair mounted onto the MCM using thermocompression. A custom diode model has been developed and verified using nonlinear network analyzer measurements: an excellent agreement between the measured and simulated powers and phases for more than nine harmonics is demonstrated. Additionally, it is shown that an optimal reactive termination for the third harmonic of the local oscillator (LO) exists such that a very flat BPSK mixer conversion is obtained. This is validated by measurements that indicate a ± 0.25 -dB variation on the conversion loss for an LO frequency varying from 6.8 to 7.6 GHz. The I/Q vector modulator consists of a Wilkinson power divider, a coplanar-waveguide Lange coupler, and two BPSK modulators. It has a measured image rejection better than -27 dB over the RF range of 13.4-15.2-GHz band (corresponding to a vector phase and amplitude error lower than $\pm 2^\circ$ and 1%). The image rejection is even better than -32 dB over the very small aperture terminal band (RF: 14-14.5 GHz).





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Measurement technique for characterizing memory effects in RF power amplifiers

J.H.K. Vuolevi, T. Rahkonen and J.P.A. Manninen. "Measurement technique for characterizing memory effects in RF power amplifiers." 2001 Transactions on Microwave Theory and Techniques 49.8 (Aug. 2001 [T-MTT] (Mini-Special Issue on the 2000 IEEE Radio and Wireless Conference (RAWCON))): 1383-1389.

Memory effects are defined as changes in the amplitude and phase of distortion components caused by changes in modulation frequency. These are particularly important in cancelling linearizer systems, e.g., when distortion is reduced by similar distortion in the opposite phase. This paper begins by describing electrical and electrothermal causes for memory effects. A three-tone test setup is then constructed to measure the phase of third-order intermodulation distortion products. This paper also presents the measured results for a bipolar junction transistor and a MESFET amplifier.

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Implementation of a real-time frequency-selective RF channel simulator using a hybrid DSP-FPGA architecture

M.A. Wickert and J. Papenfuss. "Implementation of a real-time frequency-selective RF channel simulator using a hybrid DSP-FPGA architecture." 2001 Transactions on Microwave Theory and Techniques 49.8 (Aug. 2001 [T-MTT] (Mini-Special Issue on the 2000 IEEE Radio and Wireless Conference (RAWCON))): 1390-1397.

A low cost frequency-selective RF channel simulator architecture is explored in this paper. The technique of quadrature amplitude modulation (QAM) by independent low-pass filtered white Gaussian noise sources forms a rational function approximation (RFA) to the desired Doppler spectrum for flat Rayleigh fading. To simulate frequency-selective fading, this QAM/RFA architecture may be extended by combining delayed outputs from multiple flat fading generators. In this paper, the noise shaping filter considered is in the form of an infinite-impulse-response digital filter followed by an interpolator (upsampler) using linear interpolation. The performance requirements are those in the standard channel simulator section of TIA IS-55-A. The system is implemented almost entirely in the digital domain by use of IF sampling, with the signal processing performed in a high-end floating-point digital signal processor and a field-programmable gate array. The theoretical performance of the simulator is studied with respect to the TIA standard, and limitations of the hardware prototype are identified. A system capable of simulating 12 delay taps, with a processing bandwidth of 5 MHz, can be built at about one-tenth the cost of commercially available channel simulators of comparable performance.

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Design of small and broad-band internal antennas for IMT-2000 mobile handsets

Ya Jun Wang, Ching Kwang Lee, Wee Jin Koh and Yeo Beng Gan. "Design of small and broad-band internal antennas for IMT-2000 mobile handsets." 2001 Transactions on Microwave Theory and Techniques 49.8 (Aug. 2001 [T-MTT] (Mini-Special Issue on the 2000 IEEE Radio and Wireless Conference (RAWCON))): 1398-1403.

The objective of this paper is to design some small broad-band internal antennas for third-generation International Mobile Telecommunications-2000 (IMT-2000) mobile handsets. By introducing substrates of low dielectric constants and electromagnetically coupling two shorted microstrip patch elements, of either rectangular or semidisc shape, both compactness and broad bandwidth can be achieved. These novel internal antennas for IMT-2000 mobile handsets incorporate only one single probe feed in a driven patch element, while the broad-band feature is obtained by realizing dual-frequency operation. The typical impedance behavior and far-field radiation pattern characteristics of eight different antenna configurations are discussed theoretically and experimentally.

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Orthogonal frequency-division multiplexing in wireless communication systems with multimode fiber feeds

B.J. Dixon, R.D. Pollard and S. Iezekiel. "Orthogonal frequency-division multiplexing in wireless communication systems with multimode fiber feeds." 2001 Transactions on Microwave Theory and Techniques 49.8 (Aug. 2001 [T-MTT] (Mini-Special Issue on the 2000 IEEE Radio and Wireless Conference (RAWCON))): 1404-1409.

The feasibility of using multimode fiber as an inexpensive cell feed in broad-band indoor picocellular systems is investigated in this paper. The performance of coded orthogonal frequency-division multiplexing (OFDM) for a variety of multimode fiber profiles, including stepped index and α -profile graded index fibers, is assessed. In addition to its ability to perform well in a frequency-selective multipath environment, OFDM is shown to offer good protection against the frequency selectivity of a dispersive multimode fiber. Data rates in excess of 100 Mb/s (without equalization) over a multimode fiber channel are possible, whereas they may be limited to some 20-30 Mb/s using conventional ASK modulation.





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A new pinched-off cold-FET method to determine parasitic capacitances of FET equivalent circuits

Yeong-Lin Lai and Kuo-Hua Hsu. "A new pinched-off cold-FET method to determine parasitic capacitances of FET equivalent circuits." 2001 Transactions on Microwave Theory and Techniques 49.8 (Aug. 2001 [T-MTT] (Mini-Special Issue on the 2000 IEEE Radio and Wireless Conference (RAWCON))): 1410-1418.

A new pinched-off cold FET method to extract the parasitic capacitances of FETs is proposed in this paper. The method is based on a physically meaningful depletion-layer model and the theoretical analysis of the two-port network for the pinched-off cold FETs. The parasitic gate capacitance (C_{pg}) and the parasitic drain capacitance (C_{pd}) of FETs are extracted using the linear regression technique associated with the frequency responses of Y-parameters. The extraction method can be applied to the small-signal equivalent-circuit modeling of the FETs including MESFETs, heterojunction FETs, and high-electron-mobility transistors. According to the new analytical method, the simulated S-parameters exhibit great agreement with the measured S-parameters for the equivalent-circuit models of FETs.

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Creating accurate multivariate rational interpolation models of microwave circuits by using efficient adaptive sampling to minimize the number of computational electromagnetic analyses

R. Lehmensiek and P. Meyer. "Creating accurate multivariate rational interpolation models of microwave circuits by using efficient adaptive sampling to minimize the number of computational electromagnetic analyses." 2001 Transactions on Microwave Theory and Techniques 49.8 (Aug. 2001 [T-MTT] (Mini-Special Issue on the 2000 IEEE Radio and Wireless Conference (RAWCON))): 1419-1430.

A fast and efficient adaptive sampling algorithm for multivariate rational interpolation models based on convergents of Thiele-type branched continued fractions (BCFs) is presented in this paper. We propose a variation of the standard BCF that uses approximation to establish a nonrectangular grid of support points. Starting with a low-order interpolant, the technique systematically increases the order by optimally choosing new support points in the areas of highest error until the required accuracy is achieved. In this way, accurate surrogate models are established by a small number of support points without any a priori knowledge of the data. The technique is evaluated on several passive microwave structures.





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Varactor-tuned active notch filter with low passband noise and signal distortion

C. Rauscher. "Varactor-tuned active notch filter with low passband noise and signal distortion." 2001 Transactions on Microwave Theory and Techniques 49.8 (Aug. 2001 [T-MTT] (Mini-Special Issue on the 2000 IEEE Radio and Wireless Conference (RAWCON))): 1431-1437.

The frequency-tunable band-reject filter described in this paper is designed to suppress signal interference in receivers of frequency-agile systems, while offering maximum transparency at passband frequencies. The presented solution is based on a new channelized-active-filter architecture in which the portion of the circuit that determines passband behavior is free of semiconductor devices. This permits passband residual noise and intermodulation distortion to be reduced to that of a simple nonresonant passive network. The concept is demonstrated with a varactor-tuned hybrid-integrated filter whose 40-dB-deep rejection notch of constant 70-MHz width can be tuned over a 9.5-10.5-GHz frequency span. Included are measurements of pertinent small-signal transfer characteristics and noise properties, as well as detailed assessments of nonlinear effects, such as third-order intermodulation distortion and compression of notch depth as a function of drive level.

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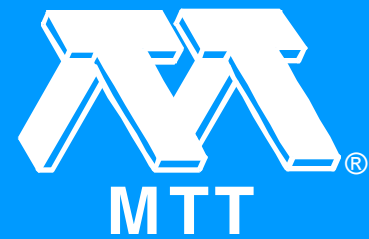
Multiport analysis of arbitrary circular-rod insets in rectangular waveguide by the generalized admittance matrix

G.G. Centili. "Multiport analysis of arbitrary circular-rod insets in rectangular waveguide by the generalized admittance matrix." 2001 Transactions on Microwave Theory and Techniques 49.8 (Aug. 2001 [T-MTT] (Mini-Special Issue on the 2000 IEEE Radio and Wireless Conference (RAWCON))): 1438-1442.

An original generalized-admittance-matrix (GAM) approach for the analysis of multiport junctions in rectangular waveguide having an arbitrary circular-rod inset is presented in this paper. The method is based on an efficient computation of the GAM for the blocks that compose the structure. The efficiency is due to the fact that, for each block, the full three-dimensional GAM is obtained by solving a set of uncoupled two-dimensional problems. The accuracy and efficiency of the method developed have been assessed by comparing the results obtained with some measured data and with data obtained by the finite-element method.

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Full-wave modeling of linear FETs for millimeter waves

M. Farina and T. Rozzi. "Full-wave modeling of linear FETs for millimeter waves." 2001 Transactions on Microwave Theory and Techniques 49.8 (Aug. 2001 [T-MTT] (Mini-Special Issue on the 2000 IEEE Radio and Wireless Conference (RAWCON))): 1443-1450.

Current monolithic-microwave integrated-circuit design, involving frequencies far in the millimeter and sub-millimeter ranges, is faced with the problem of the distributed nature of the devices. In this paper, we introduce a full-wave approach to the modeling of FETs under the small-signal hypothesis. The method is applied to MESFETs and pseudomorphic high electron-mobility transistors of different topologies and validated by comparison with available experimental data.

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Vector modulator for W-band software radar techniques

D.S. McPherson and S. Lucyszyn. "Vector modulator for W-band software radar techniques." 2001 Transactions on Microwave Theory and Techniques 49.8 (Aug. 2001 [T-MTT] (Mini-Special Issue on the 2000 IEEE Radio and Wireless Conference (RAWCON))): 1451-1461.

Direct-carrier modulation is an attractive technique for low-cost high-performance radar transceivers. In this paper, it is shown that, when the technique is applied to a generic homodyne radar architecture, the signaling waveform can be software adapted without requiring any hardware modifications. The key circuit in this novel software radar is a W-band monolithic I-Q vector modulator employing two push-pull (bi-phase) amplitude modulators. To fully exploit this circuit's capacity to generate accurate constellations at millimeter-wave frequencies, a generalized theoretical analysis of the I-Q (push-pull) vector modulator is presented. This is a comprehensive analysis of the topology and does not assume ideal components. As a demonstration of the vector modulator's flexibility, a 76.5-GHz MMIC version has been fabricated and characterized by means of static S-parameter measurements and by several modulation spectra. Based on the theoretical model and the measured results, the I-Q (push-pull) vector modulator promises to be a vital component for the realization of future software radar.

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Class-E, Class-C, and Class-F power amplifiers based upon a finite number of harmonics

F.H. Raab. "Class-E, Class-C, and Class-F power amplifiers based upon a finite number of harmonics." 2001 Transactions on Microwave Theory and Techniques 49.8 (Aug. 2001 [T-MTT] (Mini-Special Issue on the 2000 IEEE Radio and Wireless Conference (RAWCON))): 1462-1468.

Class-E operation at UHF and microwave frequencies is achieved by using transmission-line networks to provide the drain harmonic impedances of an ideal class-E power amplifier (PA). This paper develops a technique for analysis of such amplifiers that are based upon a finite number of harmonics. The technique is generally applicable to classes E, C, and F as well as PAs with harmonic reactances not corresponding to those of established classes. The analysis shows that the maximum achievable efficiency depends not upon the class of operation, but upon the number of harmonics employed. For any set of harmonic reactances, the same maximum efficiency can be achieved by proper adjustment of the waveforms and the fundamental-frequency load reactance. The power-output capability depends upon the harmonic reactances and is maximum for class F.

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Absorbing boundary conditions in the frequency-domain TLM method and their application to planar circuits

D. Pasalic, J. Bornemann and R. Vahldieck. "Absorbing boundary conditions in the frequency-domain TLM method and their application to planar circuits." 2001 Transactions on Microwave Theory and Techniques 49.8 (Aug. 2001 [T-MTT] (Mini-Special Issue on the 2000 IEEE Radio and Wireless Conference (RAWCON))): 1469-1476.

The frequency-domain transmission-line-matrix method is extended to include absorbing boundary conditions. Three different approaches are considered: zero-reflection termination (ZRT), Berenger's perfectly matched layer (PML), and anisotropic PML. The ZRT technique is the simplest one of the three. Its main advantage over the PML techniques is that it requires no additional nodes to model the boundary. However, when placed too close to an area with high field intensity, the ZRT boundary takes out substantial parts of the transmitted power, thus giving results on the "lossy side." The numerical losses can be reduced by moving the boundaries further away from the area of interest. The PML techniques are more difficult to implement and require additional nodes for their modeling. However, they offer more flexibility since the numerical reflections from the PML absorbers can be controlled by using several layers with conductivities gradually increasing with depth. The computer simulations show that Berenger's and anisotropic PMLs give virtually the same results. A detailed investigation regarding the optimal number of layers in the PML absorbers and distances between the absorbing boundaries and the structure under analysis is performed.





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Some considerations for optimal efficiency and low noise in large power combiners

R.A. York. "Some considerations for optimal efficiency and low noise in large power combiners." 2001 Transactions on Microwave Theory and Techniques 49.8 (Aug. 2001 [T-MTT] (Mini-Special Issue on the 2000 IEEE Radio and Wireless Conference (RAWCON))): 1477-1482.

This paper examines some relationships between important design parameters in large combiner systems and key performance objectives such as power, efficiency, noise, and graceful degradation. Results are derived for the combining efficiency of general combiner systems, and used to contrast spatial and corporate combiners and identify optimum combiner topology for a given device technology. The influence of array size on excess phase noise is quantified and shown to decrease with increase numbers of devices. Results are also presented for the degradation in combining efficiency due to statistical variations in amplifier characteristics, appropriate to large combiners, showing that phase errors are the dominant factor in power degradation.

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3-D Green's functions of microstrip separated into simpler terms-behavior, mutual interaction and formulas of the terms

Y.L. Chow and W.C. Tang. "3-D Green's functions of microstrip separated into simpler terms-behavior, mutual interaction and formulas of the terms." 2001 Transactions on Microwave Theory and Techniques 49.8 (Aug. 2001 [T-MTT] (Mini-Special Issue on the 2000 IEEE Radio and Wireless Conference (RAWCON))): 1483-1491.

Green's functions of microstrip substrate are important for microwave integrated circuit (MIC) analyses. Much work has been done by many researchers with successes over the years in gaining greater insight and simplifications into this complicated problem. This paper continues this trend with further simplification by arriving at formulas with insight for the Green's functions, both scalar and vector. Each Green's function is separated into three terms, namely: the quasi-dynamic, leaky wave, and surface wave. Practical MIC circuits require low surface-wave loss. This means that the formulas are constructed for frequencies low enough that with only the fundamental TM/sub 0/ surface-wave mode propagating. Formulas of dominant terms are emphasized. The formulas are accurate, with estimated errors from 1% to 2%. An important behavior observed is that the surface wave rises rapidly with frequency, at the four power even at low frequencies.

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Ring-coupled-oscillator sequentially rotated active antenna

Suidong Yang, V.F. Fusco and D.E.J. Humphrey. "Ring-coupled-oscillator sequentially rotated active antenna." 2001 Transactions on Microwave Theory and Techniques 49.8 (Aug. 2001 [T-MTT] (Mini-Special Issue on the 2000 IEEE Radio and Wireless Conference (RAWCON))): 1492-1497.

In this paper, an active four-element patch antenna, backed by four GaAs monolithic-microwave integrated-circuit (MMIC) 4.4-GHz oscillators, self-locked by mutual coupling through a lumped capacitive ring MMIC network, has been designed, fabricated, and tested. The sequentially rotated arrangement given here when augmented with a lumped capacitive coupling network suggests that in-phase oscillator entrainment is guaranteed so that spatial power combination by the antenna array occurs with circular polarization characteristics.



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Matched symmetrical five-port microstrip coupler

S.P. Yeo and F.C. Choong. "Matched symmetrical five-port microstrip coupler." 2001 Transactions on Microwave Theory and Techniques 49.8 (Aug. 2001 [T-MTT] (Mini-Special Issue on the 2000 IEEE Radio and Wireless Conference (RAWCON))): 1498-1500.

Other researchers have fabricated a symmetrical five-port microstrip coupler (with a double-ring structure) yielding a bandwidth of 58%. It has been found in this paper that a simple modification of the design topology allows the coupler's bandwidth to be broadened to 76%. A first-order model of the new prototype has also been developed, and tests have confirmed that close agreement can be expected between the predicted and experimental results for the coupler's scattering coefficients.

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Microwave filters with improved spurious performance based on sandwiched conductor dielectric resonators

A.R. Weily and A.S. Mohan. "Microwave filters with improved spurious performance based on sandwiched conductor dielectric resonators." 2001 Transactions on Microwave Theory and Techniques 49.8 (Aug. 2001 [T-MTT] (Mini-Special Issue on the 2000 IEEE Radio and Wireless Conference (RAWCON))): 1501-1507.

Microwave filters based on a novel resonator comprised of a sandwiched conductor dielectric resonator (SCDR) loaded in a cylindrical cavity are analyzed in this paper. The SCDR is a compact resonator that exhibits good spurious performance. Resonant frequencies of the lower order modes are analyzed, and mode charts, unloaded Q, slot coupling, and screw coupling graphs are presented. S-parameters are computed using the finite-difference time-domain (FDTD) method for one- and four-pole SCDR filters and compared with measured results. The measured spurious performance for the four-pole elliptic function filter shows a large improvement over conventional dielectric-resonator filters. The measured results agree closely with predicted values obtained using the FDTD method.

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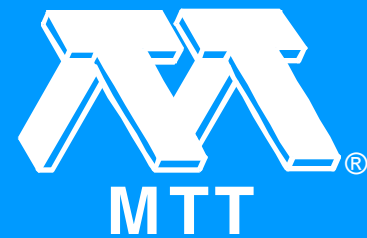
Microwave transformers, inductors and transmission lines implemented in an Si/SiGe HBT process

D.C. Laney, L.E. Larson, P. Chan, J. Malinowski, D. Hareme, S. Subbanna, R. Volant and M. Case. "Microwave transformers, inductors and transmission lines implemented in an Si/SiGe HBT process." 2001 Transactions on Microwave Theory and Techniques 49.8 (Aug. 2001 [T-MTT] (Mini-Special Issue on the 2000 IEEE Radio and Wireless Conference (RAWCON))): 1507-1510.

Experimental results are presented on microwave inductors, transformers, and transmission lines fabricated in an Si/SiGe heterojunction-bipolar-transistor process with standard metallization and a thick polyimide dielectric. Microstrip transmission lines with characteristic impedances from 44 to 73 Ω , Q's from 10 to 14, and insertion losses from 0.11 to 0.16 dB/mm at 10 GHz are presented. Conventional planar inductors with inductances from 0.5 to 15 nH and with peak Q's up to 22 are presented. Lateral transformers with a maximum available gain of better than -5 dB and a measured coupling coefficient (k) of 0.6 at 5.5 GHz and 0.4 up to 12.5 GHz are also discussed.

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Internal impedance of conductors of rectangular cross section (Comments and authors' reply)

F. Medina, R. Marques, G. Antonini, A. Orlandi and C.R. Paul. "Internal impedance of conductors of rectangular cross section (Comments and authors' reply)." 2001 Transactions on Microwave Theory and Techniques 49.8 (Aug. 2001 [T-MTT] (Mini-Special Issue on the 2000 IEEE Radio and Wireless Conference (RAWCON))): 1511-1513.

For original paper see Antonini et al., *ibid.*, vol.47, no.7, pp.979-85 (July 1999). In the original paper, Antonini et al. discussed some questions concerning the AC internal impedance of rectangular cross-sectional conductors (such as those typically used as transmission lines and interconnects in many microwave and digital printed circuits). In this paper the authors comment on their results, and a Antonini et al. reply to these comments.

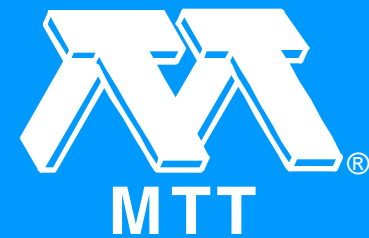
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Table of Contents (Sep. 2001 [T-MTT])

"Table of Contents (Sep. 2001 [T-MTT])." 2001 Transactions on Microwave Theory and Techniques 49.9 (Sep. 2001 [T-MTT] (Mini-Special Issue on the 2001 IEEE Radio Frequency Integrated Circuit (RFIC) Symposium)): 0_1-0_2.



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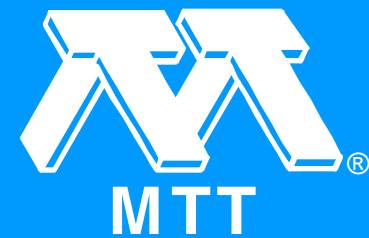
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Inside Cover (Sep. 2001 [T-MTT])

"Inside Cover (Sep. 2001 [T-MTT])." 2001 Transactions on Microwave Theory and Techniques 49.9 (Sep. 2001 [T-MTT] (Mini-Special Issue on the 2001 IEEE Radio Frequency Integrated Circuit (RFIC) Symposium)): 0_3-0_4.



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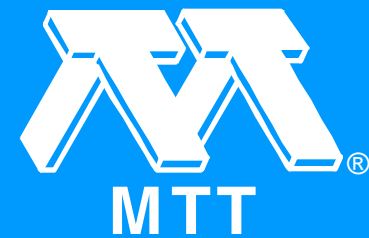
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Guest editor's overview (Sep. 2001 [T-MTT])

N. Camilleri. "Guest editor's overview (Sep. 2001 [T-MTT])." 2001 Transactions on Microwave Theory and Techniques 49.9 (Sep. 2001 [T-MTT] (Mini-Special Issue on the 2001 IEEE Radio Frequency Integrated Circuit (RFIC) Symposium)): 1517-1517.



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A temperature-dependent nonlinear analysis of GaN/AlGa_N HEMTs using Volterra series

A. Ahmed, S.S. Islam and A.F.M. Anwar. "A temperature-dependent nonlinear analysis of GaN/AlGa_N HEMTs using Volterra series." 2001 Transactions on Microwave Theory and Techniques 49.9 (Sep. 2001 [T-MTT] (Mini-Special Issue on the 2001 IEEE Radio Frequency Integrated Circuit (RFIC) Symposium)): 1518-1524.

Gain and intermodulation distortion of an AlGa_N/GaN device operating at RF have been analyzed using a general Volterra series representation. The circuit model to represent the GaN FET is obtained from a physics-based analysis. Theoretical current-voltage characteristics are in excellent agreement with the experimental data. For a 1 μm /500 μm Al_{0.15}Ga_{0.85}N/GaN FET, the calculated output power, power-added efficiency, and gain are 25 dBm, 13%, and 10.1 dB, respectively, at 15-dBm input power, and are in excellent agreement with experimental data. The output referred third-order intercept point (OIP₃) is 39.9 dBm at 350 K and 33 dBm at 650 K. These are in agreement with the simulated results from Cadence, which are 39.34 and 35.7 dBm, respectively. At 3 GHz, third-order intermodulation distortion IM₃ for 10-dBm output power is -72 dB at 300 K and -56 dB at 600 K. At 300 K, IM₃ is -66 dB at 5 GHz and -51 dB at 10 GHz. For the same frequencies, IM₃ increases to -49.3 and -40 dB, respectively, at 600 K.



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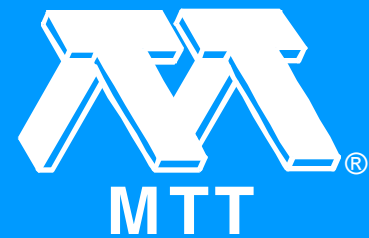
HiperLAN 5.4-GHz low-power CMOS synchronous oscillator (Sep. 2001 [T-MTT])

Y. Deval, J. Begueret, A. Spataro, P. Fouillat, D. Belot and F. Badets. "HiperLAN 5.4-GHz low-power CMOS synchronous oscillator (Sep. 2001 [T-MTT])." 2001 Transactions on Microwave Theory and Techniques 49.9 (Sep. 2001 [T-MTT] (Mini-Special Issue on the 2001 IEEE Radio Frequency Integrated Circuit (RFIC) Symposium)): 1525-1530.

A 5.4-GHz 0.25- μm very-large-scale-integration CMOS synchronous oscillator (SO) is proposed in this paper, which is designed to act as a local oscillator for HiperLAN systems. The advantage of using such an oscillator in a double-loop frequency synthesizer is demonstrated. The design strategy leading to an optimized SO with regards to its synchronization range is described. A test chip is presented, which provides a 150-MHz synchronization range and a -97-dBc/Hz phase noise at 10-kHz offset from the 5-GHz carrier, while consuming only 5 mA from a 2.5-V supply.

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A low-IF RX two-point /spl Sigma//spl Delta/-modulation TX CMOS single-chip Bluetooth solution

C. Durdodt, M. Friedrich, C. Grewing, M. Hammes, A. Hanke, S. Heinen, J. Oehm, D. Pham-Stabner, D. Seippel, D. Theil, S. van Waasen and E. Wagner. "A low-IF RX two-point /spl Sigma//spl Delta/-modulation TX CMOS single-chip Bluetooth solution." 2001 Transactions on Microwave Theory and Techniques 49.9 (Sep. 2001 [T-MTT] (Mini-Special Issue on the 2001 IEEE Radio Frequency Integrated Circuit (RFIC) Symposium)): 1531-1537.

A new low-cost concept for a system-on-chip Bluetooth solution is proposed in this paper. The single chip includes all necessary baseband and RF parts to achieve full Bluetooth functionality and is implemented in a standard 0.25-/spl mu/m CMOS technology. The two-point modulation /spl Sigma//spl Delta/ fractional N phase-locked loop achieves a phase noise of -124 dBc/Hz at 3-MHz offset. The sensitivity of the embedded low-IF receiver is measured to be -82 dBm at a bit error rate of 0.1%. The power supply voltages for the digital and analog parts are internally regulated to 2.65 V. The maximum current consumption of the analog part is 60 mA.

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Modeling of lead-frame plastic CSPs for accurate prediction of their low-pass filter effects on RFICs (Sep. 2001 [T-MTT])

Tzyy-Sheng Horng, Sung-Mao Wu, Hui-Hsiang Huang, Chi-Tsung Chiu and Chih-Pin Hung.
"Modeling of lead-frame plastic CSPs for accurate prediction of their low-pass filter effects on RFICs (Sep. 2001 [T-MTT])." 2001 Transactions on Microwave Theory and Techniques 49.9 (Sep. 2001 [T-MTT] (Mini-Special Issue on the 2001 IEEE Radio Frequency Integrated Circuit (RFIC) Symposium)): 1538-1545.

This paper presents a direct extraction method to construct the electrical models of lead-frame plastic chip scale packages for RF integrated circuits (RFICs) from the measured S-parameters. To evaluate the package effects on the reciprocal passive components, the insertion and return losses for an on-chip 50-/spl Omega/ microstrip line housed in a 32-pin bump chip carrier (BCC) package were analyzed based on the established package model. Excellent agreement with measurement has been found up to 15 GHz. When applied to the nonreciprocal active components, the gain variations for a heterojunction-bipolar-transistor array housed in an 8-pin BCC package have also been successfully predicted up to 22 GHz. Both cases have demonstrated that the package acts as a low-pass filter to cause a sharp cutoff for the RFIC components above a certain frequency.





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RF circuit performance degradation due to soft breakdown and hot-carrier effect in deep-submicrometer CMOS technology

Qiang Li, Jinlong Zhang, Wei Li, J.S. Yuan, Yuan Chen and A.S. Oates. "RF circuit performance degradation due to soft breakdown and hot-carrier effect in deep-submicrometer CMOS technology." 2001 Transactions on Microwave Theory and Techniques 49.9 (Sep. 2001 [T-MTT] (Mini-Special Issue on the 2001 IEEE Radio Frequency Integrated Circuit (RFIC) Symposium)): 1546-1551.

A systematic study of RF circuit performance degradation subject to oxide soft breakdown (SBD), and hot-carrier (HC) stress is presented in this paper. DC and RF characteristics before and after stress are extracted from the experimental data. The effects of SBD and HC stress on s-parameters, cutoff frequency, third-order interception point, and noise parameters are examined. The performance drifts of gain, noise figure, linearity, and input matching of the RF low-noise amplifier are demonstrated by SpectreRF simulation results based on measured device data.

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A monolithic Si PCS-CDMA power amplifier with 30% PAE at 1.9 GHz using a novel biasing scheme

Sifen Luo and T. Sowlati. "A monolithic Si PCS-CDMA power amplifier with 30% PAE at 1.9 GHz using a novel biasing scheme." 2001 Transactions on Microwave Theory and Techniques 49.9 (Sep. 2001 [T-MTT] (Mini-Special Issue on the 2001 IEEE Radio Frequency Integrated Circuit (RFIC) Symposium)): 1552-1557.

A monolithic Si personal-communication system-CDMA power amplifier (PA) capable of delivering 28.2-dBm output power with 30% power-added efficiency and -45-dBc adjacent-channel-power ratio at 1.9 GHz and 3.6-V supply voltage is presented for the first time in this paper. The PA implemented in a 30-GHz BiCMOS process incorporates a novel impedance-controllable biasing scheme to control the class of operation and bias impedance of the output stage. Both simulated and measured results are presented for comparison.

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RF linearity characteristics of SiGe HBTs

Guofu Niu, Qingqing Liang, J.D. Cressler, C.S. Webster and D.L. Harnome. "RF linearity characteristics of SiGe HBTs." 2001 Transactions on Microwave Theory and Techniques 49.9 (Sep. 2001 [T-MTT] (Mini-Special Issue on the 2001 IEEE Radio Frequency Integrated Circuit (RFIC) Symposium)): 1558-1565.

Two-tone intermodulation in ultrahigh vacuum/chemical vapor deposition SiGe heterojunction bipolar transistors (HBTs) were analyzed using a Volterra-series-based approach that completely distinguishes individual nonlinearities. Avalanche multiplication and collector-base (CB) capacitance were shown to be the dominant nonlinearities in a single-stage common emitter amplifier. At a given $I_{sub c}$ an optimum $V_{sub ce}$ exists for a maximum third-order intercept point (IIP3). The IIP3 is limited by the avalanche multiplication nonlinearity at low $I_{sub c}$, and limited by the $C_{sub CB}$ nonlinearity at high $I_{sub c}$. The decrease of the avalanche multiplication rate at high $I_{sub c}$ is beneficial to linearity in SiGe HBTs. The IIP3 is sensitive to the biasing condition because of strong dependence of the avalanche multiplication current and CB capacitance on $I_{sub c}$ and $V_{sub ce}$. The load dependence of linearity was attributed to the feedback through the CB capacitance and the avalanche multiplication in the CB junction. Implications on the optimization of the transistor biasing condition and transistor structure for improved linearity are also discussed.

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A 20-GHz InP-HBT voltage-controlled oscillator with wide frequency tuning range

H. Djahanshahi, N. Saniei, S.P. Voinigescu, M.C. Maliepaard and C.A.T. Salama. "A 20-GHz InP-HBT voltage-controlled oscillator with wide frequency tuning range." 2001 Transactions on Microwave Theory and Techniques 49.9 (Sep. 2001 [T-MTT] (Mini-Special Issue on the 2001 IEEE Radio Frequency Integrated Circuit (RFIC) Symposium)): 1566-1572.

This paper presents the design and implementation of a 20-GHz-band differential voltage-controlled oscillator (VCO) using InP heterojunction-bipolar-transistor process technology. Aimed at 20- or 40-Gb/s fiber-optic applications, the design is based on a single-stage feedback amplifier with no intentional L or C. The salient features of the proposed VCO are wide frequency tuning range compared to LC oscillators, and low power consumption and transistor count compared to ring-oscillator counterparts. The implemented VCO has an adjustable frequency range from 13.75 to 21.5 GHz and provides two complementary outputs. Total power consumption at 18.6 GHz is 130 mW, while the phase noise is -90.0 dBc/Hz measured at 1-MHz offset frequency.

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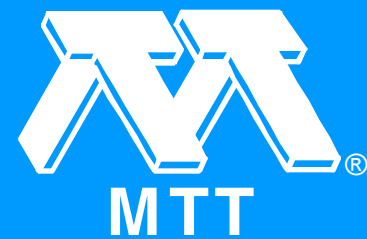
A general conformal-mapping approach to the optimum electrode design of coplanar waveguides with arbitrary cross section

M. Goano, F. Bertazzi, P. Caravelli, G. Ghione and T.A. Driscoll. "A general conformal-mapping approach to the optimum electrode design of coplanar waveguides with arbitrary cross section." 2001 Transactions on Microwave Theory and Techniques 49.9 (Sep. 2001 [T-MTT] (Mini-Special Issue on the 2001 IEEE Radio Frequency Integrated Circuit (RFIC) Symposium)): 1573-1580.

The Schwarz-Christoffel toolbox, a free MATLAB package for the computation of conformal maps, is applied to the quasi-static analysis of coplanar waveguides (CPWs) of arbitrary cross section in order to provide computationally efficient and very accurate estimates of their capacitance, inductance, characteristic impedance, and skin-effect attenuation. A few examples of many-sided polygonal waveguides are discussed, and the trapezoidal CPW, important, for example, for electrooptic modulators, is described in full detail, providing general guidelines for the electrode geometry optimization. The technique is validated through a comparison with the results of a full-wave finite-element method, and excellent agreement is demonstrated both in vacuo and with two-layer dielectric substrates.

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Three-dimensional millimeter-wave imaging for concealed weapon detection

D.M. Sheen, D.L. McMakin and T.E. Hall. "Three-dimensional millimeter-wave imaging for concealed weapon detection." 2001 Transactions on Microwave Theory and Techniques 49.9 (Sep. 2001 [T-MTT] (Mini-Special Issue on the 2001 IEEE Radio Frequency Integrated Circuit (RFIC) Symposium)): 1581-1592.

Millimeter-wave imaging techniques and systems have been developed at the Pacific Northwest National Laboratory (PNNL), Richland, WA, for the detection of concealed weapons and contraband at airports and other secure locations. These techniques were derived from microwave holography techniques that utilize phase and amplitude information recorded over a two-dimensional aperture to reconstruct a focused image of the target. Millimeter-wave imaging is well suited for the detection of concealed weapons or other contraband carried on personnel since millimeter-waves are nonionizing, readily penetrate common clothing material, and are reflected from the human body and any concealed items. In this paper, a wide-bandwidth three-dimensional holographic microwave imaging technique is described. Practical weapon detection systems for airport or other high-throughput applications require high-speed scanning on the order of 3 to 10 s. To achieve this goal, a prototype imaging system utilizing a 27-33 GHz linear sequentially switched array and a high-speed linear scanner has been developed and tested. This system is described in detail along with numerous imaging results.

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New microstrip "Wiggly-Line" filters with spurious passband suppression

T. Lopetegi, M.A.G. Laso, J. Hernandez, M. Bacaicoa, D. Benito, M.J. Garde, M. Sorolla and M. Guglielmi. "New microstrip "Wiggly-Line" filters with spurious passband suppression." 2001 Transactions on Microwave Theory and Techniques 49.9 (Sep. 2001 [T-MTT] (Mini-Special Issue on the 2001 IEEE Radio Frequency Integrated Circuit (RFIC) Symposium)): 1593-1598.

In this paper, we present a new parallel-coupled-line microstrip bandpass filter with suppressed spurious passband. Using a continuous perturbation of the width of the coupled lines following a sinusoidal law, the wave impedance is modulated so that the harmonic passband of the filter is rejected while the desired passband response is maintained virtually unaltered. This strip-width perturbation does not require the filter parameters to be recalculated and, this way, the classical design methodology for coupled-line microstrip filters can still be used. At the same time, the fabrication of the resulting filter layout does not involve more difficulties than those for typical coupled-line microstrip filters. To test this novel technique, 3rd-order Butterworth bandpass filters have been designed at 2.5 GHz, with a 10% fractional bandwidth and different values of the perturbation amplitude. It is shown that for a 47.5 % sinusoidal variation of the nominal strip width, a harmonic rejection of more than 40 dB is achieved in measurement while the passband at 2.5 GHz is almost unaltered.

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Comprehensive analysis of strip- and slot-line guided forward, backward, and complex magnetostatic waves

R. Rafii-El-Idrissi, R. Marques and F. Medina. "Comprehensive analysis of strip- and slot-line guided forward, backward, and complex magnetostatic waves." 2001 Transactions on Microwave Theory and Techniques 49.9 (Sep. 2001 [T-MTT] (Mini-Special Issue on the 2001 IEEE Radio Frequency Integrated Circuit (RFIC) Symposium)): 1599-1606.

This paper presents a comprehensive and accurate analysis of the guidance of volume and surface magnetostatic waves by strips or slots in the presence of a ferrite slab magnetized to saturation by an external uniform magnetic field. The strip/slot can be directly printed on the ferrite surface or separated from it by means of a dielectric layer of arbitrary thickness. The problem is posed in terms of a suitable integral equation accounting for the magnetostatic limit. This equation is solved by using a spectral-domain formulation. The proposed method allows for the consideration of arbitrary magnetization angles and the presence of upper and/or lower ground planes. Strip-guided forward, backward, and complex surface magnetostatic waves have been obtained and analyzed in terms of the appropriate waveguide parameters. Slot-guided backward volume magnetostatic waves have been also computed and studied. Theoretical results have been checked against theoretical (magnetostatic and full wave) and experimental data available in the literature with reasonable agreement.

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Temperature rise for the human head for cellular telephones and for peak SARs prescribed in safety guidelines (Sep. 2001 [T-MTT])

O.P. Gandhi, Qing-Xiang Li and Gang Kang. "Temperature rise for the human head for cellular telephones and for peak SARs prescribed in safety guidelines (Sep. 2001 [T-MTT])." 2001 Transactions on Microwave Theory and Techniques 49.9 (Sep. 2001 [T-MTT] (Mini-Special Issue on the 2001 IEEE Radio Frequency Integrated Circuit (RFIC) Symposium)): 1607-1613.

The bioheat equation is solved for an anatomically based model of the human head with a resolution of 3 /spl times/ 3 /spl times/ 3 mm to study the thermal implications of exposure to electromagnetic (EM) fields typical of cellular telephones both at 835 and 1900 MHz. It is shown that similar to the measured data, up to 4.5/spl deg/C temperature elevation may be caused for locations of the pinna by a cellular telephone warmed by electronic circuitry to temperatures as high as 39/spl deg/C with temperature increases for the internal tissues such as the brain and eye that are no more than 0.1/spl deg/C-0.2/spl deg/C higher than the basal values. Similar to previous studies by other authors, additional temperature increases due to EM fields of cellular telephones are fairly small and typically less than 0.1/spl deg/C. Another objective was to study the thermal implications of the SAR limits for the occupational exposures of 8 W/kg for any 1 g, or 10 W/kg for any 10 g of tissue suggested in the commonly used safety guidelines. Such specific absorption rates (SARs) would lead to temperature elevations for the electromagnetically exposed parts of the brain up to 0.5/spl deg/C with 10 W/kg for any 10 g of tissue resulting in somewhat higher temperatures and for larger volumes. Similar temperature increases are also calculated by increasing the arterial blood temperature, except that the temperature increases due to the SAR are for the more limited volume rather than the entire brain.





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Numerical study of axisymmetric dielectric resonators

Shouyuan Shi, Liuqing Yang and D.W. Prather. "Numerical study of axisymmetric dielectric resonators." 2001 Transactions on Microwave Theory and Techniques 49.9 (Sep. 2001 [T-MTT] (Mini-Special Issue on the 2001 IEEE Radio Frequency Integrated Circuit (RFIC) Symposium)): 1614-1619.

In this paper, we present an effective approach to study the behavior of axisymmetric dielectric resonators. This approach is based on the finite-difference time-domain method and two accompanying techniques in order to increase the accuracy and decrease the computational cost. These two techniques are the fast-Fourier-transform approach and the Pade method. This method is used to obtain the resonant frequencies and quality factors for several resonators. Comparisons are made to show the utility of the method.

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On the modeling of highly nonlinear circuits using total-variation-decreasing finite-difference schemes

W. Thiel and W. Menzel. "On the modeling of highly nonlinear circuits using total-variation-decreasing finite-difference schemes." 2001 Transactions on Microwave Theory and Techniques 49.9 (Sep. 2001 [T-MTT] (Mini-Special Issue on the 2001 IEEE Radio Frequency Integrated Circuit (RFIC) Symposium)): 1620-1625.

This paper presents the modeling of highly nonlinear circuits using a total-variation-decreasing (TVD) difference scheme developed for the simulation of problems involving shock phenomena. In contrast to the commonly used leapfrog scheme, a second-order accurate TVD method based on the Lax-Wendroff scheme is applied to one-dimensional nonlinear transient electromagnetic-wave problems. Furthermore, for the analysis of transmission-line-based networks, an adapted inclusion of nonlinear lumped elements in such a TVD scheme is proposed. As an example, both the scattered signals of a linear transmission line loaded with a nonlinear lumped element is investigated and the formation of a shock-wave of a low-loss nonlinear transmission line with distributed diodes is studied. In the simulation results, the modeling of rapidly rising edges occurring in the time signal are demonstrated.

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A new empirical large-signal model of Si LDMOSFETs for high-power amplifier design

Youngoo Yang, Young Yun Woo, Jaehyok Yi and Bumman Kim. "A new empirical large-signal model of Si LDMOSFETs for high-power amplifier design." 2001 Transactions on Microwave Theory and Techniques 49.9 (Sep. 2001 [T-MTT] (Mini-Special Issue on the 2001 IEEE Radio Frequency Integrated Circuit (RFIC) Symposium)): 1626-1633.

We propose a new empirical large-signal model of silicon laterally diffused MOSFETs for the design of various modes of high-power amplifiers. The new channel current model has only nine parameters that represent the unique operation principles of a MOSFET. In the channel current model, we include the thermal phenomena of high-power devices. To accurately characterize high-power devices, we incorporate the channel heating and heat-sink heating effects by providing two thermal capacitances and two thermal resistances. Nonlinear capacitances, including deep subthreshold and triode regions, as well as normal saturation regions, are extracted and modeled. For validation of our model, a 1.4-GHz 5-W amplifier is implemented, and the measured and simulated results match very well.

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A new micromachined overlay CPW structure with low attenuation over wide impedance ranges and its application to low-pass filters

Hong-Teuk Kim, Sanghwa Jung, Jae-Hyoung Park, Chang-Wook Baek, Yong-Kweon Kim and Youngwoo Kwon. "A new micromachined overlay CPW structure with low attenuation over wide impedance ranges and its application to low-pass filters." 2001 Transactions on Microwave Theory and Techniques 49.9 (Sep. 2001 [T-MTT] (Mini-Special Issue on the 2001 IEEE Radio Frequency Integrated Circuit (RFIC) Symposium)): 1634-1639.

In this paper, a new micromachined overlay-coplanar-waveguide (OCPW) structure has been developed and its characteristics are studied in detail as a function of the line parameters. In OCPW, the edges of the center conductors are lifted by micromachining techniques and partially overlapped with the ground plane to facilitate low-impedance lines. The elevated center conductors help to reduce the conductor loss by redistributing the current over a broad area. Comparative experiments on low-loss and lossy substrates also confirm the screening effect from the substrate losses by confining the electric field in the air between the overlapped conductor plates. Compared with the coplanar-waveguide (CPW) lines, the OCPW lines show wider impedance range (25-80 Ω) and lower loss (<0.95 dB/cm at 50 GHz). The advantages of OCPW for low- $Z_{sub 0}$ lines are utilized to realize a high-performance stepped-impedance low-pass filter at X-band. The OCPW filter shows distinct advantages over the conventional CPW filter in terms of size, loss, skirt, and stopband characteristics.

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A three-dimensional fourth-order finite-difference time-domain scheme using a symplectic integrator propagator

T. Hirono, Wayne Lui, S. Seki and Y. Yoshikuni. "A three-dimensional fourth-order finite-difference time-domain scheme using a symplectic integrator propagator." 2001 Transactions on Microwave Theory and Techniques 49.9 (Sep. 2001 [T-MTT] (Mini-Special Issue on the 2001 IEEE Radio Frequency Integrated Circuit (RFIC) Symposium)): 1640-1648.

A new explicit fourth-order finite-difference time-domain (FDTD) scheme for three-dimensional electromagnetic field simulation is proposed in this paper. A symplectic integrator propagator, which is also known as a decomposition of the exponential operator or a general propagation technique, is directly applied to Maxwell's equations in the scheme. The scheme is nondissipative and saves memory. The Courant stability limit of the scheme is 30% larger than that of the standard FDTD method. The perfectly matched layer absorbing boundary condition is applicable to the scheme. A specific eigenmode of a waveguide is successfully excited in the scheme. Stable and accurate performance is demonstrated by numerical examples.

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Finite-element analysis of generalized V- and W-shaped edge and broadside-edge-coupled shielded microstrip lines on anisotropic medium

Yue Yan and P. Pramanick. "Finite-element analysis of generalized V- and W-shaped edge and broadside-edge-coupled shielded microstrip lines on anisotropic medium." 2001 Transactions on Microwave Theory and Techniques 49.9 (Sep. 2001 [T-MTT] (Mini-Special Issue on the 2001 IEEE Radio Frequency Integrated Circuit (RFIC) Symposium)): 1649-1657.

This paper presents detailed finite-element analysis of generalized V- and W-shaped shielded microstrip lines in an anisotropic medium. The computed results show detailed quasistatic characteristics of the effective dielectric constant, characteristic impedance, and conductor loss of the lines. The broadside edge coupled lines are proposed for the first time in this paper. Unlike the previous analysis based on the conformal mapping method, this analysis takes into account the top walls and sidewalls, finite metallization thickness, and dielectric anisotropy. The results presented in this paper will considerable advance microwave-integrated-circuit technology using V- and W-shaped shielded microstrip lines.

Click on title for a complete paper.



An active integrated retrodirective transponder for remote information retrieval-on-demand

R.Y. Miyamoto, Yongxi Qian and T. Itoh. "An active integrated retrodirective transponder for remote information retrieval-on-demand." 2001 Transactions on Microwave Theory and Techniques 49.9 (Sep. 2001 [T-MTT] (Mini-Special Issue on the 2001 IEEE Radio Frequency Integrated Circuit (RFIC) Symposium)): 1658-1662.

A retrodirective transponder based on a novel compact phase-conjugating mixer with conversion gain has been developed. The active circuit uses one port for both incoming and outgoing signals, enabling a reduction of circuit size, and the balanced structure provides suppression of undesired signals. By using a modulated local oscillator, the circuit can modulate the received signal in order to retransmit local information to the remote site. A microstrip antenna is integrated with the phase conjugator and the whole system was fabricated on a single substrate, enabling a one-card system. A four-element prototype array with $0.5/\sqrt{\epsilon_r}$ array spacing demonstrated excellent measured retrodirectivity. Additionally, a simplified binary-phase-shift-keying signal transmitted by the array is recovered successfully at the source location, demonstrating great potential for remote tagging and wireless sensor applications.



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Some important properties of waveguide junction generalized scattering matrices in the context of the mode matching technique (Comments and reply)

M.A. Solano, J.S. Ipina, A. Gomez, A. Prieto, A. Vegas, A.S. Omar and G.V. Eleftheriades.
"Some important properties of waveguide junction generalized scattering matrices in the context of the mode matching technique (Comments and reply)." 2001 Transactions on Microwave Theory and Techniques 49.9 (Sep. 2001 [T-MTT] (Mini-Special Issue on the 2001 IEEE Radio Frequency Integrated Circuit (RFIC) Symposium)): 1663-1664.

For the original paper see *ibid.*, vol. 42, no. 10, p. 1896-1903 (1994). Here the commenters aim to provide another reason in addition to those given in Section II of the aforementioned paper in response to the rhetorical question, "Which mode-matching equations are linearly independent?" When the mode-matching method is used to obtain the generalized scattering matrix of a discontinuity between two waveguides of different cross sections, it is essential to make an adequate choice of the eigenfunctions, which will be used to test the continuity equations of the tangential components of the electromagnetic field in the plane of the discontinuity. It is known that the testing eigenmodes are chosen as being those of the larger guide for enforcing the electric-field continuity and as those of the smaller guide for enforcing the magnetic-field continuity. This means that the electric-field test eigenmodes must be chosen from the smaller guide and the magnetic-field test eigenmodes must be chosen from the larger guide. In the original paper, the authors prove this, first qualitatively and then rigorously. Now the commenters would like to add their reason which lends further support to the point-of-view presented in the paper. In reply the authors disagree with the last sentence of the comments of Solano et al., i.e., that testing the continuity of the tangential magnetic field by the M modes of the larger guide would result in a wrong formulation if the testing cross section is the smaller one. In order to clarify the whole situation, the authors present a table of all possible testing equations.





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Relationship between group delay and stored energy in microwave filters (Comments)

C. Ernst and V. Postoyalko. "Relationship between group delay and stored energy in microwave filters (Comments)." 2001 Transactions on Microwave Theory and Techniques 49.9 (Sep. 2001 [T-MTT] (Mini-Special Issue on the 2001 IEEE Radio Frequency Integrated Circuit (RFIC) Symposium)): 1664-.

For original paper, see *ibid.*, vol.49, no.1, p.192-6 (2001). In the original paper, it is shown that the time-averaged stored energy in a passive lossless reciprocal symmetrical or antimetrical two-port is proportional to the group delay. The authors point out that some of their results were previously reported in a book by Penfield et al. (1970) and apologize for claiming credit for the work.

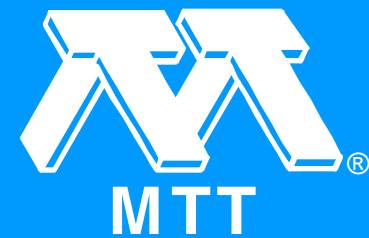
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Abstracts

Information for Authors (Sep. 2001 [T-MTT])

"Information for Authors (Sep. 2001 [T-MTT])." 2001 Transactions on Microwave Theory and Techniques 49.9 (Sep. 2001 [T-MTT] (Mini-Special Issue on the 2001 IEEE Radio Frequency Integrated Circuit (RFIC) Symposium)): 0_5-0_5.



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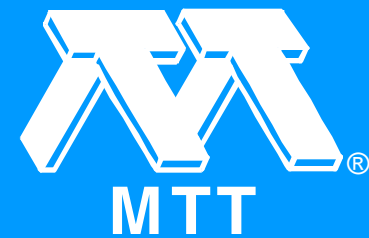
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Inside Cover (Oct. 2001, Part I [T-MTT])

"Inside Cover (Oct. 2001, Part I [T-MTT])." 2001 Transactions on Microwave Theory and Techniques 49.10 (Oct. 2001, Part I [T-MTT] (Mini-Special Issue on Electrical Performance of Electronic Packaging (EPEP))): 0_3-0_4.



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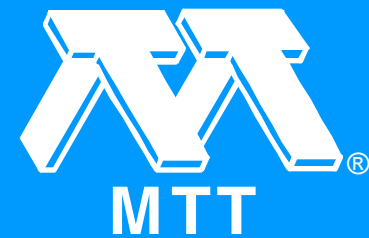
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Guest Editorial (Oct. 2001, Part I [T-MTT])

M. Swaminathan and R.W. Jackson. "Guest Editorial (Oct. 2001, Part I [T-MTT])." 2001 Transactions on Microwave Theory and Techniques 49.10 (Oct. 2001, Part I [T-MTT] (Mini-Special Issue on Electrical Performance of Electronic Packaging (EPEP))): 1669-1670.



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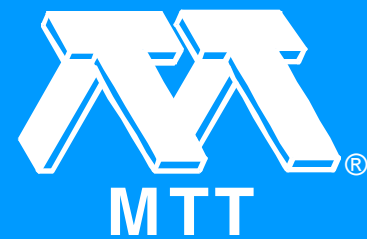
A finite ground coplanar line-to-silicon micromachined waveguide transition

J.P. Becker, Y. Lee, J.R. East and L.P.B. Katehi. "A finite ground coplanar line-to-silicon micromachined waveguide transition." 2001 Transactions on Microwave Theory and Techniques 49.10 (Oct. 2001, Part I [T-MTT] (Mini-Special Issue on Electrical Performance of Electronic Packaging (EPEP))): 1671-1676.

Circuits operating in the terahertz frequency range have traditionally been developed using hollow metal waveguides, which, due to the small wavelength at these operating frequencies, must be correspondingly small in cross section. As a result of the high cost of conventional precision machining of such small waveguides, alternate fabrication methods continue to be explored. Silicon micromachining has been suggested as a potential means to produce waveguides in a more cost-effective manner for operation at these frequencies. This paper presents a transition structure that couples the popular finite ground coplanar transmission line to a W-band silicon micromachined waveguide, forming a fully micromachined module. The waveguide is formed via bulk micromachining using a wet etchant, resulting in a diamond cross section. The consequences of utilizing a diamond waveguide in place of the more common rectangular waveguide are considered and potential means of developing rectangular-walled waveguides in silicon are noted. A Ka-band microwave model of a similar transition to a conventional rectangular waveguide is also demonstrated.

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Systematic development of transmission-line models for interconnects with frequency-dependent losses

K.M. Coperich, J. Morsey, V.I. Okhmatovski, A.C. Cangellaris and A.E. Ruehli. "Systematic development of transmission-line models for interconnects with frequency-dependent losses." 2001 Transactions on Microwave Theory and Techniques 49.10 (Oct. 2001, Part I [T-MTT] (Mini-Special Issue on Electrical Performance of Electronic Packaging (EPEP))): 1677-1685.

This paper presents a new method for the extraction of the frequency-dependent, per-unit-length (p.u.l.) resistance, and inductance parameters of multiconductor interconnects. The proposed extraction methodology is based on a new formulation of the magneto-quasi-static problem that allows lossy ground planes of finite thickness to be modeled rigorously. The formulation is such that the p.u.l. impedance matrix for the multiconductor interconnect is extracted directly at a prescribed frequency. Once the matrix has been calculated over the bandwidth of interest, rational function representations of its elements are generated through a robust matrix curve-fitting process. Such a formulation enables subsequent transient analysis of interconnects through a variety of approaches. Direct incorporation of the rational function model into a general-purpose circuit simulator and a standalone multiconductor-transmission-line simulator is demonstrated.

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A general class of passive macromodels for lossy multiconductor transmission lines

A. Dounavis, R. Achar and M. Nakhla. "A general class of passive macromodels for lossy multiconductor transmission lines." 2001 Transactions on Microwave Theory and Techniques 49.10 (Oct. 2001, Part I [T-MTT] (Mini-Special Issue on Electrical Performance of Electronic Packaging (EPEP))): 1686-1696.

This paper presents a general class of passive macromodeling algorithm for multiport distributed interconnects. A new theorem is described that specifies sufficient conditions for matrix-rational approximation of exponential functions in order to generate a passive macromodel. A proof is given showing that the currently existing passive matrix-rational approximation of exponential functions is a subclass of the generic approach presented in this paper. In addition, a technique to obtain a compact passive macromodel with predetermined coefficients, based on near-optimal approximation, is presented. The proposed model can be easily incorporated with recently developed passive model-reduction techniques.

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Physics-based CAD models for the analysis of vias in parallel-plate environments

R. Abhari, G.V. Eleftheriades and E. van Deventer-Perkins. "Physics-based CAD models for the analysis of vias in parallel-plate environments." 2001 Transactions on Microwave Theory and Techniques 49.10 (Oct. 2001, Part I [T-MTT] (Mini-Special Issue on Electrical Performance of Electronic Packaging (EPEP))): 1697-1707.

In this paper, physics-based computer-aided-design (CAD) models for through and buried vias in parallel-plate environments are presented based on radial transmission-line theory. The crosstalk power transferred by the TEM parallel-plate mode between vias is characterized, and extended to the treatment of vias in finite substrates by means of image theory. The presented CAD models can be combined with lumped and distributed circuit elements, as well as linear and nonlinear devices, providing an accurate and fast procedure for the global modeling of high-speed electronic circuits. The corresponding simulation time for representative single or multiple via configurations has been drastically reduced compared to full-wave simulations while maintaining comparable accuracy.

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A synthesis technique of time-domain interconnect models by MIMO type of selective orthogonal least-square method

M. Suzuki, H. Miyashita, A. Kamo, T. Watanabe and H. Asai. "A synthesis technique of time-domain interconnect models by MIMO type of selective orthogonal least-square method." 2001 Transactions on Microwave Theory and Techniques 49.10 (Oct. 2001, Part I [T-MTT] (Mini-Special Issue on Electrical Performance of Electronic Packaging (EPEP))): 1708-1714.

This paper describes an efficient synthesis technique of time-domain models for interconnects characterized by sampled data. In this method, poles are derived from the sampled data in the frequency domain. Next, the dominant poles and the residues are obtained efficiently by multiinput-multioutput type of selective orthogonal least-square method. Furthermore, time-domain models are derived from the frequency-domain models. Finally, the accuracy and efficiency of the proposed method are substantiated by transient simulation of example circuits using this model.

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High-Q LTCC-based passive library for wireless system-on-package (SOP) module development

A. Sutono, D. Heo, Y.-J. Emery Chen and J. Laskar. "High-Q LTCC-based passive library for wireless system-on-package (SOP) module development." 2001 Transactions on Microwave Theory and Techniques 49.10 (Oct. 2001, Part I [T-MTT] (Mini-Special Issue on Electrical Performance of Electronic Packaging (EPEP))): 1715-1724.

In this paper, we present the development and full characterization and modeling of a multilayer ceramic-based system-on-package component library. Compact high-Q three-dimensional inductor and capacitor topologies have been chosen and incorporated. A measured inductor Q factor as high as 100 and self-resonant frequency as high as 8 GHz have been demonstrated. The new vertically interdigitated capacitor topology occupies nearly an order of magnitude less of real estate while demonstrating comparable performance to the conventional topology. The low-temperature co-fired ceramic (LTCC) library has been incorporated into a 1.9-GHz CMOS power-amplifier design exhibiting a measured 17-dB gain, 26-dBm output power, and 48% power added efficiency. This power-amplifier module with fully integrated LTCC passives demonstrates a superior performance to those with full and partial on-chip passive integration.

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Optimal simultaneous interpolation/extrapolation algorithm of electromagnetic responses in time and frequency domains

Jin-Lin Hu, Chi Hou Chan and T.K. Sarkar. "Optimal simultaneous interpolation/extrapolation algorithm of electromagnetic responses in time and frequency domains." 2001 Transactions on Microwave Theory and Techniques 49.10 (Oct. 2001, Part I [T-MTT] (Mini-Special Issue on Electrical Performance of Electronic Packaging (EPEP))): 1725-1732.

In this paper, an optimal simultaneous interpolation and extrapolation algorithm in the time and frequency domains is carried out by adaptively choosing the order of the associate Hermite (AH) expansion. Due to the isomorphism of the AH function and its Fourier transform, the time-domain signal and its corresponding frequency-domain transform can be expanded as two isomorphic AH expansions, that can be used for simultaneous interpolation and extrapolation in the time and frequency domains from the partial sampled data of the two waveforms. By using an optimization algorithm, the origin of the expansion and the optimal scaling factor can be found. Hence, by using an adaptive procedure, the order of the expansion can be chosen that leads to accurate interpolation and extrapolation. Some numerical examples are presented to illustrate the efficiency of this method for the complex signal both with and without random noise. The proposed algorithm is also applied to analyze the time- and frequency-domain responses of the ground bounce and lead frame problems in electronic packaging in which the proposed algorithm remains stable when a large order of Hermite expansion is required.

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Characterization and modeling of multiple coupled on-chip interconnects on silicon substrate

Ji Zheng, V.K. Tripathi and A. Weisshaar. "Characterization and modeling of multiple coupled on-chip interconnects on silicon substrate." 2001 Transactions on Microwave Theory and Techniques 49.10 (Oct. 2001, Part I [T-MTT] (Mini-Special Issue on Electrical Performance of Electronic Packaging (EPEP))): 1733-1739.

A quasi-magnetostatic integral formulation approach is applied to compute the frequency-dependent series resistance and inductance parameters for coupled microstrip on-chip interconnects on silicon. The method is based on the simultaneous discretization of interconnect conductors and silicon substrate, and takes into account the substrate skin effect (eddy currents), as well as the conductor skin and proximity effects. An efficient equivalent-circuit model based on "effective substrate current loops" is extracted from the frequency-dependent R and L parameters for a class of coupled microstrip-type on-chip interconnects. The frequency response of the proposed model consisting of only passive R, L elements agrees well with the broad-band characteristics of the distributed resistance and inductance parameters of the interconnect obtained by electromagnetic simulation. Model extraction results are presented for asymmetric coupled interconnects to demonstrate the proposed method.





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Pulse-coupling measurement of coupled microstrip lines using a micromachined picosecond optical near-field probe

J. Lee, H. Lee, S. Baek, You Chul Jeong and J. Kim. "Pulse-coupling measurement of coupled microstrip lines using a micromachined picosecond optical near-field probe." 2001 Transactions on Microwave Theory and Techniques 49.10 (Oct. 2001, Part I [T-MTT] (Mini-Special Issue on Electrical Performance of Electronic Packaging (EPEP))): 1740-1746.

By measuring the transverse electric-field distributions using a newly developed micromachined optical near-field mapping probe, pulse-coupling phenomena on coupled microstrip lines are reported for the first time. The measured field distribution of the propagating coupled pulse provides useful information to aid understanding of the coupling phenomena; this cannot be obtained by conventional external-port access test instruments. The measurement is performed based on the picosecond photoconductivity of low-temperature-grown GaAs (LT-GaAs). A system for the measurement of the internal electric field distribution using the optical near-field probe is described and characterized. It is capable of measuring independent orthogonal components of free-space electric fields with less than 2-ps temporal resolution and with minimal loading effects. The loading effects of the probe are minimized by adopting a micromachining technique for the use of a 1- μm -thick LT-GaAs epilayer as a substrate, and by using silver-paint-coated optical fibers for electrical connections.

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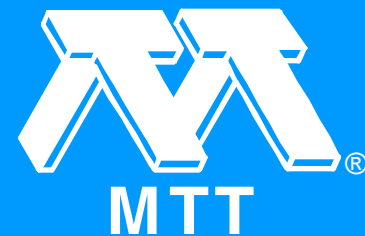


Abstracts

Development of a millimeter-wave system-on-a-package utilizing MCM integration

A. Pham, R. Ramachandran, J. Laskar, V. Krishnamurthy, D. Bates, W. Marcinkewicz, B. Schmanski, P. Piacente and L. Sprinceanu. "Development of a millimeter-wave system-on-a-package utilizing MCM integration." *2001 Transactions on Microwave Theory and Techniques* 49.10 (Oct. 2001, Part I [T-MTT] (Mini-Special Issue on Electrical Performance of Electronic Packaging (EPEP))): 1747-1749.

We present the development of a system-on-a-package at millimeter-wave frequencies utilizing a commercially available multichip-module process. This technology has established a platform for integrating multiple components of different material systems to combine digital application-specific integrated circuits (ASICs), radio-frequency integrated circuits, and microelectromechanical devices onto a package. The multilayer polymer thin films also empower the design and fabrication of integral passive devices, including thin-film resistors, filters, and Wilkinson power combiners.



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A stable and efficient admittance method via adjacency graphs and recursive thresholding

L. Tarricone and M. Mongiardo. "A stable and efficient admittance method via adjacency graphs and recursive thresholding." 2001 Transactions on Microwave Theory and Techniques 49.10 (Oct. 2001, Part I [T-MTT] (Mini-Special Issue on Electrical Performance of Electronic Packaging (EPEP))): 1750-1756.

The generalized admittance method is a rigorous full-wave approach for the analysis of waveguide circuits. Unfortunately, it may present the risk of ill conditioning, especially when very complex structures are analyzed with a considerably high number of modes. In this paper, the concepts of adjacency graph and recursive thresholding are proposed to solve its numerical problems. By applying the proposed strategy, the linear system representing the core of the analysis is partitioned into many independent and well-conditioned subsystems, thus improving the numerical stability of the approach and its efficiency. The attractive features of the proposed approach are its simplicity and immediate implementation. Results are given, referred to a real industrial case, a complex E/H-plane filter, whose analysis could not be performed via a standard admittance method when a very high number of modes were considered. With the present approach, the ill conditioning is avoided and considerable enhancements in computing times is achieved.

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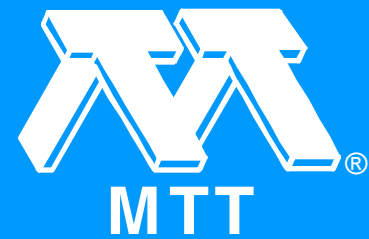
Noise characterization of multiport amplifiers

J. Randa. "Noise characterization of multiport amplifiers." 2001 Transactions on Microwave Theory and Techniques 49.10 (Oct. 2001, Part I [T-MTT] (Mini-Special Issue on Electrical Performance of Electronic Packaging (EPEP))): 1757-1763.

This paper addresses the issue of the definition and measurement of the noise figure and parameters to characterize multiport devices, particularly differential amplifiers. A parametrization in terms of the noise matrix appears to be the most practical. The noise figure for a given output port is defined and related to the noise matrix and scattering parameters of the device, as well as the correlations between different input noise waves. The degradation of the signal-to-noise ratio is obtained from a special choice of the input correlation function. Two examples are considered in detail: a three-port differential amplifier and a four-port mixed-mode amplifier, both with reflectionless terminations. The noise figures, effective input temperatures, and gains are related to the results of a series of hot-cold measurements, as in the familiar two-port case.

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A new family of all-inductive dual-mode filters

M. Guglielmi, P. Jarry, E. Kerherve, O. Roquebrun and D. Schmitt. "A new family of all-inductive dual-mode filters." 2001 Transactions on Microwave Theory and Techniques 49.10 (Oct. 2001, Part I [T-MTT] (Mini-Special Issue on Electrical Performance of Electronic Packaging (EPEP))): 1764-1769.

In this paper, we describe a new family of dual-mode filters that is based on the use of simple inductive discontinuities in a rectangular waveguide environment. The proposed filter structure can be analyzed and optimized very efficiently using multimode equivalent network representations, thus leading to a simple and rapid development procedure. In addition to theory, the measured performance of a number of filter structures is also presented, thereby fully validating the proposed filter concept.

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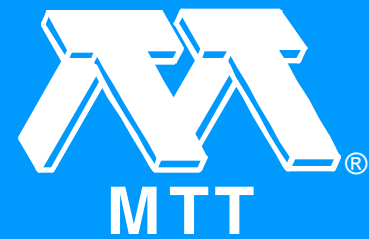
Integration of CPW quadrature couplers in multilayer thin-film MCM-D

G. Carchon, W. De Raedt and B. Nauwelaers. "Integration of CPW quadrature couplers in multilayer thin-film MCM-D." 2001 Transactions on Microwave Theory and Techniques 49.10 (Oct. 2001, Part I [T-MTT] (Mini-Special Issue on Electrical Performance of Electronic Packaging (EPEP))): 1770-1776.

In this paper, the design, integration, and measurement of quadrature couplers integrated in a multilayer thin-film multichip-module technology are discussed. We have investigated four- and six-finger coplanar-waveguide (CPW) Lange couplers and a coupler based on reentrant sections. Three methods for the design of CPW Lange couplers are compared for the first time. The method of Paolino consistently results in the best performance. The four-finger Lange coupler results in a -3.2 ± 0.2 -dB coupling bandwidth from 10.8 to 14.9 GHz, with a return loss better than -18 dB and an isolation better than -20 dB. The six-finger Lange coupler results in a -3.2 ± 0.5 -dB coupling bandwidth from 9.5 to 17 GHz, with a return loss and isolation better than -16 dB. The coupler using reentrant sections results in a -3.4 ± 1.1 -dB coupling bandwidth from 6.9 to 18.8 GHz with a return loss and isolation better than -21 dB. It is shown that CPW Lange couplers are not sensitive to planarization effects, while for the design of couplers using reentrant sections, the effect should be taken into account. The Lange couplers have the additional advantage that they are easier to design, have a lower insertion loss, and can be very well predicted using method-of-moments simulations.

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Evaluating co-channel distortion ratio in microwave power amplifiers

J.C. Pedro and N. Borges de Carvalho. "Evaluating co-channel distortion ratio in microwave power amplifiers." 2001 Transactions on Microwave Theory and Techniques 49.10 (Oct. 2001, Part I [T-MTT] (Mini-Special Issue on Electrical Performance of Electronic Packaging (EPEP))): 1777-1784.

Laboratory results, obtained with a novel setup for a corrected co-channel distortion ratio, validate the idea that no matter the notch width, a conventional noise-power-ratio test produces optimistic small-signal in-band distortion measurements, when compared to a hypothetical continuous spectrum excitation test by the authors. This paper also generalizes previous memoryless mildly nonlinear behavior predictions to saturated and frequency-dependent regimes. Finally, a close agreement between measurement results and harmonic-balance simulated data provided an alternative means of corrected co-channel power-ratio evaluation.

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A new reduced-order model of SAW interdigital transducers

O.A. Peverini, R. Orta and R. Tascone. "A new reduced-order model of SAW interdigital transducers." 2001 Transactions on Microwave Theory and Techniques 49.10 (Oct. 2001, Part I [T-MTT] (Mini-Special Issue on Electrical Performance of Electronic Packaging (EPEP))): 1785-1791.

The Green's function method is generally agreed to be the most satisfactory technique for the rigorous analysis of surface-acoustic-wave interdigital transducers (IDTs). However, its direct application to response investigations or optimization-based design activities is limited by its computational complexity. In this paper, we present a new reduced-order model of IDTs based on a moment-matching technique and on the singular value decomposition. Several numerical and experimental examples demonstrate the accuracy and the efficiency of the method.

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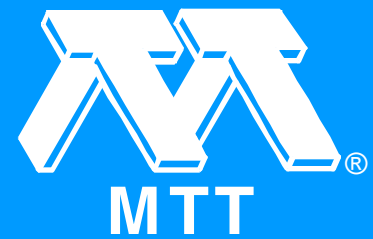
Nonlinear dynamics of microwave synthesizers- stability and noise

S. Sancho, A. Suarez and T. Fernandez. "Nonlinear dynamics of microwave synthesizers-stability and noise." 2001 Transactions on Microwave Theory and Techniques 49.10 (Oct. 2001, Part I [T-MTT] (Mini-Special Issue on Electrical Performance of Electronic Packaging (EPEP))): 1792-1803.

The nonlinear dynamics of microwave synthesizers based on type-II third-order loops is analyzed in this paper. Instead of using standard simplified models, realistic models are considered for the loop filter, phase detector (PD), and voltage-controlled oscillator based on experimental characterization. The new models enable the simulation of incidental frequency modulation and the accurate prediction of the synthesizer operation ranges, including possible hysteresis phenomena. The stability of phase-locked solutions is analyzed, enabling the prediction of possible chaotic behavior. For an accurate determination of the output spectrum, a phase-noise simulation is also carried out, considering the noise contributions from the loop elements. The sidebands inherent to the synthesizer solution are taken into account for this analysis. The analysis strategy has been applied to a microwave synthesizer, operating in the 2-3 GHz band, with very good results. Two types of PDs are considered: the JK flip-flop PD and frequency mixer, comparing the resulting loop performance in terms of stability and phase noise.

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Design of compact multilevel folded-line bandpass filters

R. Kumar Settaluri, A. Weisshaar and V.K. Tripathi. "Design of compact multilevel folded-line bandpass filters." 2001 Transactions on Microwave Theory and Techniques 49.10 (Oct. 2001, Part I [T-MTT] (Mini-Special Issue on Electrical Performance of Electronic Packaging (EPEP))): 1804-1809.

A simple design methodology for compact multilevel multiconductor folded-line bandpass filters is presented in this paper. Several new compact folded-line filter topologies in single, as well as multilevel environments are proposed. Simple closed-form design equations are presented for the extraction of an equivalent coupled transmission line representing the folded-line filter section. The folded-line filter designs are validated by full-wave electromagnetic simulation, as well as by measurement for a four-section maximally flat four-coupled-line bandpass filter. The new folded-line filters exhibit a significant reduction in footprint compared to conventional designs.

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Numerical computation of the interaction between electromagnetic waves and nonlinear superconducting materials

S. Caorsi, A. Massa and M. Pastorino. "Numerical computation of the interaction between electromagnetic waves and nonlinear superconducting materials." 2001 Transactions on Microwave Theory and Techniques 49.10 (Oct. 2001, Part I [T-MTT] (Mini-Special Issue on Electrical Performance of Electronic Packaging (EPEP))): 1810-1817.

In this paper, we propose a numerical solution to the computation of the interaction between electromagnetic waves and superconducting materials. A superconductor is identified as a material with a negative dielectric permittivity on the basis of the two-fluid model and an integral-equation formulation is developed. The approach takes into account the nonlinear behavior (i.e., the dependence of the material parameters on the internal magnetic field), experimentally observed in previous studies. An iterative process is then developed for the numerical solution; the process is based on the distorted-wave Born approximation. The mathematical formulation of the approach is described and some numerical results concerning the canonical case of a circular cylinder and the behavior of two superconducting transmission lines are reported.

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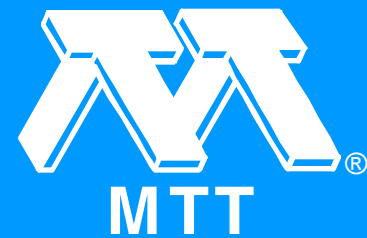
Wide-band low-loss high-isolation microstrip periodic-stub diplexer for multiple-frequency applications

B. Strassner and K. Chang. "Wide-band low-loss high-isolation microstrip periodic-stub diplexer for multiple-frequency applications." 2001 Transactions on Microwave Theory and Techniques 49.10 (Oct. 2001, Part I [T-MTT] (Mini-Special Issue on Electrical Performance of Electronic Packaging (EPEP))): 1818-1820.

This paper introduces a three-port microstrip multifrequency diplexer used in a phased-array transceiver system that employs band-stop filters with open-circuited stubs for band selection and separation. The diplexer is designed to take 10, 12, 19, and 21 GHz into port 1 and to separate 10 and 19 GHz to port 2 and 12 and 21 GHz to port 3 with minimal dispersion. The insertion loss for each frequency varies from 0.4 to 3.4 dB and the return loss is better than 10 dB. The isolation between channels at the four frequencies is greater than 50 dB. Each passband created between adjacent stopbands has a bandwidth over 1 GHz. The microstrip diplexer is designed using periodic stubs that collectively have the advantages of low insertion loss, high isolation and rejection, wide-band performance on each channel, and easy fabrication. This type of diplexer has many applications in multifrequency transceivers for communication systems.

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Frequencies of a truncated circular waveguide - method of internal matching (Comments and reply)

H.E. Green and C.Y. Wang. "Frequencies of a truncated circular waveguide - method of internal matching (Comments and reply)." 2001 Transactions on Microwave Theory and Techniques 49.10 (Oct. 2001, Part I [T-MTT] (Mini-Special Issue on Electrical Performance of Electronic Packaging (EPEP))): 1821-.

For original paper see C.Y. Wang, *ibid.*, vol.48, no.10, pp.1763-5 (Oct. 2000). In the above paper, Wang makes a useful addition to the literature on truncated circular waveguides, which have important practical applications in polarizers. Wang references several prior contributions to the theory of this particular kind of waveguide and commenting collectively on this body of literature, goes on to state "the results, however, differ considerably". This is, at best, only partly true, and results in a greater degree from the author's failure to find other available references. A reply by Wang to these comments is included.

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Carrier tracking in RAKE reception of wide-band DSSS in Ricean fading (Comments)

R.E. Ziemer and L.B. Milstein. "Carrier tracking in RAKE reception of wide-band DSSS in Ricean fading (Comments)." 2001 Transactions on Microwave Theory and Techniques 49.10 (Oct. 2001, Part I [T-MTT] (Mini-Special Issue on Electrical Performance of Electronic Packaging (EPEP))): 1822-1823.

In an earlier paper by Ziemer et al. (see *ibid.*, vol.47, no.6, pp.681-6, 1999), the effect of phase-tracking error in the fingers of a coherent RAKE receiver was characterized. This paper gives additional results for the case where the phase tracking error is due jointly to input noise to the receiver and phase noise internal to the phase tracking device. An optimum number of paths exists, giving a minimum bit-error probability.

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Branch-line couplers using unequal line lengths (Comments and reply)

R.W. Vogel, C. Toker, M. Saglam, M. Ozme and N. Gunalp. "Branch-line couplers using unequal line lengths (Comments and reply)." 2001 Transactions on Microwave Theory and Techniques 49.10 (Oct. 2001, Part I [T-MTT] (Mini-Special Issue on Electrical Performance of Electronic Packaging (EPEP))): 1824-.

For original paper see Toker et al., *ibid.*, vol.49. no.4, pp.718-21, 2001. In the above paper, Toker et al. maintain that the general solution of branch-line couplers is provided. In fact, the more general coupler was published previously by the author (see *ibid.*, vol.40, pp.253-62, 1992). Simplifying the general structure in this paper by removing the lumped elements, one can get the branch-line coupler. A reply to these comments by Toker et al. is included.

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Information for Authors (Oct. 2001, Part I [T-MTT])

"Information for Authors (Oct. 2001, Part I [T-MTT])." 2001 Transactions on Microwave Theory and Techniques 49.10 (Oct. 2001, Part I [T-MTT] (Mini-Special Issue on Electrical Performance of Electronic Packaging (EPEP))): 0_5-0_5.



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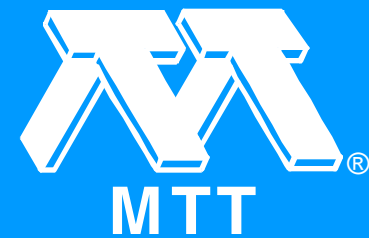
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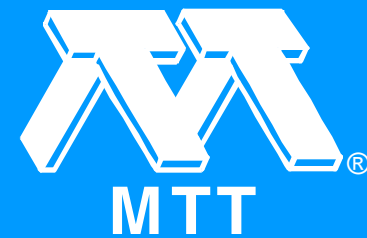
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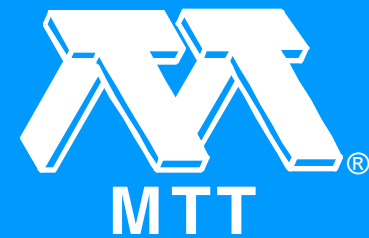
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Guest Editorial (Oct. 2001, Part II [T-MTT])

P.J. Matthews and D. Novak. "Guest Editorial (Oct. 2001, Part II [T-MTT])." 2001 Transactions on Microwave Theory and Techniques 49.10 (Oct. 2001, Part II [T-MTT] (Special Issue on Microwave and Millimeter-Wave Photonics)): 1829-1830.



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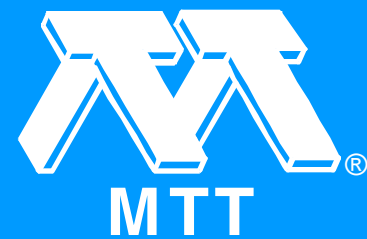
1.55-/spl mu/m photonic systems for microwave and millimeter-wave measurement

T. Nagatsuma, M. Shinagawa, N. Sabri, A. Sasaki, Y. Royter and A. Hirata. "1.55-/spl mu/m photonic systems for microwave and millimeter-wave measurement." 2001 Transactions on Microwave Theory and Techniques 49.10 (Oct. 2001, Part II [T-MTT] (Special Issue on Microwave and Millimeter-Wave Photonics)): 1831-1839.

This paper reviews recent advances in 1.55-/spl mu/m photonic systems for measurement and sensors covering the frequency range from microwaves to millimeter waves. We first deal with the basic technologies for photonic measurement, i.e., generation, transmission, and detection of high-frequency signals, and then discuss recent practical applications, including high-speed integrated-circuit probers, sampling oscilloscopes, network analyzers, and some free-space sensing systems.

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Optically sampled analog-to-digital converters

P.W. Juodawlkis, J.C. Twichell, G.E. Betts, J.J. Hargreaves, R.D. Younger, J.L. Wasserman, F.J. O'Donnell, K.G. Ray and R.C. Williamson. "Optically sampled analog-to-digital converters." 2001 Transactions on Microwave Theory and Techniques 49.10 (Oct. 2001, Part II [T-MTT] (Special Issue on Microwave and Millimeter-Wave Photonics)): 1840-1853.

Optically sampled analog-to-digital converters (ADCs) combine optical sampling with electronic quantization to enhance the performance of electronic ADCs. In this paper, we review the prior and current work in this field, and then describe our efforts to develop and extend the bandwidth of a linearized sampling technique referred to as phase-encoded optical sampling. The technique uses a dual-output electrooptic sampling transducer to achieve both high linearity and 60-dB suppression of laser amplitude noise. The bandwidth of the technique is extended by optically distributing the post-sampling pulses to an array of time-interleaved electronic quantizers. We report on the performance of a 505-MS/s (megasample per second) optically sampled ADC that includes high-extinction LiNbO₃/1-to-8 optical time-division demultiplexers. Initial characterization of the 505-MS/s system reveals a maximum signal-to-noise ratio of 51 dB (8.2 bits) and a spur-free dynamic range of 61 dB. The performance of the present system is limited by electronic quantizer noise, photodiode saturation, and preliminary calibration procedures. None of these fundamentally limit this sampling approach, which should enable multigigahertz converters with 12-b resolution. A signal-to-noise analysis of the phase-encoded sampling technique shows good agreement with measured data from the 505-MS/s system.

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A photonic bandgap (PBG) structure for guiding and suppressing surface waves in millimeter-wave antennas

Young-Jin Park, A. Herschlein and W. Wiesbeck. "A photonic bandgap (PBG) structure for guiding and suppressing surface waves in millimeter-wave antennas." 2001 Transactions on Microwave Theory and Techniques 49.10 (Oct. 2001, Part II [T-MTT] (Special Issue on Microwave and Millimeter-Wave Photonics)): 1854-1859.

Periodic and regular metal posts, a photonic bandgap (PBG) structure for guiding surface waves in a parallel-plate waveguide is proposed. The isotropic PBG structure is applied to the design of an asymmetric parallel-plate waveguide Luneburg lens (APWLL). The relation between the dimensions of the metal posts and the required refraction index in the lens is derived with transmission-line theory and the transverse resonance method. Different lattices for the entire lens are also investigated. For verification, an antenna for a 76.5 GHz adaptive-cruise control radar is fabricated, consisting of an APWLL, a primary feed, and symmetric corrugated flares to improve the property of the antenna in elevation. Measured results verify the PBG structure design in the APWLL.

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Coupled defects in photonic crystals

A.L. Reynolds, U. Peschel, F. Lederer, P.J. Roberts, T.F. Krauss and P.J.I. de Maagt. "Coupled defects in photonic crystals." 2001 Transactions on Microwave Theory and Techniques 49.10 (Oct. 2001, Part II [T-MTT] (Special Issue on Microwave and Millimeter-Wave Photonics)): 1860-1867.

We present a theoretical and numerical description of coupled defects in photonic-bandgap crystals, expandable to cover a wide range of applications. Based on a weak interaction approach, explicit expressions are derived for defect interaction. The basis is formed by a system of coupled ordinary differential equations for the field amplitudes for individual defects. The actual configuration of the defects (chain, lattice, bend, or anything else) enters the equations as a linear coupling between neighboring defects. The strength of this method is that many solutions of this system are known analytically; the band structure as well as the transmission response of a defect chain, or of a defect lattice, can be determined. The results for the superlattice of defects are compared with widely accepted numerical methods, the transfer matrix method, and finite-difference time domain method.

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Characterization of diffraction anomalies in 2-D photonic bandgap structures

M. Sarnowski, T. Vaupel, V. Hansen, E. Kreysa and H.P. Gemuend. "Characterization of diffraction anomalies in 2-D photonic bandgap structures." 2001 Transactions on Microwave Theory and Techniques 49.10 (Oct. 2001, Part II [T-MTT] (Special Issue on Microwave and Millimeter-Wave Photonics)): 1868-1872.

This paper deals with transmission anomalies of freestanding two-dimensional bandgap structures, which have found a large application range as filter and guiding structures in communication systems and radioastronomical applications in the far infrared region. The effect appears as a sharp breakdown of the transmission factor in the passband of quadratic patch and slot structures, first revealed by measurements. This paper outlines the numerical confirmation of these effects by computer simulations based on the method of moments combined with the Floquet theorem. The transmission and reflection behavior is examined for different structure geometries, frequency ranges, angle, and polarization of the incident wave also revealing alternative structures suppressing these effects. The modeling with electric and magnetic currents allows the characterization of both patch and slot arrays. Finally, cross shaped structures are examined allowing the complete suppression of this kind of anomalies.

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Optical-microwave interaction modeling in high-temperature superconducting films

A.H. Majedi, S.K. Chaudhuri and S. Safavi-Naeini. "Optical-microwave interaction modeling in high-temperature superconducting films." 2001 Transactions on Microwave Theory and Techniques 49.10 (Oct. 2001, Part II [T-MTT] (Special Issue on Microwave and Millimeter-Wave Photonics)): 1873-1881.

Optical-microwave interaction in high-T/sub c/ superconductors is investigated for performing basic optoelectronic functions in cryogenic environment. A fast bolometric photoresponse in conjunction with the unique electrical properties of high-temperature superconductor (HTS) materials allows us to explore a series of novel optoelectronic devices with low-noise/low-power and high-speed/high-frequency characteristics. After reviewing the HTS photoresponse categories, we describe the fast bolometric photoresponse and its condition with heat transfer analysis. The analytical solution of heat diffusion equation for an HTS strip mounted on a substrate will be presented for three different type of optical sources. Then the effect of optical irradiation will be incorporated in the two-fluid model by thermomodulation concept in order to model the interaction of optical radiation with electrical signal. The current-field relationship and the supercurrent response time are evaluated in the presence of both optical and electrical signals. Our numerical simulations for YBaCuO film demonstrate the possibility of RF harmonic generation when the laser beam is modulated by the RF signal in the presence of dc bias current and RF signal mixing when the HTS film is fed by a time-harmonic microwave source. The developed model can also be used to study optical control and tunability techniques for HTS microwave devices for analog signal processing.



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A mode-locked microchip laser optical transmitter for fiber radio

A.J.C. Vieira, P.R. Herczfeld, A. Rosen, M. Ermold, E.E. Funk, W.D. Jemison and K.J. Williams. "A mode-locked microchip laser optical transmitter for fiber radio." 2001 Transactions on Microwave Theory and Techniques 49.10 (Oct. 2001, Part II [T-MTT] (Special Issue on Microwave and Millimeter-Wave Photonics)): 1882-1887.

This paper is concerned with the optical domain generation of high-quality millimeter-wave signals for fiber-radio and other applications. The mode-locked millimeter-wave optical transmitter described is based on simple electrooptic microchip laser technology. The transmitter can be designed to operate from a few gigahertz to 100 GHz and beyond. The residual phase noise of the laser is below -100 dBc/Hz at 1-kHz offset, which makes it well suited for optically fed millimeter-wave wireless applications. A key feature of the transmitter is its simplicity, the very small number of elements it employs and the high level of integration of the millimeter-wave and photonic components that results in a small, rugged, and reliable package. The paper describes the design, fabrication, and experimental evaluation of the transmitter.

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Multiple-quantum-well asymmetric Fabry-Perot modulators for microwave photonic applications

R.I. Killey, C.P. Liu, M. Whitehead, P. Stavrinou, J.B. Song, J.S. Chadha, D. Wake, C.C. Button, G. Parry and A.J. Seeds. "Multiple-quantum-well asymmetric Fabry-Perot modulators for microwave photonic applications." 2001 Transactions on Microwave Theory and Techniques 49.10 (Oct. 2001, Part II [T-MTT] (Special Issue on Microwave and Millimeter-Wave Photonics)): 1888-1893.

We describe the development of InGaAsP multiquantum-well asymmetric Fabry-Perot modulators (AFPM) for RF-over-fiber applications. Advantages of the AFPM include low drive voltage and loss, high linearity and simple fiber alignment. Experimental results of initial devices, exhibiting 5.5-dB modulation depth and >3-GHz operation, are described. The effect of the optical power on the device performance was assessed, and the modulation bandwidth was found to be unaffected by incident optical powers up to 0 dBm. The linearity of the modulation characteristic was measured by carrying out two-tone intermodulation distortion tests, and a third-order intercept point of 30 dBm was observed.

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Photonics-based interference mitigation filters

R.A. Minasian, K.E. Alameh and E.H.W. Chan. "Photonics-based interference mitigation filters." 2001 Transactions on Microwave Theory and Techniques 49.10 (Oct. 2001, Part II [T-MTT] (Special Issue on Microwave and Millimeter-Wave Photonics)): 1894-1899.

New photonic filter structures for interference mitigation of microwave signals are presented. These fiber filters have a parallel topology, and comprise a grating based photonic bandpass filter, or a dual offset cavity structure based on a new noncommensurate delay-line approach. The new topologies overcome the problem of synthesizing both a narrow stopband and a very-wide and flat passband, to simultaneously excise interference with minimal impact on the wanted signal over a wide microwave range. Results demonstrate stopbands of around 1% of center frequency, wide-band flat transmission, and a shape factor of 10.5 that is the lowest reported for a photonic notch filter, in excellent agreement with predictions.

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Frequency response mechanisms for the GaAs MSM photodetector and electron detector

T.A. Yost, A. Madjar and P.R. Herczfeld. "Frequency response mechanisms for the GaAs MSM photodetector and electron detector." 2001 Transactions on Microwave Theory and Techniques 49.10 (Oct. 2001, Part II [T-MTT] (Special Issue on Microwave and Millimeter-Wave Photonics)): 1900-1907.

The GaAs metal-semiconductor-metal (MSM) device is a very useful planar and monolithic-microwave integrated-circuit compatible photodetector and electron-detector. As a photodetector, the MSM has been used for many applications in the past, however, in this paper we demonstrate its usefulness as an electron-beam detector as well. We present here a comprehensive analysis of the primary detection mechanism (electric field enhanced collection of generated electrons) as well as a newly identified secondary mechanism. This new mechanism is characterized by a high detection gain, but low speed. Experimental results are presented to verify the analysis, and possible applications are suggested by utilizing each one of the two detection mechanisms.

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Design of narrow-band photoreceivers by means of the photodiode intrinsic conductance

A. Leven, V. Hurm, R. Reuter and J. Rosenzweig. "Design of narrow-band photoreceivers by means of the photodiode intrinsic conductance." 2001 Transactions on Microwave Theory and Techniques 49.10 (Oct. 2001, Part II [T-MTT] (Special Issue on Microwave and Millimeter-Wave Photonics)): 1908-1913.

The photodiode intrinsic conductance is a versatile parameter for designing photoreceivers used in lightwave-microwave systems. A short review is given on how the transimpedance and equivalent input noise current of an optical receiver can be calculated. The design of monolithically integrated narrow-band photoreceivers for microwave-via-fiber applications at 10 GHz is demonstrated. The photoreceivers were fabricated using GaAs-based pseudomorphic high electron-mobility transistor monolithically integrated with metamorphic InGaAs photodiodes. For such a photoreceiver, a very low equivalent input noise current of 5.7 pA per square-root hertz and a high optoelectronic conversion gain of 64.1 dBV/W were measured in good agreement with simulations.

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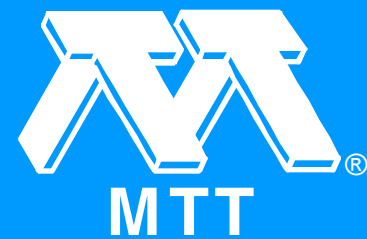
Velocity-matched distributed photodetectors and balanced photodetectors with p-i-n photodiodes

M.S. Islam, S. Murthy, T. Itoh, M.C. Wu, D. Novak, R.B. Waterhouse, D.L. Sivco and A.Y. Cho. "Velocity-matched distributed photodetectors and balanced photodetectors with p-i-n photodiodes." 2001 Transactions on Microwave Theory and Techniques 49.10 (Oct. 2001, Part II [T-MTT] (Special Issue on Microwave and Millimeter-Wave Photonics)): 1914-1920.

We report on the first demonstration of velocity-matched distributed photodetectors and balanced photodetectors with p-i-n photodiodes. Record-high linear dc photocurrent of 45 mA has been achieved without suffering from thermal damage, thanks to the superior power handling capability of p-i-n photodiodes. A novel fiber alignment technique has been developed to achieve high linear photocurrent. More than 37 dB of common-mode-rejection ratio and 45-dB suppression of laser relative intensity noise over a broad frequency range have been achieved using the distributed balanced photodetectors in an RF fiber-optic link. The frequency response is flat from 1 to 35 GHz.

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Ultrahigh-speed InP/InGaAs DHPTs for OEMMICs

H. Kamitsuna, Y. Matsuoka, S. Yamahata and N. Shigekawa. "Ultrahigh-speed InP/InGaAs DHPTs for OEMMICs." 2001 Transactions on Microwave Theory and Techniques 49.10 (Oct. 2001, Part II [T-MTT] (Special Issue on Microwave and Millimeter-Wave Photonics)): 1921-1925.

This paper presents an ultrahigh-speed InP/InGaAs double-heterostructure phototransistor (DHPT) with a record optical gain cutoff frequency of 82 GHz. This excellent performance originates from the double-heterostructure's compatibility with high-performance double-heterostructure bipolar transistor (DHBT) and a new self-aligned process. To demonstrate the excellent performance of the DHPT, two kinds of optoelectronic MMICs (OEMMICs) were designed and fabricated. One is a 40-GHz-band DHPT/DHBT photoreceiver that shows the DHPT's ability to be simultaneously integrated with a high-performance DHBT. The 40 GHz operation frequency is also the highest reported for monolithically integrated HPT/HBT photoreceivers. The other is a direct optical injection-locked oscillator that can extract an electrical clock signal from optical data streams. The OEMMICs are promising for compact and low-power-consumption optical receivers on an InP platform for millimeter-wave photonics and ultrahigh-speed optical communication systems.

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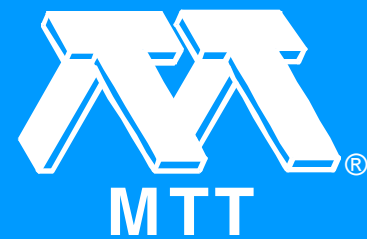
Optical heterodyne millimeter-wave generation using 1.55- μm traveling-wave photodetectors

A. Stohr, R. Heinzlmann, A. Malcoci and D. Jager. "Optical heterodyne millimeter-wave generation using 1.55- μm traveling-wave photodetectors." 2001 Transactions on Microwave Theory and Techniques 49.10 (Oct. 2001, Part II [T-MTT] (Special Issue on Microwave and Millimeter-Wave Photonics)): 1926-1933.

Optical heterodyne millimeter-wave generation using traveling-wave photodetectors (TW-PDs) is examined both experimentally and theoretically. Ultrahigh-frequency InP-based 1.55- μm TW-PDs were fabricated and employed in an experimental setup for optical heterodyning. For the first time, optical heterodyne millimeter-wave generation in excess of 160 GHz is experimentally demonstrated in the frequency domain. The maximum electrical power delivered by the TW-PD to a 50 Ω impedance is -11.5 dBm at 110 GHz with a polarization penalty of only 1.3 dB. Furthermore, a theoretical analysis in frequency domain is presented describing the frequency response of TW-PD including effects of the photogenerated carrier dynamics as well as optical and electrical wave propagation phenomena. A broadband and flat frequency response is found indicating a total rolloff of about 13.1 dB for a frequency span from 25 GHz to 200 GHz. Finally, the detectors responsivity is theoretically investigated to differentiate between the physical phenomena associated with high-frequency limitations.

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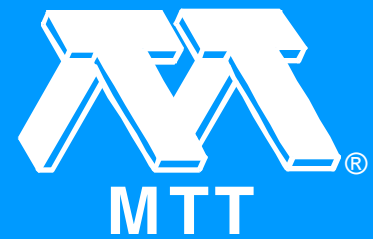
Subjects

Optoelectronic mixing, modulation, and injection locking in millimeter-wave self-oscillating InP/InGaAs heterojunction bipolar photo transistors-single and dual transistor configurations

J. Lasri, A. Bilenca, G. Eisenstein and D. Ritter. "Optoelectronic mixing, modulation, and injection locking in millimeter-wave self-oscillating InP/InGaAs heterojunction bipolar photo transistors-single and dual transistor configurations." 2001 Transactions on Microwave Theory and Techniques 49.10 (Oct. 2001, Part II [T-MTT] (Special Issue on Microwave and Millimeter-Wave Photonics)): 1934-1939.

We describe an experimental investigation of two millimeter-wave oscillators one employing a single and the other using two InGaAs/InP heterojunction bipolar photo-transistors (photo-HBTs). The single HBT oscillator can be optically injection locked to improve its spectral purity. Alternatively, it can be modulated by analog or digital data carried by an optical signal. In the two phototransistors case, one HBT oscillates and is optically injection locked while the second serves as a modulator. The two-transistor case proved to be superior in terms of carrier spectral purity, analog modulation efficiency and linearity as well as for digital modulation. Its advantages stem from the better isolation between the local oscillator and modulating signals and from the ability to separate the injection-locking and modulation functions.





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Enhanced analog transmission over fiber using sampled amplitude modulation

J.C. Chen. "Enhanced analog transmission over fiber using sampled amplitude modulation." 2001 Transactions on Microwave Theory and Techniques 49.10 (Oct. 2001, Part II [T-MTT] (Special Issue on Microwave and Millimeter-Wave Photonics)): 1940-1944.

A novel sampled modulation scheme is proposed, allowing the fiber transmission of broad-band analog signals. The deleterious effects of self phase modulation, dispersion and stimulated Brillouin scattering are all mitigated. Comparison with conventional amplitude modulation shows improvement.

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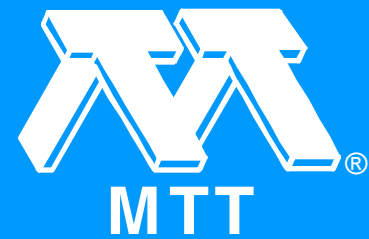
Sinusoidal drives for optical time demultiplexers

R.C. Williamson, J.L. Wasserman, G.E. Betts and J.C. Twichell. "Sinusoidal drives for optical time demultiplexers." 2001 Transactions on Microwave Theory and Techniques 49.10 (Oct. 2001, Part II [T-MTT] (Special Issue on Microwave and Millimeter-Wave Photonics)): 1945-1949.

Electrically driven arrays of optical switches can be used to time demultiplex a train of high-repetition-rate optical pulses into parallel lower speed circuits. These demultiplexers are used to advantage in high-speed communication systems and in photonic analog-to-digital converters. High-speed operation of an optical demultiplexer is simplified by the use of sinusoidal electrical drives, but suppression of crosstalk is difficult. Adequate suppression of crosstalk in these demultiplexers can be obtained through the use additional modulators. The key to our approach is the use of a combination of harmonically related sinusoidal signals applied to the additional modulators in order to select one out of every M pulses. Results with a 1: 4 demultiplexed photonic analog-to-digital converter operating at 208 MS/s demonstrate the efficacy of the technique.

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Dynamic range of optically amplified RF optical links

D.J.M. Sabido and L.G. Kazovsky. "Dynamic range of optically amplified RF optical links." 2001 Transactions on Microwave Theory and Techniques 49.10 (Oct. 2001, Part II [T-MTT] (Special Issue on Microwave and Millimeter-Wave Photonics)): 1950-1955.

We investigated, theoretically and experimentally, the effect of optical amplification on the dynamic range performance of both externally modulated direct detection and coherent RF optical links. Our results show that, for low to medium-loss links, a direct detection link with or without an optical amplifier, depending on the loss range, gives the best dynamic range. For high-loss links, the best link to use is a coherent link with the optical amplifier after the modulator. We also showed that the position of an amplifier is an important design parameter; it determines whether or not an optical amplifier improves the link's dynamic range.

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Experimental demonstration of a balanced electroabsorption modulated microwave photonic link

S. Mathai, F. Cappelluti, T. Jung, D. Novak, R.B. Waterhouse, D. Sivco, A.Y. Cho, G. Ghione and M.C. Wu. "Experimental demonstration of a balanced electroabsorption modulated microwave photonic link." 2001 Transactions on Microwave Theory and Techniques 49.10 (Oct. 2001, Part II [T-MTT] (Special Issue on Microwave and Millimeter-Wave Photonics)): 1956-1961.

A novel balanced electroabsorption modulated photonic link for simultaneous suppression of even-order distortions, third-order distortions, laser relative intensity noise (RIN), and common amplified spontaneous emission noise at the same modulator bias point was experimentally demonstrated for the first time. By biasing the balanced electroabsorption modulator at the third-order null, the third-order distortions were suppressed, while the balanced link architecture suppressed all even-order distortions and common mode noises. The fabricated balanced electroabsorption modulator (B-EAM) showed well-matched dc characteristics in terms of I-V and transfer curve. System experiments were performed to compare single-EAM and B-EAM links. In the B-EAM link, 2-dB suppression of laser RIN and 20-dB improvement in spurious free dynamic range over the single-EAM link were observed.

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Statistics of PMD-induced power fading for intensity-modulated double-sideband and single-sideband microwave and millimeter-wave signals

O.H. Adamczyk, A.B. Sahin, Qian Yu, Sanggeon Lee and A.E. Willner. "Statistics of PMD-induced power fading for intensity-modulated double-sideband and single-sideband microwave and millimeter-wave signals." 2001 Transactions on Microwave Theory and Techniques 49.10 (Oct. 2001, Part II [T-MTT] (Special Issue on Microwave and Millimeter-Wave Photonics)): 1962-1967.

Polarization-mode dispersion (PMD) can severely degrade the performance of millimeter-wave fiber-optic links by inducing a power fading penalty of the received signal that is dependent on the subcarrier frequency and accumulated PMD along the fiber. We experimentally investigate the statistics of PMD-induced power fading as a function of the differential group delay (DGD) for intensity-modulated double- and single-sideband subcarrier-multiplexed signals in the absence of chromatic dispersion. We find a similar susceptibility to PMD-induced power fading for both modulation formats with a subcarrier frequency of 7 GHz using a PMD emulator with a Maxwellian distribution of DGD (average DGD /spl sim/40 ps). A significant improvement in the worst case power fading penalty (/spl sim/20 dB) is achieved by using an electronically controlled polarization controller in combination with a single section of polarization maintaining fiber in a dynamic first-order PMD compensator. Furthermore, the results of numerical Monte Carlo simulations support the measured data and show the scalability of PMD-induced power fading for subcarrier-multiplexed signals in the microwave and millimeter-wave region.

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General expressions for IM/DD dispersive analog optical links with external modulation or optical up-conversion in a Mach-Zehnder electrooptical modulator

J.L. Corral, J. Marti and J.M. Fuster. "General expressions for IM/DD dispersive analog optical links with external modulation or optical up-conversion in a Mach-Zehnder electrooptical modulator." 2001 Transactions on Microwave Theory and Techniques 49.10 (Oct. 2001, Part II [T-MTT] (Special Issue on Microwave and Millimeter-Wave Photonics)): 1968-1976.

A general derivation of the optical modulation process in a dual-drive Mach-Zehnder modulator (DD-MZM) is introduced. The expressions include all harmonics and are entirely general in terms of bias point. Chromatic dispersion is also included allowing the prediction of a number of important phenomena in photonic signal transmission. Examples of special cases of these general equations are then presented. Similar expressions are introduced for harmonic optical up-conversion through a photonic mixer based on a DD-MZM covering any bias point or phase shift between DD-MZM drives.

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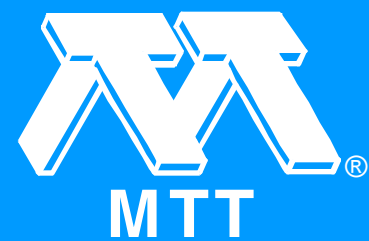
Millimeter-wave signal properties resulting from electrooptical upconversion

K. Kojucharow, M. Sauer and C. Schaffer. "Millimeter-wave signal properties resulting from electrooptical upconversion." 2001 Transactions on Microwave Theory and Techniques 49.10 (Oct. 2001, Part II [T-MTT] (Special Issue on Microwave and Millimeter-Wave Photonics)): 1977-1985.

This paper describes the combined effects of laser chirp, electrooptical mixing, dispersive fiber transmission, and photodetection on the nonlinear signal properties of the electrooptically generated millimeter-wave signal (60 GHz). Analytical expressions describing the complex currents of fundamental and higher order products are provided for the case of single-tone modulation as well as for two-tone modulation, respectively. Examples will be considered including the nonlinear amplitude response (output power at millimeter-wave range versus input power at IF), the nonlinear phase response (relative output phase at millimeter-wave range versus input power at IF), the input related 1-dB gain compression condition, the amplitude response of third- and fifth-order intermodulation products, as well as the input related intercept points for the latter signals. The model developed performed well, even under moderate to large signal conditions, and very good agreement has been achieved between theory and experiment.

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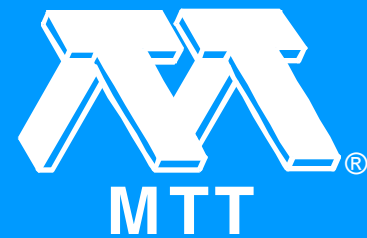
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A 60-GHz optoelectronic mixing scheme of high image and carrier rejection ratios with an integrated optical single-sideband modulator employed

Y. Ozeki, K. Higuma, S. Oikawa, M. Kishi and M. Tsuchiya. "A 60-GHz optoelectronic mixing scheme of high image and carrier rejection ratios with an integrated optical single-sideband modulator employed." 2001 Transactions on Microwave Theory and Techniques 49.10 (Oct. 2001, Part II [T-MTT] (Special Issue on Microwave and Millimeter-Wave Photonics)): 1986-1991.

We report on the first implementation and performance investigation of a 60-GHz-band optoelectronic image rejection mixing scheme based on a broad-band integrated optical single-sideband modulator. We have confirmed a few advantageous features over electrical image rejection mixers, arising from its nature of being free from electrical phase control of millimeter-wave signals. We obtained at the IF frequency of 800 MHz rejection ratios of >40 dB for the image signal and of >20 dB for the local oscillator (LO) signal in the LO frequency range of 55-65 GHz. The LO bandwidth can be extended further. The IF bandwidth with an image rejection ratio of >20 dB was also confirmed to be as broad as 550 MHz, which is limited not by the configuration but by the bandwidth of the 90/spl deg/ hybrid used in this experiment. Furthermore, fiber-optic transmission of a 155.52-Mb/s-DPSK 59.8-GHz optical millimeter-wave signal was successfully demonstrated for a 20-km standard single-mode fiber. A bit error rate of <10/sup -9/ was achieved at the received optical power of -18 dBm with a negligible dispersion penalty.





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An 8-18-GHz all-optical microwave downconverter with channelization

S.J. Strutz and K.J. Williams. "An 8-18-GHz all-optical microwave downconverter with channelization." 2001 Transactions on Microwave Theory and Techniques 49.10 (Oct. 2001, Part II [T-MTT] (Special Issue on Microwave and Millimeter-Wave Photonics)): 1992-1995.

A wide-band fiber-optic image-rejection downconverter capable of channelizing received signals into a 500-MHz intermediate frequency band is demonstrated. The downconverter utilizes phase modulators to convert received signals into optical side-bands prior to heterodyne detection with the system local oscillator. Experimental measurements performed on a two-channel system which maps 8-18-GHz signals into intermediate frequencies between 2 and 2.5 GHz reveal an image rejection of 20 dB and a spur-free dynamic range of 107 dB/Hz/sup 2/3/.

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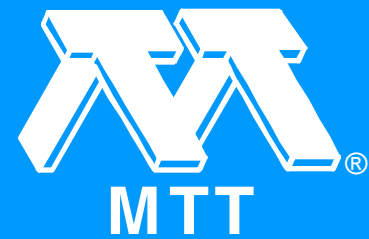
Characterization of a coherent optical RF channelizer based on a diffraction grating

Wenshen Wang, R.L. Davis, T.J. Jung, R. Lodenkamper, L.J. Lembo, J.C. Brock and M.C. Wu.
"Characterization of a coherent optical RF channelizer based on a diffraction grating." 2001
Transactions on Microwave Theory and Techniques 49.10 (Oct. 2001, Part II [T-MTT] (Special Issue on Microwave and Millimeter-Wave Photonics)): 1996-2001.

A coherent optical RF channelizer has been constructed and characterized. The optical channelizer is based on a free-space optical diffraction grating, and utilizes coherent optical heterodyne detection to translate all of the frequency channels to a common intermediate frequency (IF). The designed optical channelizer has a 1-GHz channel spacing, and a nominal 5-GHz IF and can offer an instantaneous bandwidth greater than 100 GHz. The channelizing receiver has been characterized for its frequency response, crosstalk, and spur-free dynamic range, and the results are in a good agreement with the theoretical values.

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A novel tunable microwave optical notch filter

Ningsi You and R.A. Minasian. "A novel tunable microwave optical notch filter." 2001 Transactions on Microwave Theory and Techniques 49.10 (Oct. 2001, Part II [T-MTT] (Special Issue on Microwave and Millimeter-Wave Photonics)): 2002-2005.

A new topology for a tunable microwave photonic notch filter, which achieves a wide and continuous tuning range of FSR/2, is presented. The novel principle of tuning is based on changing optical variable attenuators only; consequently, a fixed wavelength laser can be used as the optical source. Experimental filter tuning results demonstrate a wide fractional tuning range of 50%, continuous tuning capability, and a notch filter shape that does not change as it is tuned, in very good agreement with predictions.

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Wavelength reuse in the WDM optical interface of a millimeter-wave fiber-wireless antenna base station

A. Nirmalathas, D. Novak, C. Lim and R.B. Waterhouse. "Wavelength reuse in the WDM optical interface of a millimeter-wave fiber-wireless antenna base station." 2001 Transactions on Microwave Theory and Techniques 49.10 (Oct. 2001, Part II [T-MTT] (Special Issue on Microwave and Millimeter-Wave Photonics)): 2006-2012.

A novel technique for wavelength reuse has been proposed to simplify the upstream optical interface of an antenna base station in a millimeter-wave fiber-wireless system incorporating wavelength division multiplexing. This technique is based on recovering the optical carrier used in downstream signal transmission and reusing the same wavelength for upstream signal transmission. Two novel configurations for optical carrier recovery and wavelength reuse are proposed and demonstrated experimentally.

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Simultaneous modulation and fiber-optic transmission of 10-Gb/s baseband and 60-GHz-band radio signals on a single wavelength

T. Kamisaka, T. Kuri and K. Kitayama. "Simultaneous modulation and fiber-optic transmission of 10-Gb/s baseband and 60-GHz-band radio signals on a single wavelength." 2001 Transactions on Microwave Theory and Techniques 49.10 (Oct. 2001, Part II [T-MTT] (Special Issue on Microwave and Millimeter-Wave Photonics)): 2013-2017.

A simultaneous modulation and fiber-optic transmission of a 10-Gb/s baseband signal and a 60-GHz RF signal with 155-Mb/s differential-phase-shift-keying (DPSK) data on a single wavelength is investigated. To the authors' knowledge, it is experimentally demonstrated for the first time that both a 10-Gb/s on-off-keying baseband signal and a 60-GHz RF signal with 155-Mb/s DPSK data are simultaneously modulated with a single optical modulator and transmitted over 40-km-long dispersion-shifted fiber (DSF). There exists the received optical power capable of achieving a bit error rate of 10^{-9} simultaneously for both the RF and baseband signals. The degradations due to the nonlinearity of the electroabsorption modulator for the baseband and RF signals are also investigated theoretically and clarified numerically.

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Simultaneous baseband and RF optical modulation scheme for feeding wireless and wireline heterogeneous access networks

A. Martinez, V. Polo and J. Marti. "Simultaneous baseband and RF optical modulation scheme for feeding wireless and wireline heterogeneous access networks." 2001 Transactions on Microwave Theory and Techniques 49.10 (Oct. 2001, Part II [T-MTT] (Special Issue on Microwave and Millimeter-Wave Photonics)): 2018-2024.

In this paper, a novel modulation scheme that allows broad-band optical data transmission at both baseband and millimeter-wave RF carriers at twice the local-oscillator frequency is investigated. The dispersion-induced carrier suppression may be overcome by properly setting the optical transmitter parameters. Three different configurations for the modulation scheme are modeled and simulation and experimental results are provided. The key parameters of these configurations are optimized in order to achieve the best performance in broad-band heterogeneous millimeter-wave wireless and wireline access networks.

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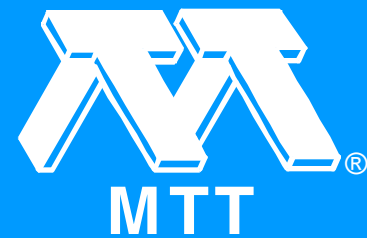
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Optical heterodyne detection of millimeter-wave-band radio-on-fiber signals with a remote dual-mode local light source

T. Kuri and K. Kitayama. "Optical heterodyne detection of millimeter-wave-band radio-on-fiber signals with a remote dual-mode local light source." 2001 Transactions on Microwave Theory and Techniques 49.10 (Oct. 2001, Part II [T-MTT] (Special Issue on Microwave and Millimeter-Wave Photonics)): 2025-2029.

A novel technique for optical heterodyne detection of a millimeter-wave radio-on-fiber signal using a remote dual-mode local light is proposed. Although a free-running dual-mode local light is used, the proposed technique is in principle free from laser phase noise. Since only two components of the optical signal are selected by the local light to demodulate themselves, this technique is also theoretically immune from the fiber-dispersion effect, even if the transmitted optical signal is in the double-sideband format. We derive the theoretical limit of the system performance and then experimentally demonstrate a 25-km-long fiber-optic transmission and the optical heterodyne detection of a 59.6-GHz radio-on-fiber signal with 155.52-Mb/s differential-phase-shift-keying formatted data.





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Optical crosstalk in fiber-radio WDM networks

D. Castleford, A. Nirmalathas, D. Novak and R.S. Tucker. "Optical crosstalk in fiber-radio WDM networks." 2001 Transactions on Microwave Theory and Techniques 49.10 (Oct. 2001, Part II [T-MTT] (Special Issue on Microwave and Millimeter-Wave Photonics)): 2030-2035.

This paper investigates the impact of optical crosstalk in fiber-radio systems incorporating wavelength division multiplexing, (WDM). We present a simple analytical model that allows the impact of optical crosstalk in such networks to be assessed and validate the results via experiment for both in-band and out-of-band optical crosstalk. We show that crosstalk-induced power penalties in fiber-radio WDM networks are reduced compared to baseband modulation for the case of in-band crosstalk. In addition, in contrast to baseband modulated optical links, the crosstalk channel in fiber-radio systems can be filtered electrically if the crosstalk signal carries a different wireless frequency. However, a power penalty is still observed for the case of in-band crosstalk, even for perfect electrical filtering of the crosstalk channel.

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Optical subcarrier multiplexing transmission for base station with adaptive array antenna

I. Seto, H. Shoki and S. Ohshima. "Optical subcarrier multiplexing transmission for base station with adaptive array antenna." 2001 Transactions on Microwave Theory and Techniques 49.10 (Oct. 2001, Part II [T-MTT] (Special Issue on Microwave and Millimeter-Wave Photonics)): 2036-2041.

We propose utilizing a radio-over-fiber technique of optical subcarrier-multiplexing transmission for radio base stations (BSs) with adaptive array antennas. The proposed system can be constructed at low cost since only one optical transmitter and receiver is required for a center station and a BS. Moreover, relative phases among antenna branches are insensitive to equivalent length fluctuation of an optical fiber.

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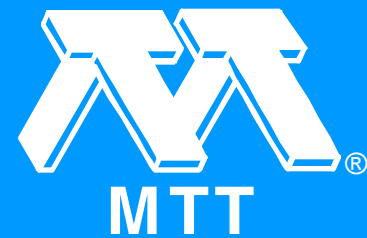
Maximizing spectral utilization in WDM systems by microwave domain filtering of tandem single sidebands

A. Narasimha, Xuejun Meng, C.F. Lam, M.C. Wu and E. Yablonovitch. "Maximizing spectral utilization in WDM systems by microwave domain filtering of tandem single sidebands." 2001 Transactions on Microwave Theory and Techniques 49.10 (Oct. 2001, Part II [T-MTT] (Special Issue on Microwave and Millimeter-Wave Photonics)): 2042-2047.

We present an optical tandem single-sideband receiver that enables the detection of signals having different information in the two sidebands of the same optical carrier. The technique relies on the use of a dual-electrode Mach-Zehnder modulator and achieves heterodyne detection without the use of an optical local oscillator. Sharp filtering requirements are met in the electrical domain, eliminating the need for wasteful guardbands.

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Rapidly tunable millimeter-wave optical transmitter for lidar-radar

Yifei Li, A.J.C. Vieira, S.M. Goldwasser and P.R. Herczfeld. "Rapidly tunable millimeter-wave optical transmitter for lidar-radar." 2001 Transactions on Microwave Theory and Techniques 49.10 (Oct. 2001, Part II [T-MTT] (Special Issue on Microwave and Millimeter-Wave Photonics)): 2048-2054.

This paper reports on the optical generation of a rapidly tunable millimeter-wave subcarrier for lidar-radar. The millimeter-wave signal is generated by beating the output from two Nd:YVO/sub 4//MgO:LiNbO/sub 3/ electrooptical monomode microchip laser sections realized monolithically in a single composite crystal. The device has a continuous tuning range up to 45 GHz. The measured chirp rate is 3816 THz/s, the voltage sensitivity is 10.6 MHz/V, and the measured residual phase noise is -106 dBc/Hz at 10-kHz offset.

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Two-dimensional optical signal-processing beamformer using multilayer polymeric optical waveguide arrays

T. Akiyama, K. Inagaki, T. Ohira and M. Hikita. "Two-dimensional optical signal-processing beamformer using multilayer polymeric optical waveguide arrays." 2001 Transactions on Microwave Theory and Techniques 49.10 (Oct. 2001, Part II [T-MTT] (Special Issue on Microwave and Millimeter-Wave Photonics)): 2055-2061.

Optically controlled beamforming techniques are very effective for phased-array antenna control. We have developed a two-dimensional (2-D) Fourier transform optical signal-processing (OSP) beamformer. In the OSP beamformer, we use multilayer polymeric optical waveguide arrays to generate and control a 2-D specific phase-front and sample 2-D distributed light beams. These multilayer optical waveguide arrays consist of three layers and 13 waveguides; each layer has four, five, and four waveguides, respectively. We experimentally demonstrate 2-D beam steering in the X-band, and show the feasibility of the 2-D OSP beamformer.

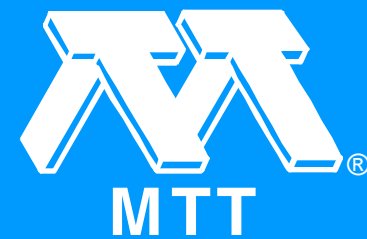
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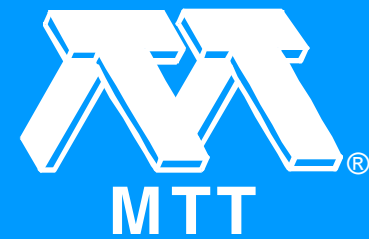
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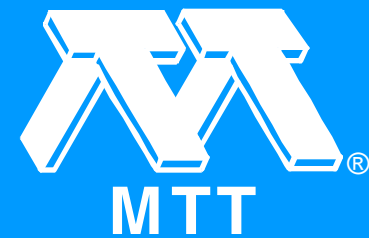
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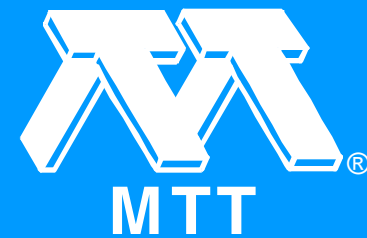
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Abstracts

Guest Editorial (Nov. 2001 [T-MTT])

A. Parfitt. "Guest Editorial (Nov. 2001 [T-MTT])." 2001 Transactions on Microwave Theory and Techniques 49.11 (Nov. 2001 [T-MTT] (Special Issue on the 2000 Asia-Pacific Microwave Conference)): 2065-2065.



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K-band and millimeter-wave MMICs for emerging commercial wireless applications

T. Tokumitsu. "K-band and millimeter-wave MMICs for emerging commercial wireless applications." 2001 Transactions on Microwave Theory and Techniques 49.11 (Nov. 2001 [T-MTT] (Special Issue on the 2000 Asia-Pacific Microwave Conference)): 2066-2072.

The recent K-band monolithic-microwave integrated-circuit (MMIC) technologies for the local multipoint distribution service systems and novel MMIC technologies for potential low-cost millimeter-wave MMICs are presented in this paper via a review of Fujitsu Quantum Devices Limited technology. The devices being demonstrated are a 23-26-GHz 2-W power amplifier module with a broad-band driver amplifier, a 19-33-GHz miniature low-noise amplifier, a frequency multiplier by four for K-band local oscillators, a flip-chip MMIC module for radar application, and three-dimensional MMIC image-rejection harmonic mixers. Through these devices, the recent trend of design and fabrication methodologies for the K-band and millimeter-wave devices will be described.

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MMIC development for millimeter-wave space application

T. Takagi, K. Yamauchi, Y. Itoh, S. Urasaki, M. Komaru, Y. Mitsui, H. Nakaguro and Y. Kazekami. "MMIC development for millimeter-wave space application." 2001 Transactions on Microwave Theory and Techniques 49.11 (Nov. 2001 [T-MTT] (Special Issue on the 2000 Asia-Pacific Microwave Conference)): 2073-2079.

The latest millimeter-wave monolithic-microwave integrated-circuit (MMIC) developments and technologies at the Mitsubishi Electric Corporation, Kanagawa, Japan, concerning high power amplifiers, low-noise amplifiers and phase shifters have been summarized. It has been shown that high-efficiency, low-noise, and low-loss performance for millimeter-wave space applications can be achieved by employing pseudomorphic high electron-mobility transistor (p-HEMT) MMIC technology. The investigation for gamma-ray irradiation hardness has cleared that millimeter wave p-HEMT MMICs have over a 100 years of life against gamma-ray irradiation in the space environment.





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Ultra-low-noise indium-phosphide MMIC amplifiers for 85-115 GHz

J.W. Archer, R. Lai and R. Gough. "Ultra-low-noise indium-phosphide MMIC amplifiers for 85-115 GHz." 2001 Transactions on Microwave Theory and Techniques 49.11 (Nov. 2001 [T-MTT] (Special Issue on the 2000 Asia-Pacific Microwave Conference)): 2080-2085.

This paper describes a high-performance indium-phosphide monolithic microwave integrated circuit (MMIC) amplifier, which has been developed for cooled application in ultra-low-noise imaging-array receivers. At 300 K, the four-stage amplifier exhibits more than 15-dB gain and better than 10-dB input and output return loss from 80 to 110 GHz. The room-temperature noise figure is typically 3.2 dB, measured between 90-98 GHz. When cooled to 15 K, the gain increases to more than 18 dB and the noise figure decreases to 0.5 dB. Only one design pass was required to obtain very good agreement between the predicted and measured characteristics of the circuit. The overall amplifier performance is comparable to the best ever reported for MMIC amplifiers in this frequency band.

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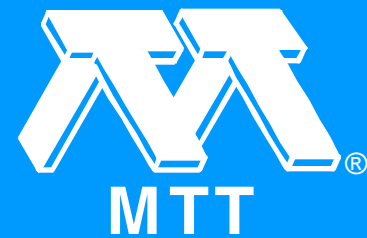


Abstracts

Analog MMICs for millimeter-wave applications based on a commercial 0.14- μm pHEMT technology

H. Zirath, C. Fager, M. Garcia, P. Sakalas, L. Landen and A. Alping. "Analog MMICs for millimeter-wave applications based on a commercial 0.14- μm pHEMT technology." 2001 Transactions on Microwave Theory and Techniques 49.11 (Nov. 2001 [T-MTT] (Special Issue on the 2000 Asia-Pacific Microwave Conference)): 2086-2092.

This paper describes recent results obtained from the monolithic-microwave integrated-circuit design activity at Chalmers University, Goteborg, Sweden. The goal is to design all circuits needed for the front end of a 60-GHz wireless local area network and to build various system demonstrators. Some recent experimental results from this activity like different 60-GHz amplifiers, a general-purpose IF amplifier, a 60-GHz resistive mixer, and frequency multipliers are reported in this paper. Parameters such as the gain, conversion loss, noise figure, dc-power dissipation, as well as the model used in the simulations are reported and discussed.



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Self-assembling MEMS variable and fixed RF inductors

V.M. Lubecke, B. Barber, E. Chan, D. Lopez, M.E. Gross and P. Gammel. "Self-assembling MEMS variable and fixed RF inductors." 2001 Transactions on Microwave Theory and Techniques 49.11 (Nov. 2001 [T-MTT] (Special Issue on the 2000 Asia-Pacific Microwave Conference)): 2093-2098.

Inductors play a key role in wireless front-end circuitry, yet are not generally well suited for conventional RF integrated-circuit (RFIC) fabrication processes. We have developed inductors that can be fabricated on a conventional RFIC silicon substrate, which use warping members to assemble themselves away from the substrate to improve quality factor (Q) and self-resonance frequency (SRF), and to provide a degree of variation in inductance value. These self-assembling variable inductors are realized through foundry provided microelectromechanical systems (MEMS) processing and have demonstrated temperature stable Q values greater than 13, SRF values well above 15 GHz, and inductance variations greater than 18%. Simulations suggest the potential for Q values above 20 and inductance variations greater than 30%, with optimized processing.

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Packaging using microelectromechanical technologies and planar components

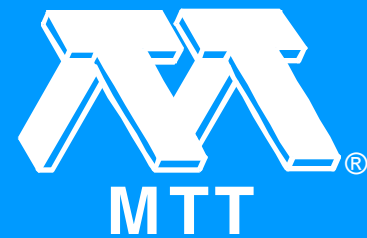
K. Takahashi, U. Sangawa, S. Fujita, M. Matsuo, T. Urabe, H. Ogura and H. Yabuki.

"Packaging using microelectromechanical technologies and planar components." 2001 Transactions on Microwave Theory and Techniques 49.11 (Nov. 2001 [T-MTT] (Special Issue on the 2000 Asia-Pacific Microwave Conference)): 2099-2104.

A novel millimeter-wave packaging structure was developed in which a micromachined low-loss planar component and flip-chip devices were integrated on a silicon substrate. A low-loss planar filter was achieved on a 7-mm-square silicon substrate employing an inverted microstrip line and a unique resonator. High attenuation in the stopband was also obtained by introducing a pole control technique. Fabrication of a compact K-band receiver front-end incorporating a built-in filter was realized using multilayered benzocyclobutene (BCB) and flip-chip bonding techniques. Furthermore, we propose an alternative BCB suspended structure and demonstrate a planar antenna for Ka-band applications. These technologies bring to reality high-performance compact packaged systems in millimeter-wave region applications.

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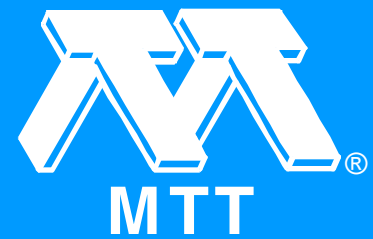
Measurement and characterization of HEMT dynamics

A.E. Parker and J.G. Rathmell. "Measurement and characterization of HEMT dynamics." 2001 Transactions on Microwave Theory and Techniques 49.11 (Nov. 2001 [T-MTT] (Special Issue on the 2000 Asia-Pacific Microwave Conference)): 2105-2111.

The variation of high electron-mobility transistor (HEMT) large-signal behavior with a change in operating condition is examined with a view to understanding the dynamics involved and developing a modeling strategy. The observed variation exhibits the dynamics of thermal, impact ionization, and trapping effects. A novel measurement of drain characteristic transients gives time-evolution information that clearly shows these as separate quantifiable phenomena with significant dependence on initial operating conditions. A drain-current model that describes high-frequency characteristics with pinchoff, gain, and drain feedback parameters is adapted to describe the variation of the characteristics with changing operating conditions. The results reported give insight and grounding for simulation of HEMT circuits.

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Size-reduction techniques for CPW and ACPS structures

K. Hettak, T. Laneve and M.G. Stubbs. "Size-reduction techniques for CPW and ACPS structures." 2001 Transactions on Microwave Theory and Techniques 49.11 (Nov. 2001 [T-MTT] (Special Issue on the 2000 Asia-Pacific Microwave Conference)): 2112-2116.

In coplanar-waveguide technology, there is a possibility of locating shunt and series matching stubs inside the center conductor of the transmission line. This principle can be used to reduce of the dimensions of microwave components such as monolithic microwave integrated circuits. This paper discusses the concept and presents the design of a reduced-size Wilkinson divider based on the realization of short-circuit series stubs in the signal conductor of an asymmetric coplanar stripline.

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Do we really need ferroelectrics in paraelectric phase only in electrically controlled microwave devices?

S.S. Gevorgian and E.L. Kollberg. "Do we really need ferroelectrics in paraelectric phase only in electrically controlled microwave devices?." 2001 Transactions on Microwave Theory and Techniques 49.11 (Nov. 2001 [T-MTT] (Special Issue on the 2000 Asia-Pacific Microwave Conference)): 2117-2124.

Typical paraelectric materials (e.g., SrTiO_3 , KTaO_3 , $\text{Ba}_{1-x}\text{Sr}_x\text{TiO}_3$, $x < 0.5$) and electrically tunable microwave devices based on these materials are briefly reviewed. The analysis shows that in spite of the recent year's extensive efforts, no considerable improvement in the microwave losses in thin paraelectric films has been achieved. Thin films, regardless of fabrication method and substrate type, have much lower dielectric permittivity than bulk single crystals, and the loss tangent at microwave frequencies ($f > 10$ GHz) is of the order of 0.01 (at zero dc-bias field) at room temperature. Nevertheless, quite promising component and subsystem level devices are successfully demonstrated. Use of ceramic (bulk and thick film) ferroelectrics in tunable microwave devices, currently considered for industrial applications, offer cost reduction. In this paper, explicitly for the first time, we consider possibilities and benefits of using ferroelectrics in polar phase in electrically controllable microwave devices. Examples of using ferroelectrics in polar state (e.g., $\text{Na}_0.5\text{K}_0.5\text{NbO}_3$, SrTiO_3 in antiferroelectric phase) in electrically tunable devices are reported.





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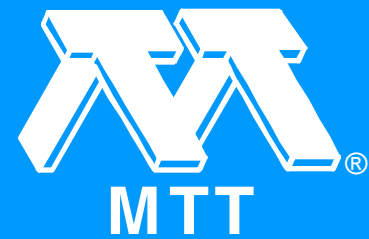
Automated computer-controlled tuning of waveguide filters using adaptive network models

P. Harscher and R. Vahldieck. "Automated computer-controlled tuning of waveguide filters using adaptive network models." 2001 Transactions on Microwave Theory and Techniques 49.11 (Nov. 2001 [T-MTT] (Special Issue on the 2000 Asia-Pacific Microwave Conference)): 2125-2130.

This paper describes a method for computer-controlled tuning of waveguide filters. The tuning algorithm is based on approximate filter network models, which take into account the effects of input/output coupling. Based on measurements of an initial filter design, the approximate network model is then corrected by optimizing the element values such that they minimize the mean square error between the measured and simulated response. The sensitivities of the tuning screws are determined directly from the sensitivities of the element values. Filter tuning is accomplished by gradient optimization of the corrected computer model rather than its physical realization. Only as a final step are the tuning screws of the physical model turned to the position determined by the optimization process.

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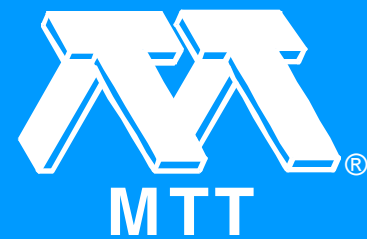
Maximizing signal strength for OFDM inside buildings

E.P. Lawrey and C.J. Kikkert. "Maximizing signal strength for OFDM inside buildings." 2001 Transactions on Microwave Theory and Techniques 49.11 (Nov. 2001 [T-MTT] (Special Issue on the 2000 Asia-Pacific Microwave Conference)): 2131-2136.

Propagation inside buildings suffer from large shadowing and high multipath effects. This is a serious problem for wireless local area network (WLAN) systems. This paper shows that shadowing and path loss can be minimized by exploiting the multipath tolerance of orthogonal frequency-division multiplexing (OFDM). This can be achieved by using multiple transmission antennas spread over the area of a WLAN cell. These antennas act as repeaters, transmitting and receiving the same signal at the same time. This decreases the average path loss, but increases the multipath delay spread. Using OFDM allows the advantage of reduced path loss to be utilized without detrimental effects of inter-symbol interference caused by the increased delay spread. The reduced path loss allows an increased system capacity, quality of service, or a decrease in intercellular interference in a cellular WLAN.

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Constant flux illumination of square cells for millimeter-wave wireless communications

C.A. Fernandes and L.M. Anunciada. "Constant flux illumination of square cells for millimeter-wave wireless communications." 2001 Transactions on Microwave Theory and Techniques 49.11 (Nov. 2001 [T-MTT] (Special Issue on the 2000 Asia-Pacific Microwave Conference)): 2137-2141.

The use of highly shaped-beam base-station antennas in millimeter-wave wireless communication systems may contribute to significantly enhance system performance. Previously proposed axial symmetric dielectric lenses provide a most useful constant-flux circular footprint, but they may fail to cover the regions near the vertices of square or rectangular cells, unless excessive wall illumination is allowed. This paper presents a simplified procedure to design shaped three-dimensional dielectric lenses that produce constant-flux illumination with square or rectangular footprints, suitable for indoor cells. The procedure is based on circular symmetric dielectric-lens design formulation, yet very sharp rectangular-cell boundary is obtained. Calculated and measured antenna performance is presented, not only in terms of radiation pattern, but also in terms of coverage and time-dispersion characteristic. The procedure is demonstrated for a square-cell lens and is extended for the rectangular-cell case.

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Performance analysis of smart antenna test-bed operating in a wide-band CDMA channel

Heung-Jae Im and Seungwon Choi. "Performance analysis of smart antenna test-bed operating in a wide-band CDMA channel." 2001 Transactions on Microwave Theory and Techniques 49.11 (Nov. 2001 [T-MTT] (Special Issue on the 2000 Asia-Pacific Microwave Conference)): 2142-2146.

In this paper, we present a performance analysis of a smart antenna system operating in a wide-band CDMA wireless-local-loop channel using a beam-forming module (BFM) that has been implemented on a digital signal processor (TMS320C6701) board. We first show the results of computer simulations obtained from the modeled received (RX) signals through a test-bed system consisting solely of baseband signal processing parts, i.e., modeled RX data-generating PC, BFM for computing the optimal weight vector and interfacing module. A test-bed system of the entire base station is then implemented to evaluate the adaptive beam-forming function with the actual wireless signals. This test-bed system includes several subscribers, as well as the array antenna, RF modules, and other receiving parts required at the cell site.

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An iterative FEM for scattering by a 3-D cavity-backed aperture

Jongkuk Park, Jungwon Lee, Heeduck Chae and Sangwook Nam. "An iterative FEM for scattering by a 3-D cavity-backed aperture." 2001 Transactions on Microwave Theory and Techniques 49.11 (Nov. 2001 [T-MTT] (Special Issue on the 2000 Asia-Pacific Microwave Conference)): 2147-2151.

A finite-element method (FEM)-based hybrid method (or iterative FEM) is successfully applied to a three-dimensional (3-D) scattering problem without the effect of internal resonance. With only a small number of meshes around a 3-D scatterer, this FEM is shown to give an accurate result through several iterative updates of the boundary conditions. To confirm the efficiency of this method, scattering from a 3-D cavity-backed aperture is analyzed and the results obtained are compared with the same obtained by another conventional method.



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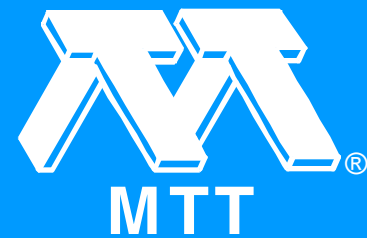
Modal analysis of waveguide antennas with arbitrary cross sections

R. Kuhne and J. Marquardt. "Modal analysis of waveguide antennas with arbitrary cross sections." 2001 Transactions on Microwave Theory and Techniques 49.11 (Nov. 2001 [T-MTT] (Special Issue on the 2000 Asia-Pacific Microwave Conference)): 2152-2156.

An approach is given to analyze the modal coupling of open-ended waveguides with arbitrary cross sections located in a conducting screen. The presented theory enables the determination of reflection characteristics of a single waveguide, as well as the analysis of mutual coupling between elements in waveguide antenna arrays. The field inside each waveguide is expressed as a sum of the transverse-electric and transverse-magnetic modes and expressions for the mutual admittances of modes excited at the aperture are obtained using a direct integration method. From these expressions, the mode reflection and conversion coefficients are determined. Computed and measured results are presented. Furthermore, this approach has been used to design a new type of horn antenna with high return loss and equal radiation patterns in the two principle planes.

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Design and characterization of a 120-GHz millimeter-wave antenna for integrated photonic transmitters

A. Hirata, H. Ishii and T. Nagatsuma. "Design and characterization of a 120-GHz millimeter-wave antenna for integrated photonic transmitters." 2001 Transactions on Microwave Theory and Techniques 49.11 (Nov. 2001 [T-MTT] (Special Issue on the 2000 Asia-Pacific Microwave Conference)): 2157-2162.

We developed a planar slot antenna on an Si substrate for a photonic >100-GHz millimeter-wave (MMW) transmitter. We designed the antenna by using three-dimensional electromagnetic-field simulators and characterized its performance by using an optoelectronic network analyzer. The transmitter uses a very fast photodiode with high output power. Using these photonic techniques, we succeeded in building this compact photonic transmitter that emits MMWs with a power of >0.2 mW at a frequency of 120 GHz.

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Synergistic design of DSP and power amplifiers for wireless communications

P.M. Asbeck, L.E. Larson and I.G. Galton. "Synergistic design of DSP and power amplifiers for wireless communications." 2001 Transactions on Microwave Theory and Techniques 49.11 (Nov. 2001 [T-MTT] (Special Issue on the 2000 Asia-Pacific Microwave Conference)): 2163-2169.

Co-design of digital signal-processing (DSP) algorithms and power-amplifier characteristics can lead to improved efficiency and linearity through a variety of strategies including: predistortion, DSP control over bias conditions, particularly the power supply voltage, and DSP generation of digital input signals for switching amplifiers. This paper discusses several amplifier architectures that exemplify these approaches, including: bias-controlled amplifiers, linear amplification with nonlinear component amplifiers, and class-S amplifiers. We envision for the future a generation of "smart power amplifiers," in which DSP optimization of amplifier parameters is carried out for changing environments.

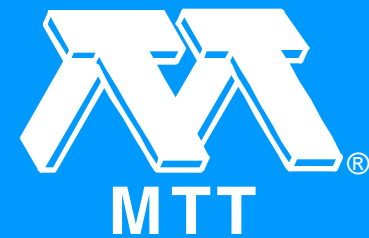
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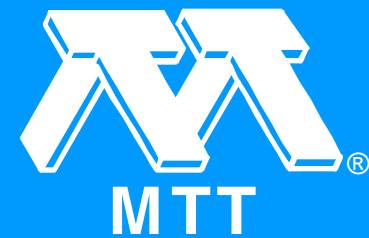
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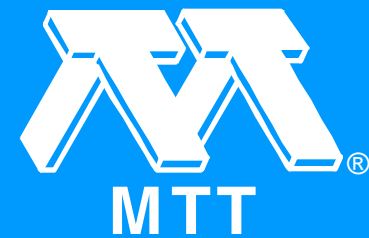
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Inside Cover (Dec. 2001 [T-MTT])

"Inside Cover (Dec. 2001 [T-MTT])." 2001 Transactions on Microwave Theory and Techniques 49.12 (Dec. 2001 [T-MTT] (Special Issue on 2001 International Microwave Symposium)): 0_4-0_5.



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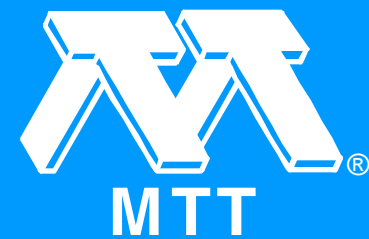
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Editors' Overview (Dec. 2001 [T-MTT])

M. Dydyk, C.A. Balanis, G.L. Heiter and R.D. Pollard. "Editors' Overview (Dec. 2001 [T-MTT])." 2001 Transactions on Microwave Theory and Techniques 49.12 (Dec. 2001 [T-MTT] (Special Issue on 2001 International Microwave Symposium)): 2176-2179.



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IMS2001 - The microwave odyssey accomplished (Dec. 2001 [T-MTT])

*S.M. El-Ghazaly. "IMS2001 - The microwave odyssey accomplished (Dec. 2001 [T-MTT])."
2001 Transactions on Microwave Theory and Techniques 49.12 (Dec. 2001 [T-MTT] (Special
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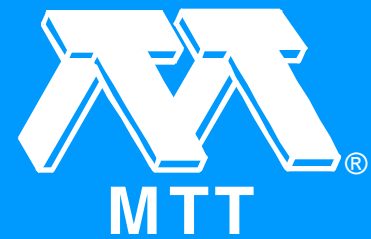
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The 2001 IMS technical program (Dec. 2001 [T-MTT])

V.K. Nair and C.E. Weitzel. "The 2001 IMS technical program (Dec. 2001 [T-MTT])." 2001 Transactions on Microwave Theory and Techniques 49.12 (Dec. 2001 [T-MTT] (Special Issue on 2001 International Microwave Symposium)): 2184-2187.



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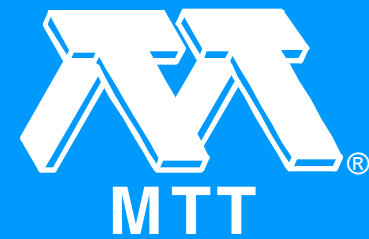
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2001 MTT-S awards (Dec. 2001 [T-MTT])

P.W. Staecker. "2001 MTT-S awards (Dec. 2001 [T-MTT])." 2001 Transactions on Microwave Theory and Techniques 49.12 (Dec. 2001 [T-MTT] (Special Issue on 2001 International Microwave Symposium)): 2188-2196.



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Low-frequency dispersion features of a new complex mode for a periodic strip grating on a grounded dielectric slab (Dec. 2001 [T-MTT])

P. Burghignoli, P. Baccarelli, F. Frezza, A. Galli, P. Lampariello and A.A. Oliner. "Low-frequency dispersion features of a new complex mode for a periodic strip grating on a grounded dielectric slab (Dec. 2001 [T-MTT])." 2001 Transactions on Microwave Theory and Techniques 49.12 (Dec. 2001 [T-MTT] (Special Issue on 2001 International Microwave Symposium)): 2197-2205.

In this paper, novel behavioral features are found for the propagation and radiation of a class of periodic structures often employed in various microwave passive devices and antennas, i.e. a periodic metallic strip grating placed on a grounded dielectric slab. At low frequencies, the dispersion features of the fundamental TE mode are completely different when the grating structure is almost closed, as compared to when it is almost open, that is, when the ratio of the strip width (s) to the grating period (p) is close to unity or close to zero. As is discussed here, this difference led to initially puzzling behavior as the ratio s/p was varied, and the behavior became clear only after a new improper complex (leaky) modal solution was discovered. This paper presents the results of a systematic parametric study of the dispersion features of the new mode in relation to the occurrence of leaky and bound regimes of the fundamental TE mode and also yields information on what ranges of the physical parameters can provide values of phase and leakage (attenuation) constants suitable for a class of practical leaky-wave antennas.

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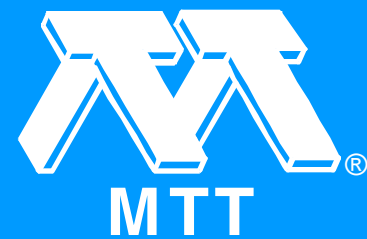
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High-frequency leaky-mode excitation on a microstrip line

F. Mesa, D.R. Jackson and M.J. Freire. "High-frequency leaky-mode excitation on a microstrip line." 2001 Transactions on Microwave Theory and Techniques 49.12 (Dec. 2001 [T-MTT] (Special Issue on 2001 International Microwave Symposium)): 2206-2215.

The excitation of leaky modes (LMs) and the continuous spectrum (CS) on a microstrip line at high frequencies from a delta-gap source is studied. The delta-gap source models a practical source or discontinuity on the line. It is shown that the current excited from the source exhibits spurious effects at high frequencies due to the excitation of the CS (radiation spectrum), which may or may not be dominated by a physical LM, depending on the frequency range and the substrate permittivity. In some cases, the spurious effects are due to a physical LM, while in other cases the effects are due to the excitation of one or more "residual-wave" (RW) currents, which have not been previously studied for open microstrip lines. There are two types of RW currents: a free-space type and a surface-wave type. Depending on the frequency and the structural parameters, either of these may be the more dominant. At certain frequencies, weakly attenuated high-order LMs may also be excited, in which case spurious effects are observed out to large distances from the source.





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Spurious radiation from a practical source on a covered microstrip line

W.L. Langston, J.T. Williams, D.R. Jackson and F. Mesa. "Spurious radiation from a practical source on a covered microstrip line." 2001 Transactions on Microwave Theory and Techniques 49.12 (Dec. 2001 [T-MTT] (Special Issue on 2001 International Microwave Symposium)): 2216-2226.

The TM/sub 0/ parallel-plate mode field that is radiated from the currents induced on a covered microstrip transmission line by a finite-gap voltage source is studied. The behavior of the total radiation field (the field radiated by the total strip current) is investigated, along with the field radiated by the constituent current components that make up the total current, namely the bound-mode (BM) and continuous-spectrum currents. The continuous-spectrum current is further resolved into the sum of a physical leaky-mode current and a residual-wave current, and the fields radiated by each of these separate components are examined. It is determined that leaky-mode fields can contribute to crosstalk and other interference effects near the source and within an angular leakage region, while the radiation field from the BM current is the predominant mechanism for these effects further away from the gap source, outside the leakage region. The field radiated from the residual-wave current can be quite strong in the "spectral-gap region," which is the frequency region where the leaky mode is nonphysical, and therefore the leaky mode does not contribute directly to the spectrum of current on the strip in the decomposition used here.





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MoM/BI-RME analysis of boxed MMICs with arbitrarily shaped metallizations

M. Bozzi, L. Perregrini, A. Alvarez Melcon, M. Guglielmi and G. Conciauro. "MoM/BI-RME analysis of boxed MMICs with arbitrarily shaped metallizations." 2001 Transactions on Microwave Theory and Techniques 49.12 (Dec. 2001 [T-MTT] (Special Issue on 2001 International Microwave Symposium)): 2227-2234.

In this paper, we propose a novel approach for the analysis of shielded microstrip circuits, composed of a number of thin metallic areas with arbitrary shapes and finite conductivity, embedded in a multilayered lossy medium. The analysis is based on the solution of an integral equation (IE) obtained by enforcing the proper boundary condition to the electric field on the metallic areas. The IE is solved by using the method of moments with entire domain basis functions, which are numerically determined by the boundary integral-resonant-mode expansion (BI-RME) method. The use of the BI-RME method allows for the efficient calculation of the basis functions independently on the shape of the domain, thus permitting the analysis of a wide class of circuits. Two examples demonstrate the accuracy, rapidity, and flexibility of the proposed method.

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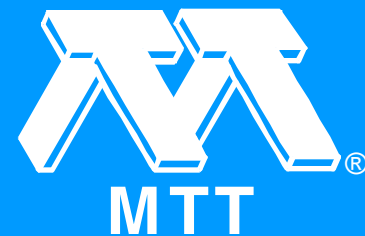


Abstracts

A 3-D integral equation-based approach to the analysis of real-life MMICs application to microelectromechanical systems

M. Farina and T. Rozzi. "A 3-D integral equation-based approach to the analysis of real-life MMICs application to microelectromechanical systems." 2001 Transactions on Microwave Theory and Techniques 49.12 (Dec. 2001 [T-MTT] (Special Issue on 2001 International Microwave Symposium)): 2235-2240.

In this paper, we introduce a three-dimensional method-of-moments approach, suitable for the analysis of real-life monolithic circuits for microwave/millimeter waves. It shares the flexibility and the efficiency of the currently available spectral-domain commercial simulators, while allowing all metallizations to have finite thickness and finite conductivity and the ability to handle dielectric discontinuities. The method is successfully applied to several structures, like metal-insulator-metal capacitor, spiral inductors, and microelectromechanical capacitive switches in the 1-50-GHz frequency range.



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Envelope-finite-element (EVFE) technique - a more efficient time-domain scheme

Yuanxun Wang and Tatsuo Itoh. "Envelope-finite-element (EVFE) technique - a more efficient time-domain scheme." *2001 Transactions on Microwave Theory and Techniques* 49.12 (Dec. 2001 [T-MTT] (Special Issue on 2001 International Microwave Symposium)): 2241-2247.

A novel technique, called the envelope-finite element (EVFE) method, is proposed as a more efficient full-wave time-domain modeling scheme of electromagnetic waves. The EVFE method simulates the signal envelope rather than the original signal waveform by de-embedding the signal carrier from the time-domain wave equation. The de-embedded equation is then solved in the time domain using finite-element methods based on Newmark-Beta time stepping. Compared to traditional time-domain simulation techniques such as finite difference time-domain or finite element time-domain methods, only the signal envelope needs to be sampled in EVFE simulation. This method can reduce computation time when signal envelope/carrier ratios are very small. The purpose of this paper is to introduce this new concept, by presenting the two-dimensional EVFE formulations, stability conditions, and some supporting numerical examples.



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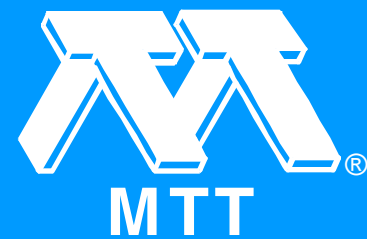
Fundamental gridding-related dispersion effects in multiresolution time-domain schemes (Dec. 2001 [T-MTT])

C.D. Sarris and L.P.B. Katehi. "Fundamental gridding-related dispersion effects in multiresolution time-domain schemes (Dec. 2001 [T-MTT])." 2001 Transactions on Microwave Theory and Techniques 49.12 (Dec. 2001 [T-MTT] (Special Issue on 2001 International Microwave Symposium)): 2248-2257.

The effect of electric and magnetic node arrangement on the dispersion characteristics of the multiresolution time-domain (MRTD) technique is investigated. It is first noted that, by adopting multiresolution analysis principles, the dispersion behavior of an arbitrary order MRTD scheme can be extracted from the analysis of the corresponding S-MRTD scheme, which is based on scaling functions only. The introduction of one wavelet level is expected to bring about a refinement in the resolution of S-MRTD by a factor of two. However, this contradicts several dispersion analyses of MRTD schemes that have been recently presented in the literature. This conflict between theoretical predictions and numerical observations is resolved through the proof that the introduction of wavelets does not result in the expected enhancement of resolution of an S-MRTD scheme, unless a certain arrangement of electric and magnetic field nodes is implemented.

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Electromagnetic and semiconductor device simulation using interpolating wavelets

S. Goasguen, M.M. Tomeh and S.M. El-Ghazaly. "Electromagnetic and semiconductor device simulation using interpolating wavelets." 2001 Transactions on Microwave Theory and Techniques 49.12 (Dec. 2001 [T-MTT] (Special Issue on 2001 International Microwave Symposium)): 2258-2265.

A MESFET and a two-dimensional cavity enclosing a cylinder are simulated using a nonuniform mesh generated by an interpolating wavelet scheme. A self-adaptive mesh is implemented and controlled by the wavelet coefficient threshold. A fine mesh can therefore be used in domains where the unknown quantities are varying rapidly and a coarse mesh can be used where the unknowns are varying slowly. It is shown that good accuracy can be achieved while compressing the number of unknowns by 50% to 80% during the whole simulation. In the case of the MESFET, the I-V characteristics are obtained and the accuracy is compared with the basic finite difference scheme. A reduction of 83% in the number of discretization points at steady state is obtained with 3% error on the drain current. The performance of the scheme is investigated using different values of threshold and two types of interpolating wavelet, namely, the second-order and fourth-order wavelets. Due to the specific problem analyzed, a tradeoff appears between good compression, accuracy, and order of the wavelet. This represents the ongoing effort toward a numerical technique that uses wavelets to solve both Maxwell's equations and the semiconductor equations. Such a method is of great interest to deal with the multiscale problem that is the full-wave simulation of active microwave circuits.

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Efficient FDTD modeling of irises/slots in microwave structures and its application to the design of combline filters

Ao Sheng Rong, Heng Yang, Xing Hao Chen and A. Cangellaris. "Efficient FDTD modeling of irises/slots in microwave structures and its application to the design of combline filters." 2001 Transactions on Microwave Theory and Techniques 49.12 (Dec. 2001 [T-MTT] (Special Issue on 2001 International Microwave Symposium)): 2266-2275.

A new methodology is proposed for the computationally efficient, numerically stable, and accurate finite difference time-domain (FDTD) simulation of microwave structures with electrically thin irises and slots. The proposed method is based on the hybridization of Yee's standard FDTD scheme with Pade approximations of the electromagnetic properties of the irises/slots. Through the use of rigorous modal expansions for the description of the fields in the waveguide sections formed by the irises and slots, highly accurate rational function approximations of their transmission and reflection properties are obtained. These transfer functions are then incorporated directly in the FDTD algorithm through their corresponding z-transform expressions. Combined with the matrix valued multivariate Pade approximation, the proposed method provides a suitable design tool for combline filters and manifold multiplexers for satellite and wireless communication systems. Results are presented to demonstrate the validity and accuracy of the proposed methodology.

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Time-domain optical response of an electrooptic modulator using FDTD (Dec. 2001 [T-MTT])

M.M. Tomeh, S. Goasguen and S.M. El-Ghazaly. "Time-domain optical response of an electrooptic modulator using FDTD (Dec. 2001 [T-MTT])." 2001 Transactions on Microwave Theory and Techniques 49.12 (Dec. 2001 [T-MTT] (Special Issue on 2001 International Microwave Symposium)): 2276-2281.

A time-domain analysis of an LiNbO₃/sub 3/ electrooptic modulator using the finite-difference time-domain (FDTD) technique is performed. This allows for the calculation of optical modulation and the time-domain optical response of an electrooptic modulator. The electromagnetic fields computed by FDTD are coupled to standard electrooptic relations that characterize electrooptic interactions inside the embedded Ti diffused LiNbO₃/sub 3/ optical waveguides. The electric field-dependent change in the index of refraction inside these optical waveguides and resulting minute phase shifts imparted to optical signals propagating along the device are determined in time, allowing for the simulation of optical intensity modulation. This novel approach to LiNbO₃/sub 3/ electrooptic modulators using a coupled FDTD technique allows for previously unattainable investigations into device operating bandwidth and data transmission speed.

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A robust algorithm for automatic development of neural-network models for microwave applications (Dec. 2001 [T-MTT])

V.K. Devabhaktuni, M.C.E. Yagoub and Qi-Jun Zhang. "A robust algorithm for automatic development of neural-network models for microwave applications (Dec. 2001 [T-MTT])." 2001 Transactions on Microwave Theory and Techniques 49.12 (Dec. 2001 [T-MTT] (Special Issue on 2001 International Microwave Symposium)): 2282-2291.

For the first time, we propose a robust algorithm for automating the neural-network-based RF/microwave model development process. Starting with zero amount of training data and then proceeding with neural-network training in a stage-wise manner, the algorithm can automatically produce a neural model that meets the user-desired accuracy. In each stage, the algorithm utilizes neural-network error criteria to determine additional training/validation samples required and their location in model input space. The algorithm dynamically generates these new data samples during training, by automatic driving of simulation tools (e.g., OSA90, Ansoft-HFSS, Agilent-ADS). Initially, fewer hidden neurons are used, and the algorithm adjusts the neural-network size whenever it detects under-learning. Our technique integrates all the subtasks involved in neural modeling, thereby facilitating a more efficient and automated model development framework. It significantly reduces the intensive human effort demanded by the conventional step-by-step neural modeling approach. The algorithm inherently distinguishes nonlinear and smooth regions of model behavior and uses relatively fewer samples in smooth subregions. It automatically deals with large data errors that can occur during dynamic sampling by using a Huber quasi-Newton technique. The algorithm is demonstrated through practical microwave device and circuit examples.





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Efficient sensitivity analysis of lossy multiconductor transmission lines with nonlinear terminations (Dec. 2001 [T-MTT])

A. Dounavis, R. Achar and M.S. Nakhla. "Efficient sensitivity analysis of lossy multiconductor transmission lines with nonlinear terminations (Dec. 2001 [T-MTT])." 2001 Transactions on Microwave Theory and Techniques 49.12 (Dec. 2001 [T-MTT] (Special Issue on 2001 International Microwave Symposium)): 2292-2299.

An efficient approach for sensitivity analysis of lossy multiconductor transmission lines in the presence of nonlinear terminations is described. Sensitivity information is extracted using the recently developed closed-form matrix-rational approximation of the distributed transmission-line model. The method enables sensitivity analysis of interconnect structures with respect to both electrical and physical parameters. An important advantage of the proposed approach is that the derivatives of the modified nodal admittance matrices with respect to per-unit-length parameters are obtained analytically.

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An extrinsic-inductance independent approach for direct extraction of HBT intrinsic circuit parameters (Dec. 2001 [T-MTT])

Tzyy-Sheng Horng, Jian-Ming Wu and Hui-Hsiang Huang. "An extrinsic-inductance independent approach for direct extraction of HBT intrinsic circuit parameters (Dec. 2001 [T-MTT])." 2001 Transactions on Microwave Theory and Techniques 49.12 (Dec. 2001 [T-MTT] (Special Issue on 2001 International Microwave Symposium)): 2300-2305.

A novel analytical procedure has been proposed for direct extraction of the intrinsic elements in a hybrid- π equivalent circuit of heterojunction bipolar transistors. This method differs from previous ones by formulating impedance-parameter based expressions that are exclusive of the extrinsic inductances associated with the base, emitter, and collector. It is therefore not susceptible to variation of the extrinsic reactances from DC to high frequencies and can lead to very accurate extraction of the intrinsic elements under different bias conditions. The distributed phenomena in the base region can be also characterized rigorously by exploiting the bias-independent features of the extrinsic elements that are extracted subsequently from knowledge of the intrinsic elements.





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Analysis of CDMA signal spectral regrowth and waveform quality (Dec. 2001 [T-MTT])

V. Aparin. "Analysis of CDMA signal spectral regrowth and waveform quality (Dec. 2001 [T-MTT])." 2001 Transactions on Microwave Theory and Techniques 49.12 (Dec. 2001 [T-MTT] (Special Issue on 2001 International Microwave Symposium)): 2306-2314.

Closed-form expressions for the spectral regrowth and waveform quality of a reverse-link code division multiple access (CDMA) signal passed through a weakly nonlinear circuit are derived using the power series and statistical methods. The third-order nonlinearity is expressed in terms of $IP_{sub 3/}$ to include the memory effects of the circuit in-band and out-of-band reactances. The analysis is based on a time-domain model of the signal that gives more accurate distortion estimates than the widely used Gaussian approximation. The model is used to derive the probability density function and other statistical properties of the CDMA signal to compare them to the Gaussian noise properties. Differences in statistics and distortions of OQPSK and QPSK modulated signals are discussed.





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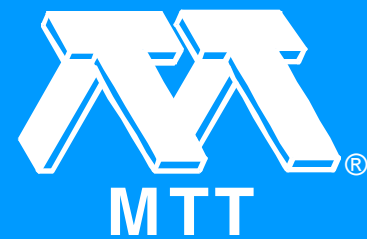
Investigation into intermodulation distortion in HEMTs using a quasi-2-D physical model

P.J. Rudge, R.E. Miles, M.B. Steer and C.M. Snowden. "Investigation into intermodulation distortion in HEMTs using a quasi-2-D physical model." 2001 Transactions on Microwave Theory and Techniques 49.12 (Dec. 2001 [T-MTT] (Special Issue on 2001 International Microwave Symposium)): 2315-2321.

The need for both linear and efficient pseudomorphic high electron-mobility transistors (pHEMTs) for modern wireless handsets necessitates a thorough understanding of the origins of intermodulation distortion at the device level. For the first time, the dynamic large-signal internal physical behavior of a pHEMT is examined using a quasi-two-dimensional physical device model. The model accounts fully for device-circuit interaction and is validated experimentally for a two-tone experiment around 5 GHz.

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Novel lumped-element uniplanar transitions

Yo-Shen Lin and Chun Hsiung Chen. "Novel lumped-element uniplanar transitions." 2001 Transactions on Microwave Theory and Techniques 49.12 (Dec. 2001 [T-MTT] (Special Issue on 2001 International Microwave Symposium)): 2322-2330.

Novel reduced-size lumped-element uniplanar transitions are proposed, using the planar parallel and series inductor-capacitor (LC) circuits to realize the effective open and short circuits, respectively. In this study, various compact lumped-element coplanar waveguide-to-slotline and finite-ground coplanar waveguide-to-coplanar stripline transition structures are developed and carefully examined. Specifically, the performance of proposed basic lumped-element transitions can easily be adjusted through the control of L and C values, while the design of lumped-element Marchand-balun-type transitions may be accomplished by the use of conventional filter synthesis techniques. Simple equivalent-circuit models are also established, from which the passband behavior of the lumped-element transition structures may be characterized.

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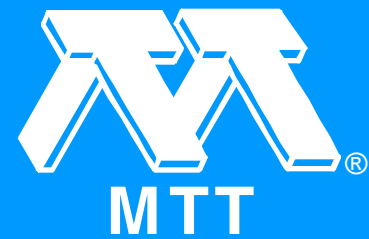
Sandwich-type ferromagnetic RF integrated inductor (Dec. 2001 [T-MTT])

M. Yamaguchi, M. Baba and K.-I. Arai. "Sandwich-type ferromagnetic RF integrated inductor (Dec. 2001 [T-MTT])." 2001 Transactions on Microwave Theory and Techniques 49.12 (Dec. 2001 [T-MTT] (Special Issue on 2001 International Microwave Symposium)): 2331-2335.

The first demonstration of a sandwich-type ferromagnetic RF integrated spiral inductor for the 2-GHz range is reported. Two ferromagnetic CoNbZr films were set to sandwich the spiral in order to enhance the amount of magnetic flux linkage across the coil current. The stresses given from the insulator to the ferromagnetic film were studied. The inductance L of 7.9 nH and the quality factor Q of 12.7 were obtained for a 200 /spl mu/m/spl times/400 /spl mu/m size four-turn rectangular spiral at $f=2$ GHz. The inductance was better than that of an air core of the same coil size by 19%, and the Q was better by 23%. Comparison with the on-top magnetic film type was also discussed.

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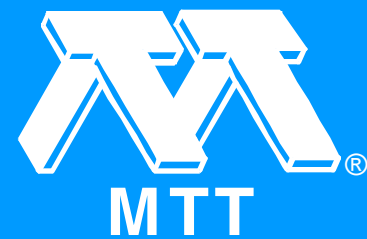
Miniature low-loss CPW periodic structures for filter applications

J. Sor, Y. Qian and T. Itoh. "Miniature low-loss CPW periodic structures for filter applications." 2001 Transactions on Microwave Theory and Techniques 49.12 (Dec. 2001 [T-MTT] (Special Issue on 2001 International Microwave Symposium)): 2336-2341.

Several novel periodic structures for coplanar waveguides are presented. The proposed structures exhibit low insertion loss in the passband, simple fabrication, and slow-wave characteristics. These structures are applied to realize miniature low-pass filters one-tenth the size of conventional filters, with spurious-free response and deep attenuation levels using only three cells.

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Chip-type LTCC-MLC baluns using the stepped impedance method

Ching-Wen Tang, Jyh-Wen Sheen and Chi-Yang Chang. "Chip-type LTCC-MLC baluns using the stepped impedance method." 2001 Transactions on Microwave Theory and Techniques 49.12 (Dec. 2001 [T-MTT] (Special Issue on 2001 International Microwave Symposium)): 2342-2349.

A chip-type low-temperature co-fired ceramic (LTCC) multilayer ceramic (MLC) balun is presented in this paper. This balun is designed using the stepped impedance method. It uses a multilayer structure, meander lines, and multisection coupled lines. The use of multisection couple lines that have various characteristic impedance ratios can shrink the length of a quarter-wavelength coupled-transmission line and makes it very easy to match various impedances of balanced output. The proposed chip-type balun operates over a bandwidth of 2.25-2.65 GHz. The in-band phase and amplitude balances are excellent because of the symmetric structure and transmission-line trimming section. Measured results of the chip-type LTCC-MLC balun match well with the computer simulation.

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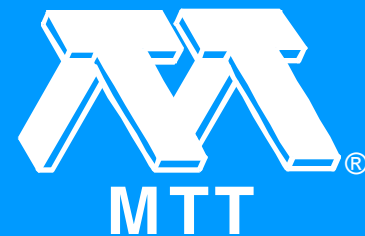


Abstracts

Design of CT and CQ filters using approximation and optimization (Dec. 2001 [T-MTT])

R. Levy and P. Petre. "Design of CT and CQ filters using approximation and optimization (Dec. 2001 [T-MTT])." 2001 Transactions on Microwave Theory and Techniques 49.12 (Dec. 2001 [T-MTT] (Special Issue on 2001 International Microwave Symposium)): 2350-2356.

A new design technique for cascaded triplet (CT) filters has been derived commencing from the well-known Chebyshev all-pole prototype filter. One or more finite frequency poles may be introduced by cross coupling across sets of three nodes, and the filter rematched by a reasonably accurate approximate compensation of the element values. Any general optimizer may then be used to obtain a nearly perfect result without undue concern over convergence failures. A previous similar theory for cascaded quadruplet sections is generalized and may be combined with the CT theory to form filters having both types of sections. The theory is applied to both singly and doubly terminated filters and may include poles on the real axis of the s-plane for delay equalization.



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Zolotarev bandpass filters (Dec. 2001 [T-MTT])

H.C. Bell. "Zolotarev bandpass filters (Dec. 2001 [T-MTT])." 2001 Transactions on Microwave Theory and Techniques 49.12 (Dec. 2001 [T-MTT] (Special Issue on 2001 International Microwave Symposium)): 2357-2362.

Zolotarev rational functions may be used in certain bandpass filter applications for which two narrower passbands are required. Coupled-resonator low-pass prototypes for narrow bandpass filters based on even- and odd-degree Zolotarev functions are synthesized using a transformed variable. Compared to other filters, those with Zolotarev responses have sharper skirt selectivity, resulting in lower passband distortion.



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Bandpass filters using dual-mode and quad-mode Mobius resonators

J.M. Pond, S. Liu and N. Newman. "Bandpass filters using dual-mode and quad-mode Mobius resonators." 2001 Transactions on Microwave Theory and Techniques 49.12 (Dec. 2001 [T-MTT] (Special Issue on 2001 International Microwave Symposium)): 2363-2368.

Compact bandpass filters are being developed using Mobius wire-loaded cavity resonators. Initial results on tuned filters indicate that excellent filter characteristics can be attained in devices that are significantly smaller than traditional wire-loaded cavity technologies. A novel quad-mode Mobius resonator is presented which occupies the same volume as a dual-mode Mobius resonator. A four-pole bandpass filter is demonstrated using a single quad-mode Mobius resonator. Precisely controlled dielectric loading of dual-mode Mobius wire resonators has been implemented to realize bandpass filters. Two-pole and four-pole bandpass filters are demonstrated using one and two dual-mode dielectric-loaded Mobius resonators, respectively.

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Small filters based on slotted cylindrical-ring resonators (Dec. 2001 [T-MTT])

R.F. Mostafavi, D. Mirshekar-Syahkal and Y.C.M. Lim. "Small filters based on slotted cylindrical-ring resonators (Dec. 2001 [T-MTT])." 2001 Transactions on Microwave Theory and Techniques 49.12 (Dec. 2001 [T-MTT] (Special Issue on 2001 International Microwave Symposium)): 2369-2375.

The realization of a small four-pole Chebyshev filter, using four matched slotted cylindrical-ring resonators, is explained. This filter, which does not need screws for tuning the resonators or couplings, is low-cost to manufacture and is suitable for mobile communications. The filter has a bandwidth of 75 MHz, centered at 1.73 GHz. To obtain the resonant frequency and Q-factor of the resonators as well as the coupling distances between the resonators, a new technique, the quasi-magneto-static finite-difference method, is used, which is also reported.

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Integration of optimized low-pass filters in a bandpass filter for out-of-band improvement (Dec. 2001 [T-MTT])

C. Quendo, E. Rius, C. Person and M. Ney. "Integration of optimized low-pass filters in a bandpass filter for out-of-band improvement (Dec. 2001 [T-MTT])." 2001 Transactions on Microwave Theory and Techniques 49.12 (Dec. 2001 [T-MTT] (Special Issue on 2001 International Microwave Symposium)): 2376-2383.

In this paper, we discuss the control and suppression of spurious resonances commonly encountered with distributed bandpass filters. The basic idea consists of introducing low-pass structures within bandpass topologies. By adjusting low-pass filter cutoff frequencies, harmonic resonances are attenuated, while maintaining in-band performances. In addition, transmission losses may be reduced as the insertion technique leads to optimum designs in terms of overall size. The approach described here is based upon the combination of classical synthesis techniques and optimization procedures provided by conventional computer-aided-design tools. Experimental results are obtained in the case of $\lambda/4$ shunt-stub filters implemented in classical semilumped low-pass architectures. Then, we investigate alternative integration technologies and techniques to improve the out-of-band rejection over very wide operating bandwidth. To overcome some design limitations, i.e., workable characteristic impedance value, we propose and validate a multilayer solution. Finally, new low-pass topologies are suggested to improve low-pass filter band rejection.

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Full-wave analysis of coupling between combline resonators and its application to combline filters with canonical configurations

M. El Sabbagh, K.A. Zaki, Hui-Wen Yao and Ming Yu. "Full-wave analysis of coupling between combline resonators and its application to combline filters with canonical configurations." 2001 Transactions on Microwave Theory and Techniques 49.12 (Dec. 2001 [T-MTT] (Special Issue on 2001 International Microwave Symposium)): 2384-2393.

Resonant frequencies and coupling coefficient between two combline cavities, in the presence of other cavities, are obtained accurately using the mode-matching technique. The effect of iris dimensions and position on the electric and magnetic coupling is rigorously investigated. The corresponding data for two isolated cavities are included for comparison. The adjacent and nonadjacent couplings are rigorously investigated for different configurations of three coupled cavities. A four-pole slot-coupled elliptic combline filter is designed.

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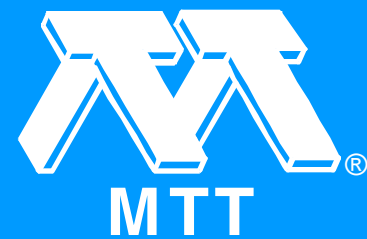
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Low-loss analog and digital micromachined impedance tuners at the Ka-band

Hong-Teuk Kim, Sanghwa Jung, Kyungteh Kang, Jae-Hyoung Park, Yong-Kweon Kim and Youngwoo Kwon. "Low-loss analog and digital micromachined impedance tuners at the Ka-band." 2001 Transactions on Microwave Theory and Techniques 49.12 (Dec. 2001 [T-MTT] (Special Issue on 2001 International Microwave Symposium)): 2394-2400.

Presents new types of analog and digital micromachined impedance tuners. Analog impedance tuners using resonant unit cells realized by tunable micromachined capacitors showed a wide tuning range equivalent to almost two quadrants of the Smith chart with a maximum voltage standing-wave ratio (VSWR) of 21.2 at the Ka-band. Frequency variability is also provided through the use of J-inverters with tunable capacitors. Also presented is a digital micromachined tuner, where the short-circuited shunt stubs are loaded with microelectromechanical system (MEMS) capacitive switches. The electrical length of the stub and the overall impedance of the tuner are thus controlled according to the switching states of the MEMS capacitors. The digital tuner presented impedance ranges suitable for load impedances of the RF power transistors and showed a high maximum VSWR of 32.3. Compared with the state-of-the-art tuners using field-effect transistors, micromachined tuners of this paper show superior VSWR ranges as well as wide impedance ranges. Micromachined tuners are very promising for low-loss tuning of the monolithic circuits as well as for accurate noise and power characterization.





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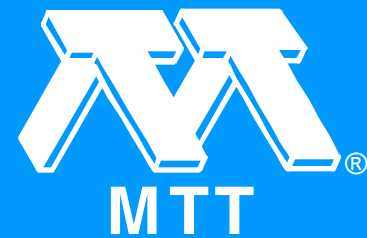
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Simplified method for measurements and calculations of coupling coefficients and $Q_{0/}$ factor of high-temperature superconducting dielectric resonators

M.V. Jacob, J. Mazierska, K. Leong and J. Krupka. "Simplified method for measurements and calculations of coupling coefficients and $Q_{0/}$ factor of high-temperature superconducting dielectric resonators." 2001 Transactions on Microwave Theory and Techniques 49.12 (Dec. 2001 [T-MTT] (Special Issue on 2001 International Microwave Symposium)): 2401-2407.

To accurately determine the surface resistance of high-temperature superconducting films, multifrequency measurements of S_{21} , S_{11} , and S_{22} and sophisticated data processing are required. As a result, surface resistance measurements and calculations for varying temperatures are very time consuming. In this paper, we introduce a simplified method for calculations of the unloaded Q ($Q_{0/}$) factor, which require measurements of S_{11} and S_{22} at the lowest temperature only. For all other temperatures, only S_{21} measurements are needed. The method has been shown to give sufficiently accurate $Q_{0/}$ values and, hence, the surface resistance of superconducting samples, as compared to results obtained from S_{21} , S_{11} , and S_{22} measurements using the transmission-mode Q factor technique. The presented method has been tested under different coupling coefficients and frequencies.





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Microwave noise and power performance of metamorphic InP heterojunction bipolar transistors (Dec. 2001 [T-MTT])

S. Halder, Yong Zhong Xiong, Geok-Ing Ng, Hong Wang, Haiqun Zheng, K. Radhakrishnan and J.C.M. Hwang. "Microwave noise and power performance of metamorphic InP heterojunction bipolar transistors (Dec. 2001 [T-MTT])." 2001 Transactions on Microwave Theory and Techniques 49.12 (Dec. 2001 [T-MTT] (Special Issue on 2001 International Microwave Symposium)): 2408-2412.

For the first time, microwave noise and power performance of metamorphic InP heterojunction bipolar transistors (MM-HBTs) grown on GaAs substrates are reported. We find that microwave performance of MM-HBTs is comparable to that of lattice-matched InP heterojunction bipolar transistors of identical design. The preliminary results imply that the superior performance of InP heterojunction bipolar transistors can be confidently exploited with the more mature manufacturing technology of GaAs.

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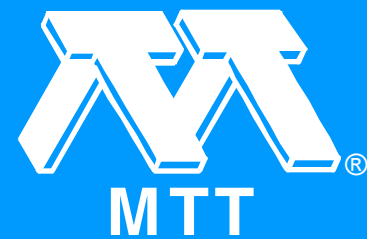


Abstracts

Study of self-heating effects, temperature-dependent modeling, and pulsed load-pull measurements on GaN HEMTs

S. Nuttinck, E. Gebara, J. Laskar and H.M. Harris. "Study of self-heating effects, temperature-dependent modeling, and pulsed load-pull measurements on GaN HEMTs." 2001 Transactions on Microwave Theory and Techniques 49.12 (Dec. 2001 [T-MTT] (Special Issue on 2001 International Microwave Symposium)): 2413-2420.

On-wafer RF and IV characterizations are performed for the first time on power GaN high electron-mobility transistors (HEMTs) under pulse and continuous conditions at different temperatures. These measurements give an in-depth understanding of self-heating effects and allow one to investigate the possibility of improving heat-dissipation mechanisms. A pulsed load-pull system that measures the power gain of the device-under-test (DUT) under pulsed RF and bias condition has been developed. To the best of our knowledge, this is the first time that the reflected power at the DUT is measured under the pulse mode of operation. Additionally, an improved small-signal model for power GaN HEMTs that incorporates the geometry of the device is developed at various temperatures. This is the basis for empirical large-signal modeling.



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Tunable active filters having multilayer structure using LTCC (Dec. 2001 [T-MTT])

K. Kageyama, K. Saito, H. Murase, H. Utaki and T. Yamamoto. "Tunable active filters having multilayer structure using LTCC (Dec. 2001 [T-MTT])." 2001 Transactions on Microwave Theory and Techniques 49.12 (Dec. 2001 [T-MTT] (Special Issue on 2001 International Microwave Symposium)): 2421-2424.

Two types of tunable filters have been developed at 400- and 800-MHz frequency bands, respectively. These filters have been fabricated with low-temperature co-fired-ceramics multilayer technologies assisted by varactor diodes. The filter size is 5.6 /spl times/ 5.6 /spl times/ 3.0 mm. Each filter has approximately 11% and 13% tuning range of frequency with a controlling voltage of 1-4 V, IL < 2.0 dB, and has an attenuation over 40 dB at fo /spl plusmn/ 30%, respectively. Temperature stability data is also discussed.





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Using a negative capacitance to increase the tuning range of a varactor diode in MMIC technology (Dec. 2001 [T-MTT])

S. Kolev, B. Delacressonniere and J.-L. Gautier. "Using a negative capacitance to increase the tuning range of a varactor diode in MMIC technology (Dec. 2001 [T-MTT])." 2001 Transactions on Microwave Theory and Techniques 49.12 (Dec. 2001 [T-MTT] (Special Issue on 2001 International Microwave Symposium)): 2425-2430.

An original method to increase the tuning range of a monolithic-microwave integrated-circuit (MMIC) varactor diode is presented in this paper. An active circuit simulating a negative capacitance is connected to the varactor diode. This method allows to increase the varactor's tuning range more than ten times and to compensate its series resistance at the same time. A MMIC simulating a negative capacitance have been successfully fabricated and measured. To the best of the authors' knowledge, this is the first realization of a MMIC simulating a negative capacitance.

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A 60-GHz-band planar dielectric waveguide filter for flip-chip modules (Dec. 2001 [T-MTT])

M. Ito, K. Maruhashi, K. Ikuina, T. Hashiguchi, S. Iwanaga and K. Ohata. "A 60-GHz-band planar dielectric waveguide filter for flip-chip modules (Dec. 2001 [T-MTT])." 2001 Transactions on Microwave Theory and Techniques 49.12 (Dec. 2001 [T-MTT] (Special Issue on 2001 International Microwave Symposium)): 2431-2436.

A planar dielectric waveguide filter with coplanar waveguide (CPW) I/O ports suitable for flip-chip bonding is proposed and is demonstrated for 60-GHz-band applications. The filter is formed incorporating metallized through holes in an alumina substrate. In order to improve stopband rejection, short-circuited CPW resonators with a half-wavelength are added to waveguide-to-CPW transitions. A fabricated four-resonator filter exhibits an insertion loss of 3.2 dB with a 3-dB bandwidth of 3.0 GHz and rejection of 35 dB at 3-GHz lower separation from a center frequency of 59.5 GHz. The filter is mounted by using flip-chip bonding in a multilayer ceramic package with structures to suppress parasitically propagating electromagnetic waves. No degradation of the stopband rejection is observed from 50 to 80 GHz.

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A highly linear single balanced mixer based on heterojunction interband tunneling diode (Dec. 2001 [T-MTT])

A. Cidronali, G. Collodi, M.R. Deshpande, N. El-Zein, V. Nair, G. Manes and H. Goronkin. "A highly linear single balanced mixer based on heterojunction interband tunneling diode (Dec. 2001 [T-MTT])." 2001 Transactions on Microwave Theory and Techniques 49.12 (Dec. 2001 [T-MTT] (Special Issue on 2001 International Microwave Symposium)): 2437-2445.

In this paper, a compact and highly linear monolithic-microwave integrated circuit (MMIC) single balanced mixer based on heterojunction interband tunnel diode (HITD) technology working at 1.8 GHz is described. The prototype consists of a pair of HITDs biased at 0 V and a lumped-element directional coupler with arbitrary impedance terminations. The HITDs are in the InGaAs/InAlAs material system lattice matched to InP. The relevant feature of the mixer is the linearity due to the quasi-square-law dc current-voltage (IV) characteristics exhibited by the device around zero voltage. A qualitative treatment of the third-order intermodulation product and the conversion loss as a function of the HITDs IV characteristic and the embedding impedance is provided. The design techniques along with a detailed experimental validation are also provided. The prototype working in down-conversion mode, exhibited an third-order intercept point power level of +17.5 dBm, a conversion loss of 11 dB and a 1-dB compression point of +7 dBm at the operative frequency of 1.8 GHz with a +5-dBm local-oscillator drive level.





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An ultra-broad-band reflection-type phase-shifter MMIC with series and parallel LC circuits

K. Miyaguchi, M. Hieda, K. Nakahara, H. Kurusu, M. Nii, M. Kasahara, T. Takagi and S. Urasaki. "An ultra-broad-band reflection-type phase-shifter MMIC with series and parallel LC circuits." 2001 Transactions on Microwave Theory and Techniques 49.12 (Dec. 2001 [T-MTT] (Special Issue on 2001 International Microwave Symposium)): 2446-2452.

An ultra-broad-band reflection-type phase shifter is proposed. Theoretically, the proposed phase shifter has frequency-independent characteristics in the case of 180/spl deg/ phase shift. The phase shifter is composed of a 3-dB hybrid coupler and a pair of novel reflective terminating circuits. The reflective terminating circuit switches two states of series and parallel LC circuits. Using an ideal circuit model without parasitic circuit elements, we have derived the determining condition of frequency independence of circuit elements. Extending the concept, we can also obtain a broad-band phase shifter for other phase difference as well. In this case, for a given phase difference and an operating frequency, we also derive a condition to obtain minimum variation of phase difference around the operating frequency. This enables the broad-band characteristics for arbitrary phase difference. The fabricated 180/spl deg/ reflective terminating circuit monolithic microwave integrated circuit (MMIC) has achieved a phase difference of 183/spl deg/ /spl plusmn/ 3 over 0.5-30 GHz. The 180/spl deg/ phase-shifter MMIC has demonstrated a phase shift of 187/spl deg/ /spl plusmn/ 7/spl deg/ over 0.5-20 GHz. The 90/spl deg/ reflective terminating circuit MMIC has performed a phase difference of 93/spl deg/ /spl plusmn/ 7/spl deg/ over 4-12 GHz.

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High-isolation series-shunt FET SPDT switch with a capacitor canceling FET parasitic inductance

M. Hieda, K. Nakahara, K. Miyaguchi, H. Kurusu, Y. Iyama, T. Takagi and S. Urasaki. "High-isolation series-shunt FET SPDT switch with a capacitor canceling FET parasitic inductance." 2001 Transactions on Microwave Theory and Techniques 49.12 (Dec. 2001 [T-MTT] (Special Issue on 2001 International Microwave Symposium)): 2453-2458.

A novel series-shunt FET narrow-band high-isolation single-pole double-throw switch, which employs series capacitors to cancel the parasitic inductances has been developed. The proposed switch can have significantly high isolation characteristics at higher frequency. The fabricated two switches have demonstrated high isolation characteristics of 28.9 dB in the 28- and 18-GHz band, respectively.

K-band receiver front-ends in a GaAs metamorphic HEMT process

B. Matinpour, N. Lal, J. Laskar, R.E. Leoni and C.S. Whelan. "K-band receiver front-ends in a GaAs metamorphic HEMT process." 2001 Transactions on Microwave Theory and Techniques 49.12 (Dec. 2001 [T-MTT] (Special Issue on 2001 International Microwave Symposium)): 2459-2463.

In this paper, we present K-band receiver blocks fabricated in a state-of-the-art 0.18- μm GaAs metamorphic high electron-mobility transistor (MHEMT) process using a 60% indium-content InGaAs channel. Several circuits are developed to demonstrate the superior noise performance and successful integration of K-band receiver components in such a process. We show a low-power three-stage low-noise amplifier (LNA) with a gain of 23 dB and a noise figure (NF) of less than 1.6 dB at 30 GHz. This LNA shows InP-like performance on a GaAs substrate with a high RF yield of 84%. This is the first report of a statistical yield analysis of an MHEMT integrated circuit. We also demonstrate on-chip integration of a single-stage amplifier with a diode subharmonic mixer for low-power and broad-band receiver performance. This down-converter exhibits a conversion loss of 3 dB, overall NF of 5 dB, and third-order input intercept point of -5 dBm from 26 to 30 GHz.

Variable-gain power amplifier for mobile WCDMA applications (Dec. 2001 [T-MTT])

V.T.S. Vintola, M.J. Matilainen, S.J.K. Kalajo and E.A. Jarvinen. "Variable-gain power amplifier for mobile WCDMA applications (Dec. 2001 [T-MTT])." 2001 Transactions on Microwave Theory and Techniques 49.12 (Dec. 2001 [T-MTT] (Special Issue on 2001 International Microwave Symposium)): 2464-2471.

A single-chip linear power amplifier (PA) with >48-dB gain control range and >24-dBm output power with adjacent channel leakage power below -36 dBc is presented. The chip is realized using an AlGaAs-GaAs heterojunction-bipolar-transistor process and is aimed for 1.95-GHz mobile WCDMA applications. The amplifier consists of two blocks, the variable-gain amplifier, and the PA. The chip size is 1.3/spl times/1.1 mm/sup 2/ and it is mounted on an 8/spl times/8 mm/sup 2/ FR-4 type laminate with 26 pieces of 0402 surface-mountable discrete components composing a complete 50-/spl Omega/ input-output amplifier module. This paper presents the design of the two blocks, discusses issues related to their combination, and presents complete amplifier realization and measurement results.



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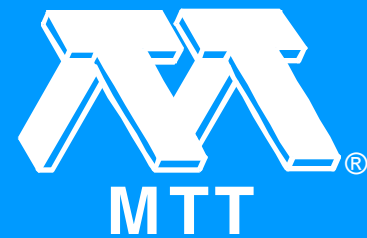
An extended Doherty amplifier with high efficiency over a wide power range (Dec. 2001 [T-MTT])

M. Iwamoto, A. Williams, Pin-Fan Chen, A.G. Metzger, L.E. Larson and P.M. Asbeck. "An extended Doherty amplifier with high efficiency over a wide power range (Dec. 2001 [T-MTT])." 2001 Transactions on Microwave Theory and Techniques 49.12 (Dec. 2001 [T-MTT] (Special Issue on 2001 International Microwave Symposium)): 2472-2479.

An extension of the Doherty amplifier, which maintains high efficiency over a wide range of output power (>6 dB), is presented in this paper. This extended Doherty amplifier is demonstrated experimentally with InGaP/GaAs heterojunction bipolar transistors at 950 MHz. Power-added efficiency (PAE) of 46% is measured at $P_{\text{sub 1dB}}$ of 27.5 dBm and 45% is measured at 9 dB backed off from $P_{\text{sub 1dB}}$. Additionally, PAE of at least 39% is maintained for over an output power range of 12 dB backed off from $P_{\text{sub 1dB}}$. This is an improvement over the classical Doherty amplifier, where high efficiency is typically obtained up to 5-6 dB backed off from $P_{\text{sub 1dB}}$. Compared to a single transistor class-B amplifier with similar gain and $P_{\text{sub 1dB}}$, the extended Doherty amplifier has PAE 2.6 /spl times/ higher at 10 dB back off and 3 /spl times/ higher at 20 dB back off from $P_{\text{sub 1dB}}$. Under different bias and output matching conditions, the amplifier was also evaluated with CDMA signals. At the highest measured power of 25 dBm, the extended Doherty amplifier achieves a PAE of 45% with an adjacent channel power ratio of -42 dBc. Generalized design equations are also derived and the consequences of finite device output impedance on amplifier gain and linearity are explored.

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Current-mode class-D power amplifiers for high-efficiency RF applications (Dec. 2001 [T-MTT])

H. Kobayashi, J.M. Hinrichs and P.M. Asbeck. "Current-mode class-D power amplifiers for high-efficiency RF applications (Dec. 2001 [T-MTT])." 2001 Transactions on Microwave Theory and Techniques 49.12 (Dec. 2001 [T-MTT] (Special Issue on 2001 International Microwave Symposium)): 2480-2485.

We show that current-mode class-D (CMCD) power amplifiers can achieve high efficiency at RF frequencies. In contrast with conventional voltage-mode class-D amplifiers, the CMCD features "zero voltage switching," which eliminates the output capacitance discharge loss. Experimental CMCD amplifiers with 76.3% power-added efficiency (PAE) at 290-mW output and 71.3% PAE at 870-mW output are demonstrated using GaAs FETs at 900 MHz.

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High-power broad-band AlGaIn/GaN HEMT MMICs on SiC substrates (Dec. 2001 [T-MTT])

B.M. Green, V. Tilak, S. Lee, H. Kim, J.A. Smart, K.J. Webb, J.R. Shealy and L.F. Eastman. "High-power broad-band AlGaIn/GaN HEMT MMICs on SiC substrates (Dec. 2001 [T-MTT])." 2001 Transactions on Microwave Theory and Techniques 49.12 (Dec. 2001 [T-MTT] (Special Issue on 2001 International Microwave Symposium)): 2486-2493.

Broad-band high-power cascode AlGaIn/GaN high electron-mobility transistor monolithic-microwave integrated-circuit (MMIC) amplifiers with high gain and power-added efficiency (PAE) have been fabricated on high-thermal conductivity SiC substrates. A cascode gain cell exhibiting 5 W of power at 8 GHz with a small-signal gain of 19 dB was realized. A nonuniform distributed amplifier (NDA) based on this process was designed, fabricated, and tested, yielding a saturated output power of 3-6 W over a dc-8-GHz bandwidth with an associated PAE of 13%-31%. A broad-band amplifier MMIC using cascode cells in conjunction with a lossy-match input matching network showed a useful operating range of dc-8 GHz with an output power of 5-7.5 W and a PAE of 20%-33.% over this range. The third-order intermodulation products of the amplifiers under two-tone excitation were studied and third-order-intercept values of 42 and 43 dBm (computed using two-tone carrier power) for the lossy match and NDA amplifiers were obtained.

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New design method of uniform and nonuniform distributed power amplifiers

C. Duperrier, M. Campovecchio, L. Roussel, M. Lajugie and R. Quere. "New design method of uniform and nonuniform distributed power amplifiers." 2001 Transactions on Microwave Theory and Techniques 49.12 (Dec. 2001 [T-MTT] (Special Issue on 2001 International Microwave Symposium)): 2494-2500.

A new design methodology of uniform and nonuniform distributed power amplifiers is reported in this paper. This method is based on analytical expressions of the optimum input and output artificial lines making up the uniform and nonuniform distributed architectures. These relationships are derived from the load-line requirement of each transistor size for optimum power operation. Furthermore, specific design criteria are presented to enable an efficient choice between uniform and nonuniform distributed architectures. To validate this new design methodology, a nonuniform distributed power amplifier has been manufactured at the TriQuint Semiconductor Foundry, Richardson, TX, using a 0.25- μm power pseudomorphic high electron-mobility process. This single-stage monolithic-microwave integrated-circuit amplifier is made of six nonuniform cells and demonstrates 1-W output power with 7-dB associated gain and 20% power-added efficiency over a multioctave bandwidth.

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X-band MMIC power amplifier with an on-chip temperature-compensation circuit (Dec. 2001 [T-MTT])

K. Yamauchi, Y. Iyama, M. Yamaguchi, Y. Ikeda, S. Urasaki and T. Takagi. "X-band MMIC power amplifier with an on-chip temperature-compensation circuit (Dec. 2001 [T-MTT])." 2001 Transactions on Microwave Theory and Techniques 49.12 (Dec. 2001 [T-MTT] (Special Issue on 2001 International Microwave Symposium)): 2501-2506.

An X-band monolithic-microwave integrated-circuit (MMIC) power amplifier with a simplified on-chip temperature-compensation circuit composed of a few diodes and a resistor are presented in this paper. At first, the operation principle and design method of the temperature-compensation circuit have been investigated. The fabricated four-stage X-band MMIC power amplifier with the on-chip temperature-compensation circuit has demonstrated the improvement of gain variation from 5.5 to 1.3 dB in the temperature range from -10/spl deg/C to +80/spl deg/C.

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Gain/phase imbalance-minimization techniques for LINC transmitters

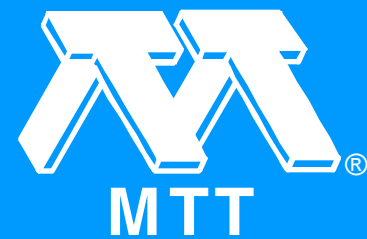
X. Zhang, L.E. Larson, P.M. Asbeck and P. Nanawa. "Gain/phase imbalance-minimization techniques for LINC transmitters." *2001 Transactions on Microwave Theory and Techniques* 49.12 (Dec. 2001 [T-MTT] (Special Issue on 2001 International Microwave Symposium)): 2507-2516.

Two simple calibration schemes for the correction of the path imbalance in a linear amplification with nonlinear components (LINC) transmitter have been demonstrated. In the foreground algorithm, a baseband digital signal processor (DSP) evaluates the gain and phase imbalance with a set of calibration signals, while in the background algorithm, the imbalance is characterized by exchanging the two LINC vector components. In both cases, the compensation of the path imbalance is accomplished within the DSP by introducing a predistortion term. A prototype LINC system has been tested for CDMA IS-95 baseband input, and -38 and -35-dBc adjacent channel interference were achieved for the foreground and background schemes, respectively. The quadrature errors of the in-phase/quadrature modulators set a limit on the overall performance of both algorithms.

A new direct millimeter-wave six-port receiver (Dec. 2001 [T-MTT])

S.O. Tatu, E. Moldovan, K. Wu and R.G. Bosisio. "A new direct millimeter-wave six-port receiver (Dec. 2001 [T-MTT])." 2001 Transactions on Microwave Theory and Techniques 49.12 (Dec. 2001 [T-MTT] (Special Issue on 2001 International Microwave Symposium)): 2517-2522.

A new direct-conversion wide-band (23-31 GHz) six-port receiver is proposed suitable for millimeter-wave integrated system design. This new hardware receiver is found to be robust, rugged, low cost, and suitable for use in broad-band wireless mass-market QPSK communications. The prototype circuits are fabricated to validate this new concept with our miniaturized hybrid microwave integrated-circuit technology and the proposed receiver topology is also suitable for monolithic-microwave integrated-circuit fabrication. This application-specific integrated receiver is designed on the basis of a wide-band six-port junction and other analogical circuits in the form of a simple multichip module. Bit-error-rate measurements and simulation results are shown and discussed in the presence of noise, adjacent signal interference, local-oscillator (LO) phase shift, and LO phase noise. The maximum bit rate is fundamentally limited by the speed of the video and decoder circuits. Nevertheless, several hundred megabits per second can be achieved at low cost.



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Simultaneous measurements of electric and thermal fields utilizing an electrooptic semiconductor probe

R.M. Reano, Kyoung Yang, L.P.B. Katehi and J.F. Whitaker. "Simultaneous measurements of electric and thermal fields utilizing an electrooptic semiconductor probe." 2001 Transactions on Microwave Theory and Techniques 49.12 (Dec. 2001 [T-MTT] (Special Issue on 2001 International Microwave Symposium)): 2523-2531.

A method to simultaneously measure electric and thermal fields with a single probe is presented in this paper. The Pockels effect is employed within a gallium-arsenide probe to measure electric fields, and the effect of photon absorption due to bandtail states in the semiconductor is used to determine temperature. The measured optical power is found to be inversely related to temperature, in agreement with theory, and experimental results demonstrate a temperature sensitivity of $0.31 \mu\text{W}/^\circ\text{C}$ at 25°C and an accuracy of $\pm 0.5^\circ\text{C}$ between 20°C - 60°C . The minimum detectable electric field is 1.24 V/m using a 300-ms electrical bandwidth. Temporal phase stability of $\pm 3^\circ/\text{h}$ is achieved through the implementation of a system phase reference channel. The invasiveness of the probe is quantified by examining the change in the characteristic impedance and capacitance per unit length of a planar transmission line. Measured and simulated data show that the effect is equivalent to a lumped shunt capacitance on the order of a few femtofarads. The examination of a monolithic microwave integrated circuit in an X-band quasi-optical power-combining array and the calibration of electric-field data that was corrupted by temperature-dependent effects inherent to the electrooptic probe demonstrate the capability of this combined electrothermal measurement technique.

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Automated filter tuning using generalized low-pass prototype networks and gradient-based parameter extraction

P. Harscher, R. Vahldieck and S. Amari. "Automated filter tuning using generalized low-pass prototype networks and gradient-based parameter extraction." 2001 Transactions on Microwave Theory and Techniques 49.12 (Dec. 2001 [T-MTT] (Special Issue on 2001 International Microwave Symposium)): 2532-2538.

A novel technique for automated filter tuning is introduced. The filter to be tuned is represented by a generalized filter low-pass prototype model rather than a specialized equivalent network. The prototype model is based on the minimum number of characteristic filter parameters to represent the filter transfer function correctly. The parameter values are found from a gradient-based parameter-extraction process using measured S-parameters. Automated filter tuning is performed as a two-step procedure. First, the parameter sensitivities with respect to the tuning elements are determined by a series of S-parameter measurements. Second, the parameter values of the filter are compared to the values of the ideal filter prototype found from a filter synthesis, thus yielding the optimal screw positions. This novel tuning technique has been tested successfully with direct coupled three-resonator and cross-coupled four- and six-resonator filters.





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Power absorption and temperature elevations induced in the human head by a dual-band monopole-helix antenna phone

P. Bernardi, M. Cavagnaro, S. Pisa and E. Piuzzi. "Power absorption and temperature elevations induced in the human head by a dual-band monopole-helix antenna phone." 2001 Transactions on Microwave Theory and Techniques 49.12 (Dec. 2001 [T-MTT] (Special Issue on 2001 International Microwave Symposium)): 2539-2546.

A numerically efficient way to evaluate specific absorption rate (SAR) deposition and temperature elevation inside the head of a user of a cellular phone equipped with a dual-band monopole-helix antenna is proposed. The considered antenna operates at both frequencies (900 and 1800 MHz) employed in global system for mobile communication. The results obtained show that, for a given radiated power, although the maximum SAR value as averaged over 1 g in the brain is higher at 900 MHz than at 1800 MHz, the maximum temperature increase in the brain is higher at 1800 MHz. However, taking into account that the average power levels radiated at the two operating frequencies are different (250 mW at 900 MHz and 125 mW at 1800 MHz), higher temperature elevations are obtained at 900 MHz. In this last case, the temperature increases are of the order of 0.2/spl deg/C in the ear, and less than 0.1/spl deg/C in the external brain region close to the phone. When the heating effect due to the contact of the ear and cheek with the phone is also taken into account, it is found that the predominant heating effect in the ear, able to cause temperature increases as high as 1.5/spl deg/C, is the one due to the phone contact, while SAR deposition plays a significant role only in the heating of the external brain region.

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New phase shifters and phased antenna array designs based on ferroelectric materials and CTS technologies (Dec. 2001 [T-MTT])

M.F. Iskander, Zhijun Zhang, Zhengqing Yun, R.S. Isom, M.G. Hawkins, R. Emrick, B. Bosco, J. Synowczynski and B. Gersten. "New phase shifters and phased antenna array designs based on ferroelectric materials and CTS technologies (Dec. 2001 [T-MTT])." 2001 Transactions on Microwave Theory and Techniques 49.12 (Dec. 2001 [T-MTT] (Special Issue on 2001 International Microwave Symposium)): 2547-2553.

As the search continues for low-cost and high-performance components for the front-end devices for wireless communications systems, some focus has been placed on exploring new and innovative designs based on ferroelectric technology. In this paper, we present new phase-shifter designs and an integrated phased-array antenna system based on the use of multilayer ferroelectric materials and the continuous transverse stub (CTS) technologies. Simulation results show that with the appropriate selection of the materials properties and the dimensions of the multilayer dielectric system, insertion losses may be reduced by as much as a factor of 100. These results also show that while only a slight reduction (15%) in the maximum achievable tunability was observed, it was possible to achieve significant improvement in impedance-matching characteristics. A procedure to enhance the radiation efficiency from an integrated ferroelectric/CTS phased antenna array design is described and specific array designs are discussed.

Click on title for a complete paper.



A W-band overmoded-waveguide oscillator with Gunn diodes

J. Bae, M. Fujita and K. Mizuno. "A W-band overmoded-waveguide oscillator with Gunn diodes." 2001 Transactions on Microwave Theory and Techniques 49.12 (Dec. 2001 [T-MTT] (Special Issue on 2001 International Microwave Symposium)): 2554-2559.

Spatial power combining of Gunn diodes having an efficiency of greater than 80% has been demonstrated at W-band using an overmoded-waveguide resonator having an array of fundamental mode (TE/sub 10/) waveguides. Nine Gunn diodes contained in the 3/spl times/3 TE/sub 10/-waveguide array have oscillated in a single TE/sub 30/ mode in the overmoded-waveguide resonator, and have produced 0.45-W output power (continuous wave) with a combining efficiency of 55% at 98.8 GHz. This efficiency has been improved to 84% using a small and compact resonator that reduces the number of undesirable modes in the overmoded waveguide. The output mode of TE/sub 30/ in the oscillator has been converted to TE/sub 10/ using a mitered-waveguide junction mode converter.



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Fully integrated automotive radar sensor with versatile resolution (Dec. 2001 [T-MTT])

C. Metz, J. Grubert, J. Heyen, A.F. Jacob, S. Janot, E. Lissel, G. Oberschmidt and L.C. Stange. "Fully integrated automotive radar sensor with versatile resolution (Dec. 2001 [T-MTT])." 2001 Transactions on Microwave Theory and Techniques 49.12 (Dec. 2001 [T-MTT] (Special Issue on 2001 International Microwave Symposium)): 2560-2566.

A planar radar sensor for automotive application is presented in this paper. The design comprises a fully integrated transceiver multichip module (MCM) and an electronically steerable microstrip patch array. The antenna feed network is based on a modified Rotman lens. An extended angular coverage, together with an adapted resolution, allows for the integration of automatic cruise control, precrash sensing, and cut-in detection within a single 77-GHz front-end. For ease of manufacturing, the interconnects between antenna and MCM rely on a mixed wire bond and flip-chip approach. The concept is validated by laboratory radar measurements.

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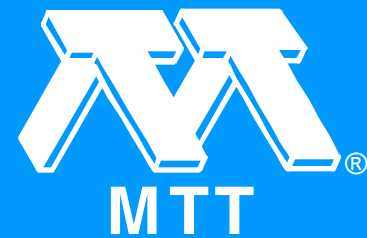
An in-circuit noncontacting measurement method for S-parameters and power in planar circuits

J. Stenarson, K. Yhland and C. Wingqvist. "An in-circuit noncontacting measurement method for S-parameters and power in planar circuits." 2001 Transactions on Microwave Theory and Techniques 49.12 (Dec. 2001 [T-MTT] (Special Issue on 2001 International Microwave Symposium)): 2567-2572.

A method for measuring the reflection coefficient and absolute power in the propagating waves from a circuit embedded in a planar circuit environment is presented. The method utilizes a pair of inductive and capacitive probes. The standard one-port vector-network-analyzer calibration is extended to allow the measurement of power in the forward and backward waves. Experimental results are presented for measurements between 700 MHz and 20 GHz. Good agreement between the new noncontacting method and a standard coaxial measurement method is demonstrated up to 12 GHz for power and up to 14 GHz for the reflection coefficient. The method is useful for in-circuit testing of open transmission-line structures, e.g., microstrip.

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Characteristic impedance extraction using calibration comparison

S. Vandenberghe, D.M.M.-P. Schreurs, G. Carchon, B.K.J.C. Nauwelaers and W. De Raedt.
"Characteristic impedance extraction using calibration comparison." 2001 Transactions on Microwave Theory and Techniques 49.12 (Dec. 2001 [T-MTT] (Special Issue on 2001 International Microwave Symposium)): 2573-2579.

A robust line impedance identification method is presented in this paper. It determines the characteristic impedance of on-wafer thru-line-reflect (TLR) standards measured after an initial off-wafer line-reflect-match or TLR calibration. The only assumption made is that the obtained trans-wafer error boxes are a cascade of a symmetric probe-related disturbance and a change in reference impedance. The proposed method yields an unbiased estimate of the complex characteristic impedance. Results from coplanar lines on a medium resistivity silicon substrate support the made assumption.

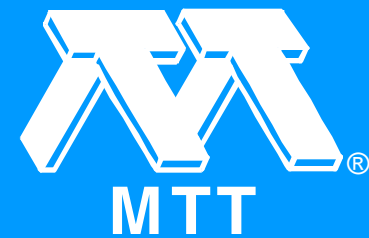
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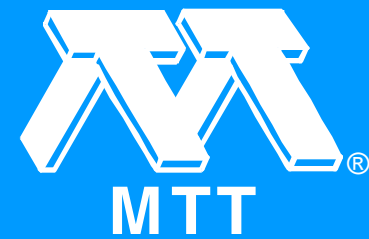
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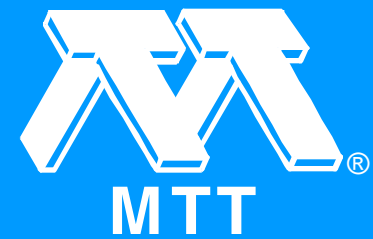
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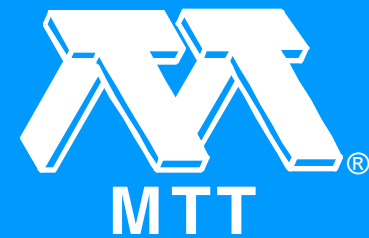
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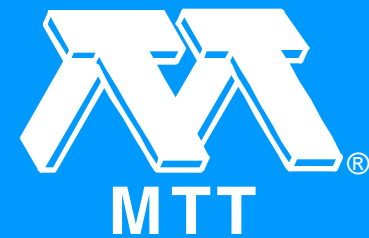
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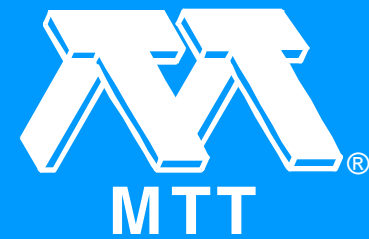
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"Information for Authors (Jan. 2001 [MWCL])." 2001 Microwave and Wireless Components Letters 11.1 (Jan. 2001 [MWCL]): 0_4-0_4.



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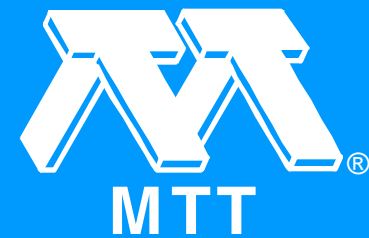
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S.M. El-Ghazaly. "Editorial (Jan. 2001 [MWCL])." 2001 Microwave and Wireless Components Letters 11.1 (Jan. 2001 [MWCL]): 1-3.



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An indium phosphide MMIC amplifier for 180-205 GHz

J.W. Archer, R. Lai, R. Grundbacher, M. Barsky, R. Tsai and P. Reid. "An indium phosphide MMIC amplifier for 180-205 GHz." 2001 Microwave and Wireless Components Letters 11.1 (Jan. 2001 [MWCL]): 4-6.

This paper describes a high-performance indium phosphide (InP) monolithic microwave integrated circuit (MMIC) amplifier, which has been developed for application in radioastronomy and imaging-array receivers. Implemented using coplanar waveguide, the six-stage amplifier exhibits 15 db gain, 10 dB input and output return loss, and low noise figure over the 180-205 GHz frequency range. Only one design pass was needed to obtain excellent agreement between the predicted and measured characteristics of the circuit, a unique achievement in this frequency band. The circuit is also the first 180-205 GHz amplifier designed for and successfully fabricated using TRW's standard 0.1- μm InP HEMT process.

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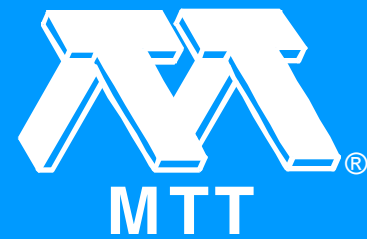


Abstracts

A beam-forming network for a circular switched-beam phased array antenna

N.C. Karmakar and M.E. Bialkowski. "A beam-forming network for a circular switched-beam phased array antenna." 2001 Microwave and Wireless Components Letters 11.1 (Jan. 2001 [MWCL]): 7-9.

This paper reports on the design and development of a dividing/phasing network for a compact switched-beam array antenna for land-vehicle mobile satellite communications. The device is formed by a switched radial divider/combiner and 1-bit phase shifters and generates a sufficient number of beams for the proper satellite tracking.



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High-isolation W-band MEMS switches

J. Rizk, Guan-Leng Tan, J.B. Muldavin and G.M. Rebeiz. "High-isolation W-band MEMS switches." 2001 Microwave and Wireless Components Letters 11.1 (Jan. 2001 [MWCL]): 10-12.

This paper presents the design, fabrication and measurement of single, T-match and π -match W-band high-isolation MEMS shunt switches on silicon substrates. The single and T-match design result in -20 dB isolation over the 80-110 GHz range with an insertion loss of 0.25/dB plusmn/0.1 dB. The π -match design results in a reflection coefficient lower than -20 dB up to 100 GHz, and an isolation of -30 to -40 dB from 75 to 110 GHz (limited by leakage through the substrate). The associated insertion loss is 0.4/dB plusmn/0.1 dB at 90 GHz. To our knowledge, this is the first demonstration of high-performance MEMS switches at W-band frequencies.

[Click on title for a complete paper.](#)



High efficiency, wide dynamic range variable gain and power amplifier MMICs for wideband CDMA handsets

G. Hau, T.B. Nishimura and N. Iwata. "High efficiency, wide dynamic range variable gain and power amplifier MMICs for wideband CDMA handsets." 2001 Microwave and Wireless Components Letters 11.1 (Jan. 2001 [MWCL]): 13-15.

A linearized variable gain amplifier (VGA) and a two-stage power amplifier (PA) MMIC were developed for 1.95-GHz wideband CDMA (W-CDMA) handsets application. A complete PA block with power control ability was obtained by cascading the VGA with the PA. The linearized VGA consists of a predistorter (PD) integrated with a conventional VGA, performing dual function for achieving high linearity power control, as well as reducing output distortion level of the following PA. With the use of predistortion, the P/sub out/ and power added efficiency (PAE) of the PA block improved from 27.5 dBm and 39.8% to 28.5 dBm and 44.8%, respectively, measured at -35 dBc adjacent channel leakage power ratio (ACPR). Under power control operation, the control range of the PA block increased from 23.6 dB to 31.2 db, and ACPR reduction of over 10 dB was achieved with the use of linearized VGA.

110 GHz vector modulator for adaptive software-controlled transmitters

D.S. McPherson, Hwa-Chang Seo, Young-Lae Jing and S. Lucyszyn. "110 GHz vector modulator for adaptive software-controlled transmitters." 2001 Microwave and Wireless Components Letters 11.1 (Jan. 2001 [MWCL]): 16-18.

A 110 GHz MMIC vector modulator for use in low-cost, high-performance, radar and communication transmitters is presented. The circuit consists of two push-pull (bi-phase) attenuators arranged in phase quadrature and has dimensions of $1.7/\text{spl times/ } 1.4 \text{ mm/sup } 2/$. The fabricated MMIC has been characterized by means of static S-parameter measurements and shows a minimum insertion loss of 12 dB at 110 GHz. Using these measurements, the required baseband input levels for a 64-QAM static constellation were determined. These levels were then applied at 10 MSample/s, by an arbitrary waveform generator, to demonstrate a 60 Mb/s data rate transmitter operating at 110 GHz. To date, this represents the highest reported RF frequency for direct multilevel carrier modulation using monolithic technology.



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Optical injection locking of a 38-GHz-band InP-based HEMT oscillator using a 1.55- μm DSB-SC modulated lightwave

H. Furuta, M. Maeda, T. Nomoto, J. Kobayashi and S. Kawasaki. "Optical injection locking of a 38-GHz-band InP-based HEMT oscillator using a 1.55- μm DSB-SC modulated lightwave." 2001 Microwave and Wireless Components Letters 11.1 (Jan. 2001 [MWCL]): 19-21.

Optical injection locking was experimentally performed using a 38-GHz-band InP-based HEMT MMIC oscillator and a 1.55- μm lightwave. Two optical modulation schemes were compared for optical injection locking, and no difference was found except for the optical modulation frequency. With suppressed carrier modulation of the lightwave, phase noise of less than -73.2 dBc/Hz at a 10-kHz frequency offset and a 14-MHz locking range were achieved.

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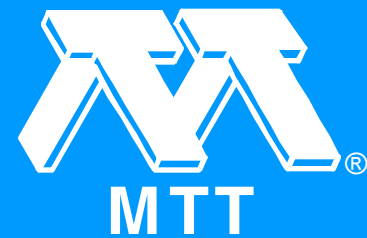


Abstracts

Application of biorthogonal interpolating wavelets to the Galerkin scheme of time dependent Maxwell's equations

M. Fujii and W.J.R. Hoefer. "Application of biorthogonal interpolating wavelets to the Galerkin scheme of time dependent Maxwell's equations." 2001 Microwave and Wireless Components Letters 11.1 (Jan. 2001 [MWCL]): 22-24.

A family of biorthogonal interpolating wavelets has been applied to time-domain electromagnetic field modeling through the wavelet-Galerkin scheme. The scaling functions are the Deslauriers-Dubuc interpolating functions and the wavelets are the shifted and contracted version of the scaling functions. This set of bases yields a simple algorithm for the solution of Maxwell's equations in time domain due to their interpolation properties. The derivation of the algorithm is presented in this paper, followed by a series of numerical verifications on some resonant structures.



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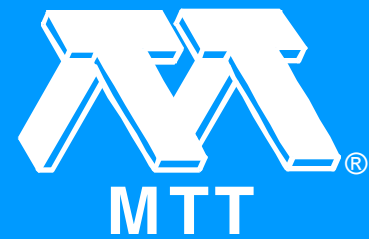
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A conformal finite difference time domain technique for modeling curved dielectric surfaces

Wenhua Yu and R. Mittra. "A conformal finite difference time domain technique for modeling curved dielectric surfaces." 2001 *Microwave and Wireless Components Letters* 11.1 (Jan. 2001 [MWCL]): 25-27.

In this paper, we present a simple yet accurate conformal Finite Difference Time Domain (FDTD) technique, which can be used to analyze curved dielectric surfaces. Unlike the existing conformal techniques for handling dielectrics, the present approach utilizes the individual electric field component along the edges of the cell, rather than requiring the calculation of its area or volume, which is partially filled with a dielectric material. The new technique shows good agreement with the results derived by mode matching and analytical methods.

Click on title for a complete paper.



A wideband coplanar stripline to microstrip transition

Young-Ho Suh and Kai Chang. "A wideband coplanar stripline to microstrip transition." 2001 Microwave and Wireless Components Letters 11.1 (Jan. 2001 [MWCL]): 28-29.

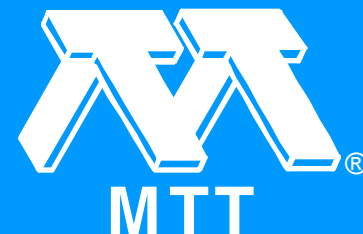
A wideband coplanar stripline (CPS)-to-microstrip line was developed. The transition has a simple structure for the ease of fabrication with low cost. The measured performance of two back-to-back transitions exhibits an insertion loss of less than 3 dB and a return loss of better than 10 dB over a bandwidth from 1.3 GHz to 13.3 GHz (1:10.2). For narrower bandwidth, an insertion loss of less than 1 dB with a return loss of better than 10 dB was achieved from 1.4 GHz to 7.3 GHz (1:5.2).

Abstracts

A new 3-dB power divider for millimeter-wavelengths

V. Vassilev, V. Belitsky, D. Urbain and S. Kovtonyuk. "A new 3-dB power divider for millimeter-wavelengths." 2001 Microwave and Wireless Components Letters 11.1 (Jan. 2001 [MWCL]): 30-32.

This paper presents a new type of 3-dB power divider that achieves wideband, low-loss, and symmetric power division. In the paper, we discuss the design considerations and present results of measurements at 10 and 100 GHz. The power divider symmetry is examined as a function of the termination loads mismatch. The simplicity of the presented divider makes it very suitable for application at millimeter and submillimeter bands. The predicted and the measured performance are in very good agreement.



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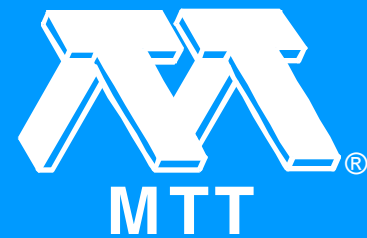
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Characteristic analysis of coupled HTS interconnects with two-dimensional FDTD

Jun-Fa Mao, Xiaoning Qian and Zhengyu Yuan. "Characteristic analysis of coupled HTS interconnects with two-dimensional FDTD." 2001 Microwave and Wireless Components Letters 11.1 (Jan. 2001 [MWCL]): 33-35.

In this work, the frequency-dependent RLGC parameters of high-speed coupled high T_c superconductor (HTS) interconnects are extracted with a two-dimensional (2-D) FDTD algorithm. The response signals of an HTS interconnect circuit and a normal Al interconnect circuit are simulated and compared, showing that not only the signal dispersion, delay, and magnitude decay of HTS interconnects are smaller than that of Al interconnects, the crosstalk of HTS interconnects is much smaller, too.

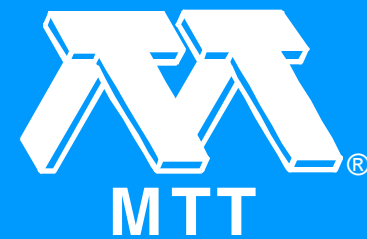
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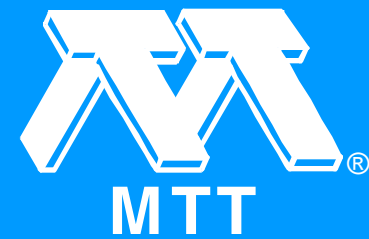
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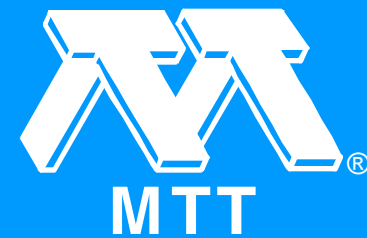
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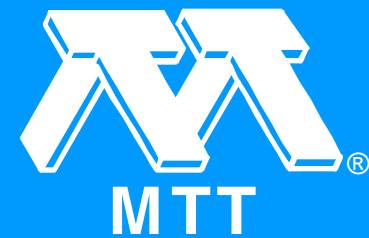
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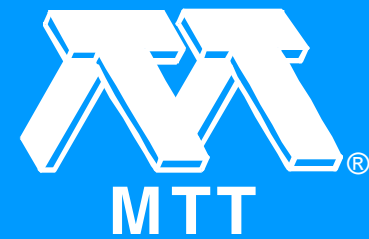
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MEM relay for reconfigurable RF circuits

R.E. Mihailovich, M. Kim, J.B. Hacker, E.A. Sovero, J. Studer, J.A. Higgins and J.F. DeNatale. "MEM relay for reconfigurable RF circuits." 2001 Microwave and Wireless Components Letters 11.2 (Feb. 2001 [MWCL]): 53-55.

We describe a microelectromechanical (MEM) relay technology for high-performance reconfigurable RF circuits. This microrelay, fabricated using surface micromachining, is a metal contact relay with electrical isolation between signal and drive lines. This relay provides excellent switching performance over a broad frequency band (insertion loss of 0.1 dB and isolation of 30 dB at 40 GHz), versatility in switch circuit configurations (microstrip and coplanar, shunt and series), and the capability for monolithic integration with high-frequency electronics. In addition, this MEM relay technology has demonstrated yields and lifetimes that are promising for RF circuit implementation.

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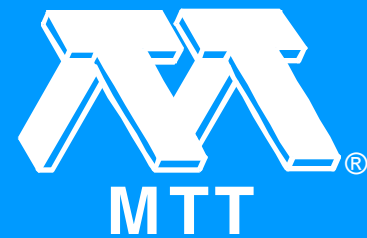


A DC-to-40 GHz four-bit RF MEMS true-time delay network

M. Kim, J.B. Hacker, R.E. Mihailovich and J.F. DeNatale. "A DC-to-40 GHz four-bit RF MEMS true-time delay network." 2001 Microwave and Wireless Components Letters 11.2 (Feb. 2001 [MWCL]): 56-58.

A monolithic true-time delay (TTD) network containing sixteen metal-to-metal contact RF microelectromechanical systems (MEMS) switches has been successfully fabricated and characterized. The TTD network was designed to produce flat delay time over a dc-to-40 GHz bandwidth with full 360-degree phase control at 22.5-degree intervals at 10.8 GHz.

Measurements show a close match to the designed delay times for all sixteen switch states with 2.2 to 2.6 dB of insertion loss at 10 GHz. The worst group delay ripple in the dc-to-30 GHz range was 3 ps, well within the single bit delay time of 5.8 ps.



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Low-loss micromachined inverted overlay CPW lines with wide impedance ranges and inherent airbridge connection capability

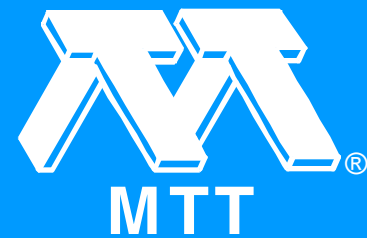
Youngwoo Kwon, Hong-Teuk Kim, Jae-Hyoung Park and Yong-Kweon Kim. "Low-loss micromachined inverted overlay CPW lines with wide impedance ranges and inherent airbridge connection capability." 2001 Microwave and Wireless Components Letters 11.2 (Feb. 2001 [MWCL]): 59-61.

A new type of overlay coplanar waveguide (CPW) structure, "inverted overlay CPW (IOCPW)" is developed using micromachining techniques to provide easy means of airbridge connection between the ground planes, as well as to achieve low losses over wide impedance ranges. Measured IOCPW showed less than 1 dB/cm loss at 50 GHz over a wide impedance range from 25 to 80 Ω . It also offered low effective dielectric constant, and insensitivity to the substrate losses. Wide impedance ranges and simple process steps make IOCPW a promising uniplanar transmission line medium for mm-wave monolithic applications.

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Surface wave enhanced broadband planar antenna for wireless applications

K.M.K.H. Leong, Y. Qian and T. Itoh. "Surface wave enhanced broadband planar antenna for wireless applications." 2001 Microwave and Wireless Components Letters 11.2 (Feb. 2001 [MWCL]): 62-64.

This letter explores the development of a new class of broadband antenna in which TE/sub 0/ surface-wave is used as the primary source of free space radiation. We demonstrate that antennas based on this concept can be designed to operate over a broad bandwidth, be extremely compact, and can be easily integrated with MIC and MMIC technology. Measurement of return loss and radiation pattern characteristics of the antenna described in this letter indicate a 47% operating bandwidth, covering a large part of the frequency spectrum assigned for U.S. as well as European high-speed wireless local area network (WLAN) applications, making it ideal for integration with WLAN modules.

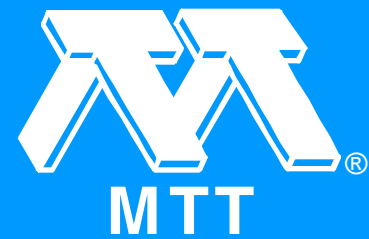
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Novel reduced-size coplanar-waveguide bandpass filters

Yu-Kang Kuo, Chi-Hsueh Wang and Chun Hsiung Chen. "Novel reduced-size coplanar-waveguide bandpass filters." 2001 Microwave and Wireless Components Letters 11.2 (Feb. 2001 [MWCL]): 65-67.

Two novel reduced-size coplanar-waveguide (CPW) bandpass filters are proposed. Specifically, the bended short-end parallel stubs together with the folded open-end series stubs are utilized to design a broadband filter, and the slow-wave structures are adopted to implement a narrowband filter. In this study, the proposed filters are examined, theoretically and experimentally.



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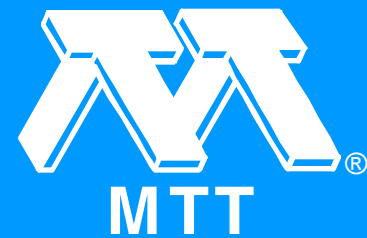
Integrated microstrip and rectangular waveguide in planar form

D. Deslandes and K. Wu. "Integrated microstrip and rectangular waveguide in planar form." 2001 Microwave and Wireless Components Letters 11.2 (Feb. 2001 [MWCL]): 68-70.

Usually transitions from microstrip line to rectangular waveguide are made with three-dimensional complex mounting structures. In this paper, a new planar platform is developed in which the microstrip line and rectangular waveguide are fully integrated on the same substrate, and they are interconnected via a simple taper. Our experiments at 28 GHz show that an effective bandwidth of 12% at 20 dB return loss is obtained with an in-band insertion loss better than 0.3 dB. The new transition allows a complete integration of waveguide components on substrate with MICs and MMICs.

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On the existence of spurious modes in Battle-Lemarie based MRTD

C.D. Sarris and L.P.B. Katehi. "On the existence of spurious modes in Battle-Lemarie based MRTD." 2001 Microwave and Wireless Components Letters 11.2 (Feb. 2001 [MWCL]): 71-73.

A distinction between the effects of inaccuracy of the Battle-Lemarie wavelet based multiresolution time domain (W-MRTD) scheme for high spatial frequencies and spurious modes is drawn and explained. Investigating the performance of the scheme under various excitation methods, it is concluded that what was described earlier in the literature as a spurious mode effect actually corresponds to alias frequencies stemming from the excitation of higher order modes by the wavelets, given that the latter are spectrally supported at higher wavenumbers.

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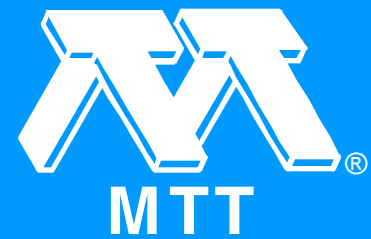


Abstracts

An accurate 2-D hard-source model for FDTD

R. Makinen, J. Juntunen and M. Kivikoski. "An accurate 2-D hard-source model for FDTD." 2001 Microwave and Wireless Components Letters 11.2 (Feb. 2001 [MWCL]): 74-76.

This letter describes an accurate two-dimensional (2-D) hard-source model for finite-difference time-domain (FDTD). The proposed model allows accurate control over the effective radius of a 2-D hard source. In addition, the TM version of the source model is directly applicable as a very accurate 2-D thin-wire model. The proposed model is verified in 2-D for both TM and TE case using a recently introduced method for finding the effective radius of a filamentary 2-D hard source.



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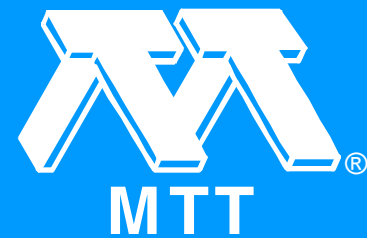
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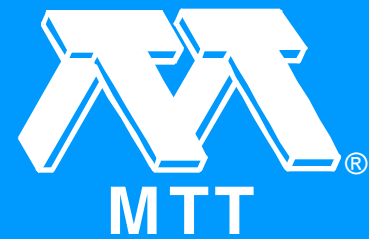
Incorporating two-port networks with S-parameters into FDTD

X. Ye and J.L. Drewniak. "Incorporating two-port networks with S-parameters into FDTD." 2001 Microwave and Wireless Components Letters 11.2 (Feb. 2001 [MWCL]): 77-79.

A modeling approach for incorporating a two-port network with S-parameters in the finite-difference time-domain (FDTD) method is reported. The proposed method utilizes the time-domain Y-parameters to describe the network characteristics, and incorporates the Y-parameters into the FDTD algorithm. The generalized pencil-of-function technique is applied to improve the memory efficiency of this algorithm by generating a complex exponential series for the Y-parameters and using recursive convolution in the FDTD updating equations. A modeling example is given, which shows that this approach is effective and accurate. This modeling technique can be extended for incorporating any number of N-port networks in the FDTD modeling.

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S-parameter broadband measurements on-coplanar and fast extraction of the substrate intrinsic properties

J. Hinojosa. "S-parameter broadband measurements on-coplanar and fast extraction of the substrate intrinsic properties." 2001 Microwave and Wireless Components Letters 11.2 (Feb. 2001 [MWCL]): 80-82.

A broadband technique for determining the electromagnetic properties of isotropic thin-film materials, which uses a coplanar line, is presented. Complex permittivity and permeability are computed from S-parameter measurements of a coplanar cell propagating the dominant mode. Measured ϵ_{eff} and μ_{eff} data for several materials are presented between 0.05 GHz and 40 GHz. This technique shows a good agreement between measured and predicted data.

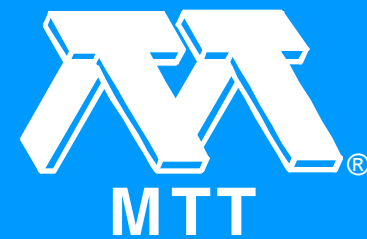
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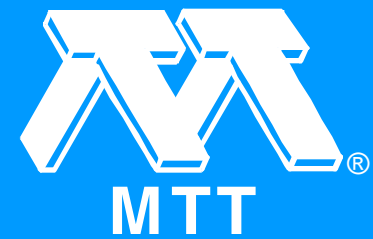
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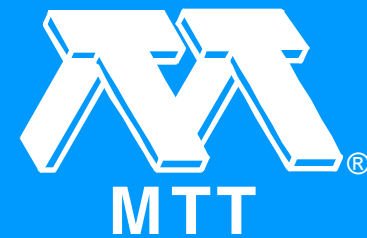
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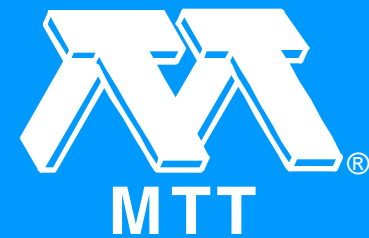
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*"Information for Authors Submitting Manuscripts in Electronic Form (Mar. 2001 [MWCL])." 2001
Microwave and Wireless Components Letters 11.3 (Mar. 2001 [MWCL]): 0_3-0_4.*



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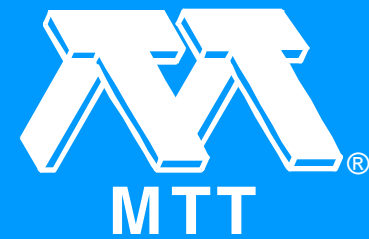
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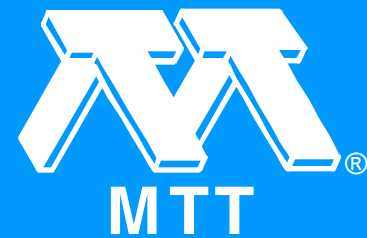
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60 GHz millimeter-wave source using two-mode injection-locking of a Fabry-Perot slave laser

M. Ogusu, K. Inagaki and Y. Mizuguchi. "60 GHz millimeter-wave source using two-mode injection-locking of a Fabry-Perot slave laser." 2001 Microwave and Wireless Components Letters 11.3 (Mar. 2001 [MWCL]): 101-103.

We demonstrate 60 GHz carrier generation and transmission using a two-mode injection-locked Fabry-Perot (F-P) slave laser. The relationship between the power of the generated carriers and the frequency of the reference signal for the injection-locking is also investigated. The RF power-penalty caused by fiber dispersion was within 2.0 dB when the locked modes were transmitted at a distance of 0.5-48 km. Accordingly, the two-mode locked F-P laser can be used in fiber-based millimeter-wave systems.

Click on title for a complete paper.



Ultra compact, low loss, varactor tuned phase shifter MMIC at C-band

F. Ellinger, R. Vogt and W. Bachtold. "Ultra compact, low loss, varactor tuned phase shifter MMIC at C-band." 2001 Microwave and Wireless Components Letters 11.3 (Mar. 2001 [MWCL]): 104-105.

This paper presents a high yield, ultra compact, low loss phase shifter MMIC, realized with a commercial 0.6 μm GaAs MESFET process. Phase shift is enabled by varying the varactor capacitances of the lumped element equivalent of a transmission line. Continuously adjustable phase control over 90 deg is achieved from 4 GHz up to 6 GHz, with a loss of less than 2.2 dB. At 5.2 GHz, a loss of 1.2 dB and a loss variation of ± 0.5 dB is measured. Phase and loss variations for several circuits from different wafers are within ± 1 deg and ± 0.1 dB, respectively, indicating low dependences on process variations. The phase shifter requires a circuit size of only 0.2 mm², which to our knowledge is the smallest size for a continuously adjustable passive phase shifter with comparable performance, reported to date.

MEMS microswitches for reconfigurable microwave circuitry

S. Duffy, C. Bozler, S. Rabe, J. Knecht, L. Travis, P. Wyatt, C. Keast and M. Gouker. "MEMS microswitches for reconfigurable microwave circuitry." 2001 Microwave and Wireless Components Letters 11.3 (Mar. 2001 [MWCL]): 106-108.

The performance is reported for a new microelectromechanical structure (MEMS) cantilever microswitch. We report on both dc- and capacitively-contacted microswitches. The dc-contacted microswitches have contact resistance of less than 1 Ω , and the RF loss of the switch up to 40 GHz in the closed position is 0.1-0.2 dB. Capacitively-contacted switches have an impedance ratio of 141:1 from the open to closed state and in the closed position have a series capacitance of 1.2 pF. The capacitively-contacted switches have been measured up to 40 GHz with S_{22} less than -0.7 dB across the 5-40 GHz band.



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Intermodulation nulling in HEMT common source amplifiers

A.E. Parker and Guoli Qu. "Intermodulation nulling in HEMT common source amplifiers." 2001 Microwave and Wireless Components Letters 11.3 (Mar. 2001 [MWCL]): 109-111.

A new model of the second- and third-order intermodulation products from HEMT and MESFET small-signal amplifiers, resulting from nonlinear drain-source current has been proposed in our previous publications. Based on this model, intermodulation nulling conditions in terms of the Taylor series coefficients, hence in terms of bias, have been investigated. This paper now examines the load dependence of the second- and third-order intermodulation products in HEMT small-signal common source amplifiers. Intermodulation nulling conditions are proposed and validated. This is useful in designing a high performance amplifier by calculation of optimum load for minimum distortion and studying distortion generation as a function of circuit topology.

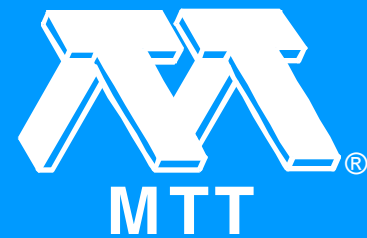
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Close coupled resonant aperture inserts for waveguide filtering applications

R.D. Seager and J.C. Vardaxoglou. "Close coupled resonant aperture inserts for waveguide filtering applications." 2001 Microwave and Wireless Components Letters 11.3 (Mar. 2001 [MWCL]): 112-114.

A two-layer frequency selective surface (FSS) is used as a very compact and lightweight transverse waveguide filter element. A narrow-band transmission response is produced from two layers, which, otherwise, in isolation would exhibit a broadband response. Measured results are compared with theoretical data obtained from a Transmission Line Matrix (TLM) based modeling method. Reduction in the passband bandwidth of a factor of four has been achieved using the proposed structure.



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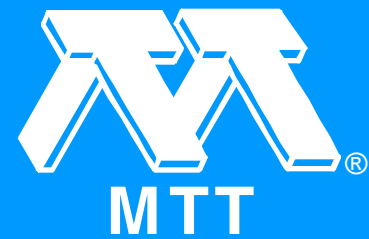
Use of induced noise to calibrate injection-locked phase noise measurements

A. Robriquez, L.P. Dunleavy and A. Boudiaf. "Use of induced noise to calibrate injection-locked phase noise measurements." 2001 Microwave and Wireless Components Letters 11.3 (Mar. 2001 [MWCL]): 115-117.

A new calibration approach is described for phase noise measurements of free-running voltage controlled oscillators using the injection locking technique. The injection locking technique allows the locking of free running oscillators to a reference over a wide bandwidth during a phase noise measurement. Compared to conventional phase noise measurement techniques, the injection locking technique involves a calibration procedure, which may be tedious and time consuming. The new approach may be used to perform an automated calibration procedure of the system commonly used for these measurements.

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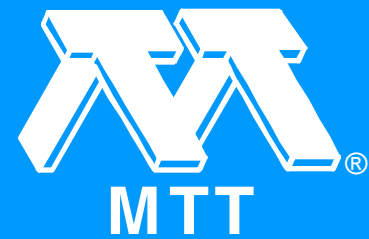
A simple method for accurate loss tangent measurement of dielectrics using a microwave resonant cavity

Daiqing Li, C.E. Free, K.E.G. Pitt and P.G. Barnwell. "A simple method for accurate loss tangent measurement of dielectrics using a microwave resonant cavity." 2001 Microwave and Wireless Components Letters 11.3 (Mar. 2001 [MWCL]): 118-120.

A simple yet rigorous method has been developed to enable the loss tangent of dielectrics, having a known relative permittivity, to be accurately measured using a waveguide resonant cavity. The novel method eliminates the need for any physical measurement, either on the cavity or dielectric sample under test. The only electrical parameters that need to be measured are resonant frequencies and Q-factors of a reference cavity and those of the same cavity loaded with the dielectric sample. One of the advantages of the new technique is that dielectrics, of arbitrary shape, can be characterized at very high microwave frequencies. The new method has been verified through measurement over X-band.

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Multiple dielectric slabs in waveguide cell

K.P. Thakur and A.G. Williamson. "Multiple dielectric slabs in waveguide cell." 2001 Microwave and Wireless Components Letters 11.3 (Mar. 2001 [MWCL]): 121-123.

The transverse resonance method is used to evaluate the effective dielectric constant of a material present in the form of multiple slabs that partially fill a waveguide cell. It is shown that the commonly-used linear relationship for the effective dielectric constant of a mixture of dielectrics holds good to better than 1% accuracy only when the slabs are, in general, of a width each less than 5% of the wavelength in the dielectric. Alternative mixture equations with empirical terms are also presented.

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A 4:1 unequal Wilkinson power divider

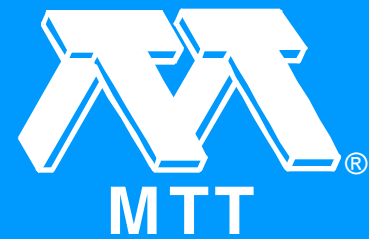
Jeng-Sik Lim, Sung-Won Lee, Chul-Soo Kim, Jun-Seok Park, Dal Ahn and Sangwook Nam. "A 4:1 unequal Wilkinson power divider." 2001 Microwave and Wireless Components Letters 11.3 (Mar. 2001 [MWCL]): 124-126.

This letter presents the design and measured performances of a microstrip 4:1 unequal Wilkinson power divider. The divider is designed using the conventional Wilkinson topology with the defected ground structure (DGS). The DGS on the ground plane provides an additional effective inductive component to the microstrip line. This enables the microstrip line to be realized with very high impedance of over $150 \text{ } \Omega$. By employing the DGS to the unequal Wilkinson topology, 4:1 power dividing ratio can be obtained easily without any problem in realization, while it has been impractical to fabricate a 4:1 divider using the conventional microstrip line because of very thin conductor width and extremely low aspect ratio (W/H). As an example, a 4:1 divider has been designed and measured at 1.5 GHz in order to show the validity of the proposed DGS and unequal divider. The measured performances of the 4:1 unequal power divider well agree with the exactly same dividing ratio as that expected.

Finite-ground coplanar-waveguide branch-line couplers

Chieng-Tang Lin, Chun-Lin Liao and Chun Hsiung Chen. "Finite-ground coplanar-waveguide branch-line couplers." 2001 Microwave and Wireless Components Letters 11.3 (Mar. 2001 [MWCL]): 127-129.

Two branch-line (BL) couplers based on finite-ground coplanar-waveguide (FGCPW) structures are proposed. The first one uses the bended structure to reduce the size of the normal quarter-wavelength two-arm BL coupler. The second one improves the bandwidth by adding external compensated networks, which are also folded for size reduction. In this study, the performances of these BL couplers are examined, theoretically and experimentally.



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A confocal microwave imaging algorithm for breast cancer detection

Xu Li and S.C. Hagness. "A confocal microwave imaging algorithm for breast cancer detection." 2001 Microwave and Wireless Components Letters 11.3 (Mar. 2001 [MWCL]): 130-132.

We present a computationally efficient and robust image reconstruction algorithm for breast cancer detection using an ultrawideband confocal microwave imaging system. To test the efficacy of this approach, we have developed a two-dimensional (2-D) anatomically realistic MRI-derived FDTD model of the cancerous breast. The image reconstruction algorithm is applied to FDTD-computed backscatter signals, resulting in a microwave image that clearly identifies the presence and location of the malignant lesion. These simulations demonstrate the feasibility of detecting and imaging small breast tumors using this novel approach.

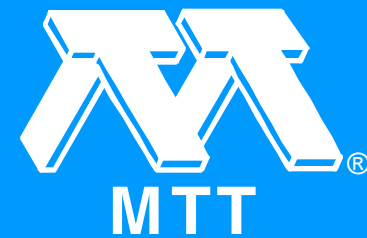
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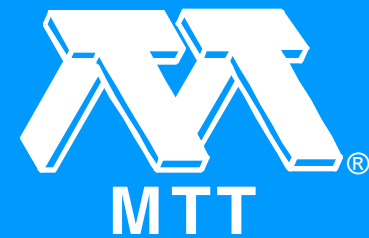
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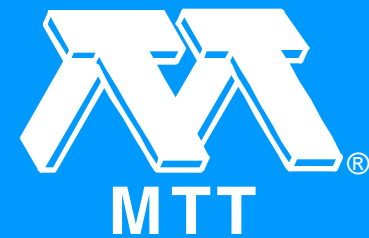
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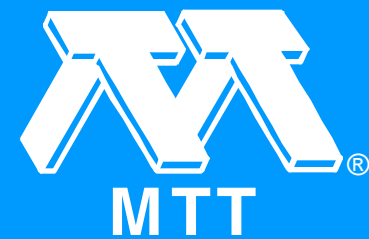
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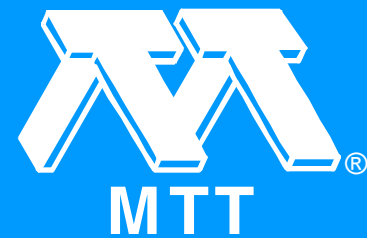
Unconditionally stable D-H FDTD formulation with anisotropic PML boundary conditions

G. Lazzi. "Unconditionally stable D-H FDTD formulation with anisotropic PML boundary conditions." 2001 Microwave and Wireless Components Letters 11.4 (Apr. 2001 [MWCL]): 149-151.

An unconditionally stable finite difference time domain (FDTD) method based on a D-H formulation and the recently proposed alternating-direction-implicit (ADI) marching scheme is presented. The advantage of the D-H algorithm over the conventional E-H is the possibility to easily implement an unsplit field components formulation of the PML absorbing boundary condition that is independent from the background material used in the FDTD grid. The method allows therefore immersing any dielectric in the PML layers without any special consideration, and is amenable for models truncation often used in biomedical simulations. Furthermore, the proposed scheme can be extended to account for frequency dispersive dielectrics.

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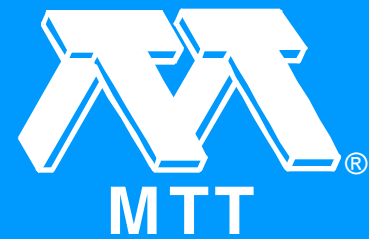
High-performance absorbing boundary conditions for photonic crystal waveguide simulations

M. Koshiba, Y. Tsuji and S. Sasaki. "High-performance absorbing boundary conditions for photonic crystal waveguide simulations." 2001 Microwave and Wireless Components Letters 11.4 (Apr. 2001 [MWCL]): 152-154.

A high-performance absorbing boundary condition is newly developed for the reduction of spurious reflections in photonic crystal (PC) waveguide simulations. The PC waveguide is terminated with a perfectly matched layer (PML) in which the original PC structure remains as is. This PC-based PML works well, compared to a conventional PML, which acts as a homogeneous absorbing medium, simulating a semi-infinite free space and to a distributed-Bragg-reflector waveguide, which was recently developed to reduce reflections from PC waveguide ends, improving a wavenumber matching condition for PC waveguide modes.

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Zero reflection coefficient in discretized PML

J.S. Juntunen, N.V. Kantartzis and T.D. Tsiboukis. "Zero reflection coefficient in discretized PML." 2001 Microwave and Wireless Components Letters 11.4 (Apr. 2001 [MWCL]): 155-157.

In this paper we present a closed-form reflection coefficient for the perfectly matched layer (PML), when realized using the finite-difference time-domain (FDTD) algorithm. Examining the reflection coefficient, it is found that zero reflection can be obtained for isolated pairs of frequency and angle of incidence.

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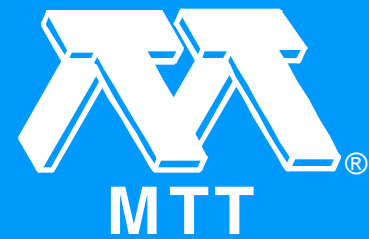
Effective permittivities for second-order accurate FDTD equations at dielectric interfaces

Kyu-Pyung Hwang and A.C. Cangellaris. "Effective permittivities for second-order accurate FDTD equations at dielectric interfaces." 2001 Microwave and Wireless Components Letters 11.4 (Apr. 2001 [MWCL]): 158-160.

In Yee's finite-difference time-domain (FDTD) scheme, effective permittivities are often used to account for offsets of dielectric interfaces from grid nodes. The specific values of these effective permittivities must be chosen in such a way that the second-order accuracy of the scheme is preserved. It is shown in this work that, contrary to more elaborate techniques proposed recently for the development of these effective permittivities, a rigorous application of the integral forms of Maxwell's curl equations on the Yee's lattice leads to the desired values in a straightforward fashion. Numerical experiments in a two-dimensional (2-D) cavity are used to verify that the calculated effective permittivities preserve the second-order accuracy of the FDTD scheme.

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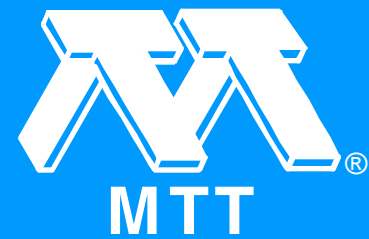
State-variable-based transient circuit simulation using wavelets

C.E. Christoffersen and M.B. Steer. "State-variable-based transient circuit simulation using wavelets." 2001 Microwave and Wireless Components Letters 11.4 (Apr. 2001 [MWCL]): 161-163.

For the first time a state variable transient analysis using wavelets is developed and implemented in a circuit simulator. The formulation is particularly well suited to modeling RF and microwave circuits and is validated by considering a nonlinear transmission line. However, results indicate that still more research is needed to make this method efficient for the simulation of large circuits.

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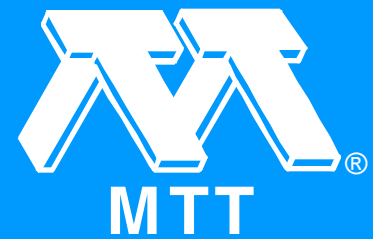
Electric field mapping system using an optical-fiber-based electrooptic probe

K. Yang, P.B. Katehi and J.F. Whitaker. "Electric field mapping system using an optical-fiber-based electrooptic probe." 2001 Microwave and Wireless Components Letters 11.4 (Apr. 2001 [MWCL]): 164-166.

A microwave electric-field mapping system based on electrooptic sampling has been developed using micromachined GaAs crystals mounted on gradient index lenses and single-mode optical fibers. The probes are able to detect three orthogonal polarizations of electric fields and, due to the flexibility and size of the optical fiber, can be positioned not only from the extreme near-field to the far-field regions of microwave and millimeter-wave structures, but also inside of enclosures such as waveguides and packages.

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Membrane-supported CPW with mounted active devices

W.Y. Liu, D. Steenson and M.B. Steer. "Membrane-supported CPW with mounted active devices." 2001 Microwave and Wireless Components Letters 11.4 (Apr. 2001 [MWCL]): 167-169.

This paper reports the fabrication of printed circuit lines on a 5 μm thick membrane that minimizes dielectric loss and effectively eliminates surface modes, both of which are important for operation at millimeter-wave and submillimeter-wave frequencies. The relatively low-cost low-temperature process uses a photosensitive resin (SU-8) to form the membrane and enables devices to be mounted on it.

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A power amplifier with efficiency improved using defected ground structure

Jong-Sik Lim, Ho-Sup Kim, Jun-Seok Park, Dal Ahn and Sangwook Nam. "A power amplifier with efficiency improved using defected ground structure." 2001 Microwave and Wireless Components Letters 11.4 (Apr. 2001 [MWCL]): 170-172.

The authors report the effects of defected ground structure (DGS) on the output power and efficiency of a class-A power amplifier. In order to evaluate the effects of DGS on the efficiency and output power, two class-A GaAs FET amplifiers have been measured at 4.3/spl sim/4.7 GHz. One of them has a 50 /spl Omega/ microstrip line with DGS at the output section, while the other has only 50 /spl Omega/ straight line. It is shown that DGS rejects the second harmonic at the output and yields improved output power and power added efficiency by 1/spl sim/5%.



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Accurate modeling of metal plate-loaded loop-coupled cavities with slots

L. Pierantoni and T. Rozzi. "Accurate modeling of metal plate-loaded loop-coupled cavities with slots." 2001 Microwave and Wireless Components Letters 11.4 (Apr. 2001 [MWCL]): 173-175.

In this work, we analyze the problem of the electromagnetic field radiated from apertures in coaxial fed metal enclosures loaded with metal inserts. Such situations are found, for example, in PC environments where slots and apertures are used for the purpose of heat dissipation, CD-ROMs, cable penetration etc. We derive an accurate model of the entire structure, including the coaxial line-to-loop-to-cavity feed and the inner metal planes, simulating the presence of the circuitry inside. The analysis is developed by means of the hybrid transmission line matrix-integral equation (TLM-IE) method and theoretical results are compared with experimental ones showing very good agreement. The evaluation of the reflection coefficient and of the level of radiated emission as functions of the metal plates position is very helpful toward the engineering design of the entire structure. The numerical simulations require rather low computational effort.

Click on title for a complete paper.



Efficient analysis of magnetostatic surface waves in printed and suspended ferrite loaded strip lines

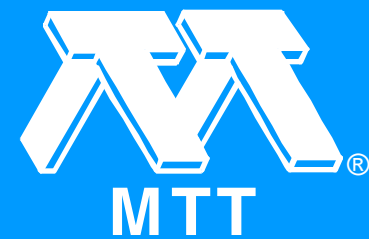
R. Rafii-El-Idrissi, R. Marques and F. Medina. "Efficient analysis of magnetostatic surface waves in printed and suspended ferrite loaded strip lines." 2001 Microwave and Wireless Components Letters 11.4 (Apr. 2001 [MWCL]): 176-178.

This paper analyzes the guidance of magnetostatic surface waves (MSSW) by a metallic strip printed on a ferrimagnetic slab or on a dielectric/ferrimagnetic structure (suspended configuration) in the frame of the magnetostatic approach. An integral spectral domain analysis (SDA) is used for this purpose. Shielding upper and/or lower ground planes are also considered. Some interesting new physical effects, such as backward and complex MSSWs in the suspended configuration are reported. Good agreement with previously published experimental and computed results confirms the validity of our approach.

Abstracts

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"Patent abstracts (Apr. 2001 [MWCL])." 2001 Microwave and Wireless Components Letters 11.4 (Apr. 2001 [MWCL]): 179-190.



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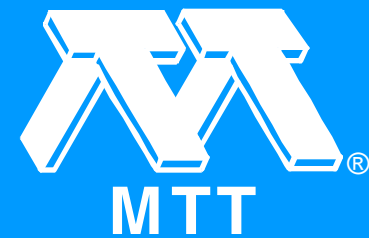
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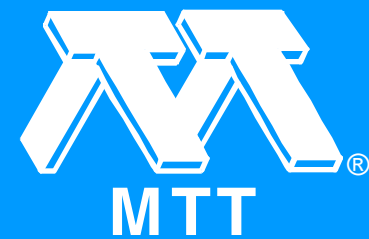
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"Inside Cover (May 2001 [MWCL])." 2001 Microwave and Wireless Components Letters 11.5 (May 2001 [MWCL]): 0_2-0_2.



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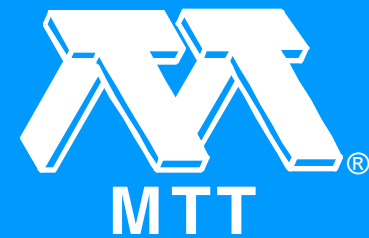
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*"Information for Authors Submitting Manuscripts in Electronic Form (May 2001 [MWCL])." 2001
Microwave and Wireless Components Letters 11.5 (May 2001 [MWCL]): 0_3-0_4.*



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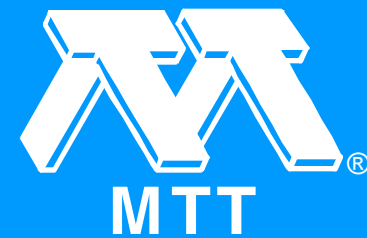
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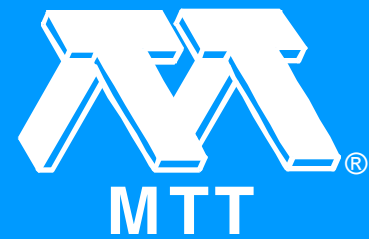


An efficient HBT/RTD oscillator for wireless applications

H.J. De Los Santos, K.K. Chui, D.H. Chow and H.L. Dunlap. "An efficient HBT/RTD oscillator for wireless applications." 2001 Microwave and Wireless Components Letters 11.5 (May 2001 [MWCL]): 193-195.

In this paper, we introduce a novel HBT/RTD oscillator suitable for monolithic integration and efficient low power/battery-operated applications. Implementation of a circuit prototype was accomplished by configuring an InP-based monolithic HBT/RTD chip with a gold wire bond inductor in a hybrid microwave package. For an output frequency of 5.8 GHz, the circuit draws a current of 15.5 mA from a 1.5 V supply and generates an output power of +3.13 dBm, for an efficiency of 8.84%.

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Effects of nonlinear diode junction capacitance on the nose-to-nose calibration

K.A. Remley, D.F. Williams, D.C. DeGroot, J. Verspecht and J. Kerley. "Effects of nonlinear diode junction capacitance on the nose-to-nose calibration." 2001 Microwave and Wireless Components Letters 11.5 (May 2001 [MWCL]): 196-198.

We examine the effects of nonlinear diode junction capacitance on the fundamental premise of the nose-to-nose calibration, that the kickout pulse is identical in shape and duration to the impulse response of a sampling circuit. We offer a physical explanation for the error introduced by the nonlinear junction capacitance using small-signal diode equations.

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A fully-integrated low-power low-noise 2.6-GHz bipolar VCO for wireless applications

C. Samori, A. Zanchi, S. Levantino and A.L. Lacaita. "A fully-integrated low-power low-noise 2.6-GHz bipolar VCO for wireless applications." 2001 Microwave and Wireless Components Letters 11.5 (May 2001 [MWCL]): 199-201.

The low quality factor of the inductors fabricated in fully-integrated LC tanks results in a poor indirect stability of the oscillators, which are therefore highly sensitive to low-frequency noise and disturbances coupled through substrate and supply lines. The paper addresses the design of a 2-V voltage-controlled oscillator (VCO) at 2.6 GHz fabricated in a Si-bipolar process with $f_{\text{sub T}}$ of 20 GHz. The circuit bias and the transistor layout have been specifically optimized to minimize the phase noise degradation due to the intrinsic low indirect stability. A single sideband-to-carrier ratio (SSCR) of -104 dBc/Hz at 100 kHz is demonstrated with less than 14 mW power consumption.

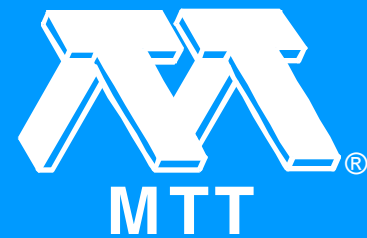
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Novel oscillator incorporating a compact microstrip resonant cell

Quan Xue, Kam Man Shum and Chi Hou Chan. "Novel oscillator incorporating a compact microstrip resonant cell." 2001 Microwave and Wireless Components Letters 11.5 (May 2001 [MWCL]): 202-204.

A novel transistor oscillator incorporating a compact microstrip resonant cell (CMRC) as its terminating resonance is proposed. Adjusting the dimensions of the cell, it is possible that the fundamental frequency can be positively fed back and the second harmonic negatively fed back at the input port of the oscillator. The fundamental output is enhanced with the second harmonic being suppressed. The output power of the proposed CMRC oscillator is 14.7 dBm at 2.5 GHz with 27.1 dB rejection of the second harmonic, outperforming the conventional microstrip termination with a 40% size reduction.



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High performance dual directional couplers for near-mm wavelengths

N.R. Erickson. "High performance dual directional couplers for near-mm wavelengths." 2001 Microwave and Wireless Components Letters 11.5 (May 2001 [MWCL]): 205-207.

A low loss, high directivity dual directional coupler has been developed suitable for fabrication in waveguide bands up to WR3 (220-325 GHz). The design uses waveguide split on the E plane centerline with three waveguides running side by side and coupling holes made by drilling through all three guides. Construction is relatively simple and the resulting structure is very robust mechanically. Typical coupling is 15 dB, directivity is 25-30 dB, and the insertion loss of the WR3 coupler is 0.5 dB.

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Novel low-cost ultra-wideband, ultra-short-pulse transmitter with MESFET impulse-shaping circuitry for reduced distortion and improved pulse repetition rate

Jeong Soo Lee and Cam Nguyen. "Novel low-cost ultra-wideband, ultra-short-pulse transmitter with MESFET impulse-shaping circuitry for reduced distortion and improved pulse repetition rate." 2001 Microwave and Wireless Components Letters 11.5 (May 2001 [MWCL]): 208-210.

A new ultra-wideband, ultra-short-pulse transmitter has been developed using microstrip lines, step-recovery and Schottky diodes, MESFET, and monolithic microwave integrated circuit (MMIC) amplifier. This transmitter employs a novel MESFET impulse-shaping circuit to achieve several unique advantages, including less distortion, easy broadband matching, and increased pulse repetition rate. The transmitter produces 300-ps monocycle pulses with about 2 V peak-to-peak and a pulse repetition rate of 10 MHz. The measured pulses have good symmetry and low ringing level.

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A new finite element model for reduced order electromagnetic modeling

Yu Zhu and A.C. Cangellaris. "A new finite element model for reduced order electromagnetic modeling." 2001 Microwave and Wireless Components Letters 11.5 (May 2001 [MWCL]): 211-213.

This paper introduces a new formulation suitable for direct model order reduction of finite element approximations of electromagnetic systems using Krylov subspace methods. The proposed formulation utilizes a finite element model of Maxwell's curl equations to generate a state-space representation of the electromagnetic system most suitable for the implementation of model order reduction techniques based on Krylov subspaces. It is shown that, with a proper selection of the finite element interpolation functions for the fields, the proposed formulation is equivalent to the commonly used approximation of the vector wave equation with tangentially continuous vector finite elements. This equivalence is exploited to improve the computational efficiency of the model order reduction process.

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Cutoff wavenumbers in truncated waveguides

Sheng-Li Lin, Le-Wei Li, Tat-Soon Yeo and Mook-Seng Leong. "Cutoff wavenumbers in truncated waveguides." 2001 Microwave and Wireless Components Letters 11.5 (May 2001 [MWCL]): 214-216.

Truncated waveguides are used in some microwave components. The cutoff wavenumbers in truncated circular waveguide and truncated square waveguide are desired but usually difficult to be computed. In this paper, they are efficiently determined using the unified method that we proposed earlier. Both TE-polarized and TM-polarized modes are studied. To demonstrate the applicability and correctness of this method, two practical examples are considered, one is a truncated circular waveguide and the other is a truncated square waveguide. Results obtained for the two cases are compared with existing data in literature and a good agreement is observed. A further extension of the work is made to compute cutoff wavenumbers of a truncated elliptical waveguide. It is found from the analysis that the cutoff wavenumbers in these irregular waveguides can be computed easily, rapidly, and accurately using the unified method.

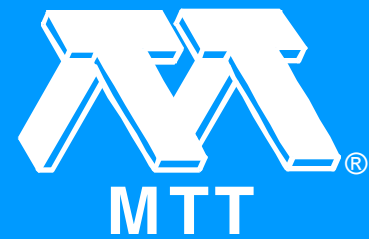
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Optical fiber recirculating delay line incorporating a fiber grating array

W. Zhang, J.A.R. Williams and I. Bennion. "Optical fiber recirculating delay line incorporating a fiber grating array." 2001 Microwave and Wireless Components Letters 11.5 (May 2001 [MWCL]): 217-219.

For a practical optical fiber recirculating delay line the maximum notch depth and tunable free spectral range are difficult to achieve because of fixed coupling coefficient and loop length. We present here an optical fiber recirculating delay line incorporating a fiber grating array. In this work, the effect of insertion loss in the delay loop is investigated and used to maximize the notch depth of the frequency response. The tunable free spectral range is obtained from the wavelength dependent loop length introduced by the fiber grating array.



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Time-domain finite-element modeling of dispersive media

D. Jiao and Jian-Ming Jin. "Time-domain finite-element modeling of dispersive media." 2001 Microwave and Wireless Components Letters 11.5 (May 2001 [MWCL]): 220-222.

A general formulation is described for time-domain finite-element modeling of electromagnetic fields in a general dispersive medium. The formulation is based on the second-order vector wave equation and incorporates the dispersion effect of a medium via a recursively evaluated convolution integral. This evaluation is kept to second order in accuracy using linear interpolation within each time step. Numerical examples are given to validate the proposed formulation.

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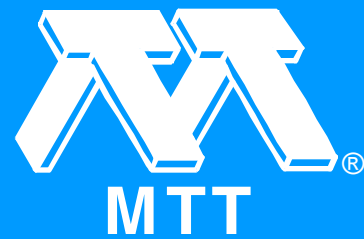


Abstracts

Computation of resonant frequencies and quality factors of cavities by FDTD technique and Pade approximation

Wei-Hua Guo, Wei-Jun Li and Yong-Zhen Huang. "Computation of resonant frequencies and quality factors of cavities by FDTD technique and Pade approximation." 2001 Microwave and Wireless Components Letters 11.5 (May 2001 [MWCL]): 223-225.

The finite-difference time domain (FDTD) technique and the Pade approximation with Baker's algorithm are used to calculate the mode frequencies and quality factors of cavities. Comparing with the fast Fourier transformation/Pade method, we find that the Pade approximation and the Baker's algorithm can obtain exact resonant frequencies and quality factors based on a much shorter time record of the FDTD output.



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A fast PEEC technique for full-wave parameters extraction of distributed elements

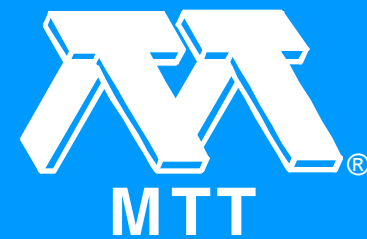
Swee Ann Teo, Ban Leong Ooi, Siou Teck Chew and Mook Seng Leon. "A fast PEEC technique for full-wave parameters extraction of distributed elements." 2001 Microwave and Wireless Components Letters 11.5 (May 2001 [MWCL]): 226-228.

In this paper, a full wave partial element equivalent circuit (PEEC) technique using exact Green's function is introduced for the parameter extraction of a passive device in a homogeneous media over a wide frequency range from dc to a frequency of interest. This technique makes use of some analytical techniques and cartesian multipole expansion to derive simple closed form expressions for each individual element of the coupling matrices that commonly arise in integral equation algorithms, in terms of the wave number alone. Hence, these matrices can be reused each time a new frequency is selected. As simple closed form expressions are used, very fast computation is possible.

Abstracts

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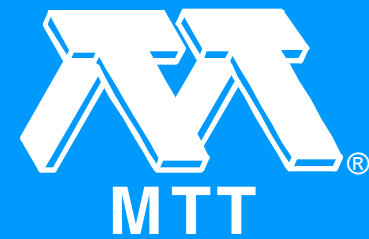
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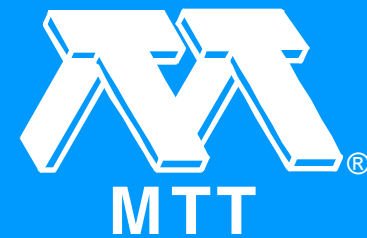
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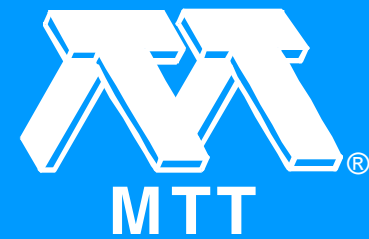
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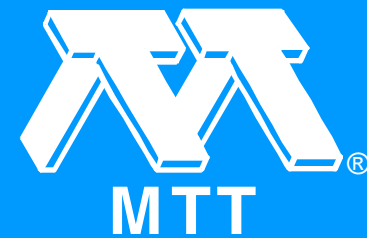
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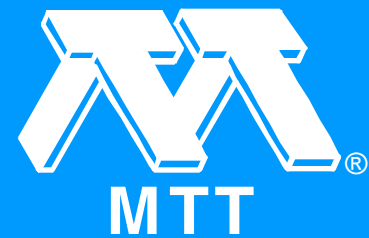
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164-GHz MMIC HEMT doubler

V. Radisic, M. Micovic, M. Hu, P. Janke, C. Ngo, L. Nguyen, L. Samoska and M. Morgan. "164-GHz MMIC HEMT doubler." 2001 Microwave and Wireless Components Letters 11.6 (Jun. 2001 [MWCL]): 241-243.

In this paper, a MMIC frequency doubler based on an InP HEMT and grounded CPW (GCPW) technology is reported. The doubler demonstrated a conversion loss of only 2 dB and output power of 5 dBm at 164 GHz. The 3 dB output power bandwidth is 14 GHz, or 8.5%. This is the best reported result for a MMIC HEMT doubler above 100 GHz.

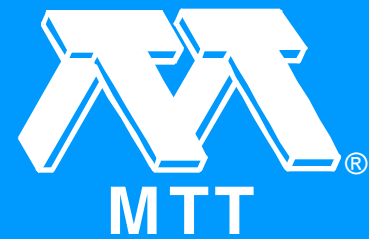
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Low-phase noise AlGaIn/GaN FET-based voltage controlled oscillators (VCOs)

J.B. Shealy, J.A. Smart and J.R. Shealy. "Low-phase noise AlGaIn/GaN FET-based voltage controlled oscillators (VCOs)." 2001 Microwave and Wireless Components Letters 11.6 (Jun. 2001 [MWCL]): 244-245.

The first report of AlGaIn/GaN HEMT-based voltage controlled oscillators (VCOs) is presented. Varactor-tuned oscillators implemented using distributed networks oscillate at 6 GHz with high output power (0.5 W), low-phase noise (-92 dBc/Hz SSB noise at 100 kHz offset), and high-tuning bandwidth (10%). The measured phase noise of AlGaIn/GaN FETs is compared to the phase noise of GaAs FET and GaAs HBTs at 6 GHz, indicating the AlGaIn/GaN FET exhibits equivalent SSB noise to GaAs FETs. These results indicate high power AlGaIn/GaN-based VCOs may be used to simplify the line up in a communication radio, while improving the overall efficiency of the radio.



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High isolation, planar filters using EBG substrates

J. Chappell, M.P. Little and L.P.B. Katehi. "High isolation, planar filters using EBG substrates." 2001 Microwave and Wireless Components Letters 11.6 (Jun. 2001 [MWCL]): 246-248.

The concept of electromagnetic bandgaps (EBGs) has been utilized to develop a high-quality filter that can be integrated monolithically with other components due to a reduced height, planar design. Coupling adjacent defect elements in a periodic lattice creates a filter characterized by its ease of fabrication, high-Q performance, high-port isolation, and integrability to planar or 3-D circuit architectures. The filter proof of concept has been demonstrated in a metallo-dielectric lattice. The measured and simulated results of 2-, 3-, and 6-pole filters are presented at 10.7 GHz.

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A 1.9-GHz DECT CMOS power amplifier with fully integrated multilayer LTCC passives

D. Heo, A. Sutono, E. Chen, Y. Suh and J. Laskar. "A 1.9-GHz DECT CMOS power amplifier with fully integrated multilayer LTCC passives." 2001 Microwave and Wireless Components Letters 11.6 (Jun. 2001 [MWCL]): 249-251.

We present the first demonstration of a CMOS power amplifier (PA) utilizing fully integrated multilayer low-temperature co-fired ceramic (LTCC) high-Q passives for 1.9-GHz digital European cordless telecommunications (DECT) applications. The inductor and capacitor library were built in a multilayer LTCC board using a compact topology. An inductor Q-factor as high as 100 with a self-resonant frequency (SRF) as high as 8 GHz was demonstrated. Measured results of the CMOS-LTCC PA show good agreement with the simulated results exhibiting 48% power added efficiency, 26-dBm output power and 17-dB gain at 1.9 GHz with a 3.3-V drain supply voltage. This result is the first significant step toward a compact DECT transceiver module development utilizing fully integrated multilayer LTCC passives and a standard CMOS technology.

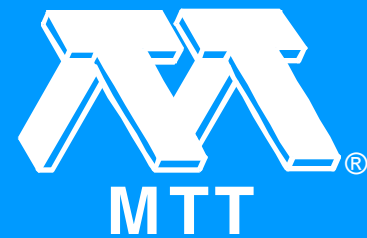
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Low-loss sapphire waveguides for 75-110 GHz frequency range

D. Lioubtchenko, S. Dudorov, J. Mallat, J. Tuovinen and A.V. Raisanen. "Low-loss sapphire waveguides for 75-110 GHz frequency range." 2001 Microwave and Wireless Components Letters 11.6 (Jun. 2001 [MWCL]): 252-254.

Low-loss dielectric waveguides are promising for use instead of metal ones, but problems in transitions have to be overcome. A simple and effective structure made of a monocrystalline sapphire waveguide has been designed. Experimental results at 75-110 GHz indicate good matching with metal waveguides (VSWR /spl les/1.13) and low insertion loss (0.05-0.35 dB for 47 mm dielectric section).



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A high-Q reconfigurable planar EBG cavity resonator

M.J. Hill, R.W. Ziolkowski and J. Papapolymerou. "A high-Q reconfigurable planar EBG cavity resonator." 2001 Microwave and Wireless Components Letters 11.6 (Jun. 2001 [MWCL]): 255-257.

A reconfigurable planar electromagnetic bandgap (EBG) cavity resonator has been designed, fabricated, and tested. The resonator, based on a microstrip-coupled cavity constructed with periodic metallic post side walls, resonates at 10.60 GHz or 8.63 GHz, depending on the state of two rows of switchable post elements. Fabricated on 0.031 inch 5880 Duroid, the resonator exhibits Qs of 348 and 274 for the 10.60 GHz and 8.63 GHz resonances, respectively. In addition to the reasonably high Qs achievable with this design, the circuit utilizes standard printed circuit board (PCB) fabrication techniques and is 100% compatible with commercial PCB processes, enabling low-cost mass production.

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A novel microstrip ring hybrid incorporating a PBG cell

Kam Man Shum, Quan Xue and Chi Hou Chan. "A novel microstrip ring hybrid incorporating a PBG cell." 2001 Microwave and Wireless Components Letters 11.6 (Jun. 2001 [MWCL]): 258-260.

An experimental investigation of a novel compact microstrip 180/spl deg/ ring hybrid incorporating a one-dimensional (1-D) slow-wave structure, in the form of perforations on the ring itself, is presented. The size of the hybrid is reduced by 23% due to the slow-wave effect, and this size reduction technique has potential applications in MICs and MMICs. The measured insertion loss is comparable to that of a conventional microstrip hybrid.

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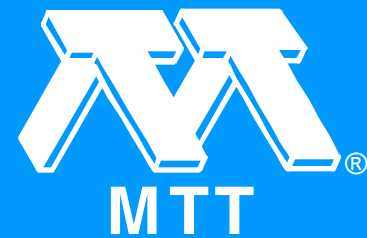
A novel periodic electromagnetic bandgap structure for finite-width conductor-backed coplanar waveguides

Shau-Gang Mao and Ming-Yi Chen. "A novel periodic electromagnetic bandgap structure for finite-width conductor-backed coplanar waveguides." 2001 Microwave and Wireless Components Letters 11.6 (Jun. 2001 [MWCL]): 261-263.

The one-dimensional (1-D) periodic electromagnetic bandgap (EBG) structure for the finite-width conductor-backed coplanar waveguide (FW-CBCPW) is proposed. Unlike the conventional EBG structures for the microstrip line and the coplanar waveguide (CPW), which are typically placed on one of the signal strips and the ground plane, this EBG cell is etched on both the signal strip and the upper ground plane of FW-CBCPW resulting in a novel circuit element. The equivalent circuit is also used to model the EBG cell. Measured and full-wave simulated results show that the cell exhibits remarkable stopband effect. The low-pass filter with lower cutoff frequency and wider rejection bandwidth is constructed from a serial connection of the EBG cells. The effect of back metallization on the guiding characteristic is also discussed. Compared to the published EBG cells, the proposed structure has the advantages of relative flexibility, higher compactness, lower radiation loss, and easier integration with the uniplanar circuits.

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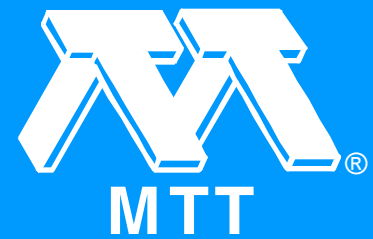
Direct synthesis of folded symmetric resonator filters with source-load coupling

S. Amari. "Direct synthesis of folded symmetric resonator filters with source-load coupling." 2001 Microwave and Wireless Components Letters 11.6 (Jun. 2001 [MWCL]): 264-266.

A direct synthesis technique of coupled symmetric resonator filters with source-load coupling is presented. An examination of the implications of power conservation on the possible solutions to the synthesis problem is examined. It is shown that at least two different coupling matrices whose entries differ not only in signs but in magnitude, as well, can be extracted. The two matrices have the same coupling and routing scheme. Typical examples of synthesized filters are presented to document the validity of the technique.

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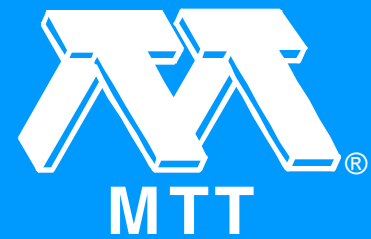
The time-frequency interpretation for transient evolution of wave propagation through dispersive medium

Dong Xiaoting, Jiang Yansheng and Wang Wenbing. "The time-frequency interpretation for transient evolution of wave propagation through dispersive medium." 2001 Microwave and Wireless Components Letters 11.6 (Jun. 2001 [MWCL]): 267-269.

The propagation of electromagnetic waves in a linear, dispersive Lorentz medium is calculated using the finite-difference time-domain (FDTD) method; their time-frequency (TF) characteristics are studied using the Gabor extension. Numerical results show that the TF spectrum gives a clear interpretation for transient evolution of ultra wideband pulse propagation through a Lorentz medium.

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Efficient analysis of microstrip lines including edge singularities in spatial domains

Jong-Sung Kim and Wee Sang Park. "Efficient analysis of microstrip lines including edge singularities in spatial domains." 2001 Microwave and Wireless Components Letters 11.6 (Jun. 2001 [MWCL]): 270-272.

Microstrip lines are analyzed by considering edge-singular behavior using closed-form Green's functions in a spatial domain. A Maxwell function which incorporates the appropriate edge conditions of the line is introduced for the derivations of a transverse correlation function. From calculations of excess lengths of an open-end discontinuity, the results of the proposed method using the edge conditions are in better agreement with the quasistatic results than those of transverse uniform current variations for conductor strips with relatively wider width.

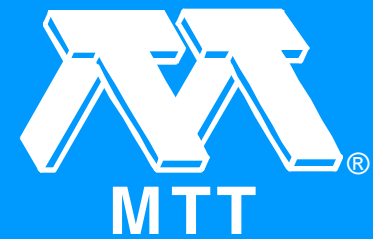
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H.C. Bell. "Patent abstracts (Jun. 2001 [MWCL])." 2001 Microwave and Wireless Components Letters 11.6 (Jun. 2001 [MWCL]): 273-280.



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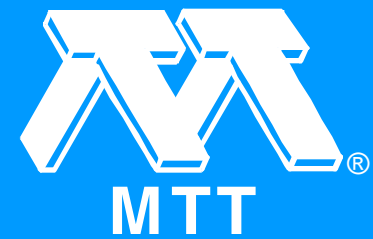
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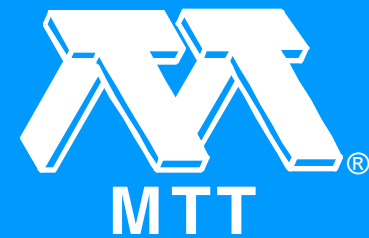
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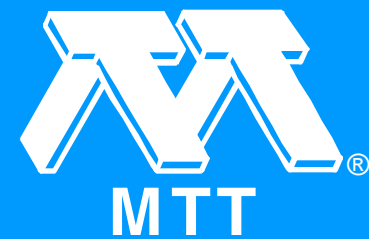
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Information for Authors Submitting Manuscripts in Electronic Form (Jul. 2001 [MWCL])

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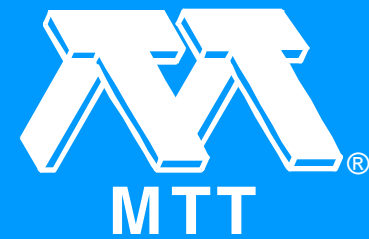
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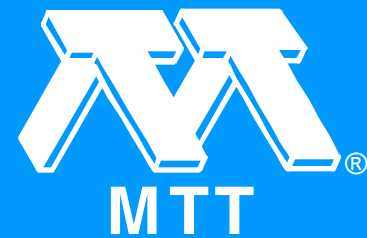
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A monolithic MEMS switched dual-path power amplifier

M. Kim, J.B. Hacker, R.E. Mihailovich and J.F. DeNatale. "A monolithic MEMS switched dual-path power amplifier." 2001 Microwave and Wireless Components Letters 11.7 (Jul. 2001 [MWCL]): 285-286.

RF MEMS switches have been successfully integrated with HEMT MMIC circuits on a GaAs substrate to construct a dual-path power amplifier at X-band. The amplifier uses two MEMS switches at the input to guide the RF signal between two paths. Each path provides single-stage amplification using different size HEMT devices, one with 80- μm width and the other with 640- μm . Depending on the required output power level, one of the two paths is selected to minimize the dc power consumption. Measurements showed the amplifier producing similar small signal gains of 13.2 and 11.5 dB at 10 GHz for the small and the large devices, respectively. The best PAE was 28.1 percent with 8.5 dBm of output power for the small device, and 15.3 percent with 14.6 dBm for the large device.

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An X-band high-power amplifier using SiGe/Si HBT and lumped passive components

Zhenqiang Ma, S. Mohammadi, Liang-Hung Lu, P. Bhattacharya, L.P.B. Katehi, S.A. Alterovitz and G.E. Ponchak. "An X-band high-power amplifier using SiGe/Si HBT and lumped passive components." 2001 Microwave and Wireless Components Letters 11.7 (Jul. 2001 [MWCL]): 287-289.

We report the design and fabrication of a compact microwave monolithic integrated circuit (MMIC) amplifier, which demonstrates high output power at X-Band. A single-stage power amplifier is demonstrated, with a double-mesa type SiGe/Si HBT as the active device and spiral inductors and MIM capacitors as lumped passive components. At 8.4 GHz, a linear gain of 8.7 dB, an output power at peak efficiency of 23 dBm, and a saturated output power P_{sat} of 25 dBm, are measured. To our knowledge, this is the first MMIC X-Band power amplifier using SiGe/Si HBTs.

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IF signal transmission at 60 GHz-band using direct modulation of a two-mode locked Fabry-Perot slave laser

M. Ogusu, K. Inagaki, Y. Mizuguchi and T. Ohira. "IF signal transmission at 60 GHz-band using direct modulation of a two-mode locked Fabry-Perot slave laser." 2001 Microwave and Wireless Components Letters 11.7 (Jul. 2001 [MWCL]): 290-292.

We demonstrate the fiber transmission of an IF signal at 60 GHz-band using a two-mode injection-locked Fabry-Perot slave laser for fiber radio systems. The IF signal can be generated by the CW modulation of the slave laser without using an optical intensity-modulator. We confirm the fast response of the modulated slave laser and a 77 dB dynamic range for signal modulation against third-order distortion. The IF signals power deviation caused by fiber dispersion is also investigated.

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Adaptive transversal preamplifier for high speed lightwave systems

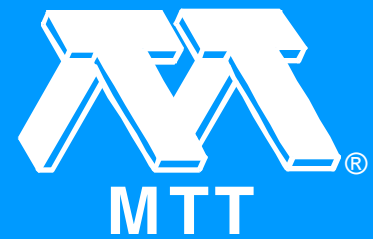
A.P. Freundorfer, D.H. Choi and Y. Jamani. "Adaptive transversal preamplifier for high speed lightwave systems." 2001 Microwave and Wireless Components Letters 11.7 (Jul. 2001 [MWCL]): 293-295.

A nine-tap transversal preamplifier using cascode MESFETs in a distributed structure has been designed for pulse shaping data, AGC and group delay control in high speed lightwave systems. The circuit was fabricated in a microwave monolithic integrated circuit (MMIC) implementation using 0.8 μm GaAs MESFET technology. The AGC capability was demonstrated. The best noise measured for this preamplifier was 15 pA/spl radic/(Hz).

A dynamical load-cycle charge model for RF power FETs

J.M. Collantes, P. Bouysse, J. Portilla and R. Quere. "A dynamical load-cycle charge model for RF power FETs." 2001 Microwave and Wireless Components Letters 11.7 (Jul. 2001 [MWCL]): 296-298.

A nonlinear charge model for RF power FETs is presented. The model, intended for use in harmonic-balance simulators, calculates the time evolution of the nonlinear charge in a period of the steady-state regime. For that, the experimentally extracted capacitances are integrated using the device dynamic load cycle as integration path. The proposed approach is technology independent and it has been applied here to a Si LDMOSFET and a SiC MESFET. Load pull measurements have been performed to verify the validity of the model.



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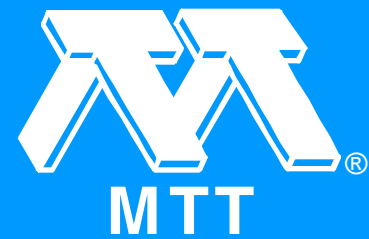
Characteristic-impedance measurement error on lossy substrates

D.F. Williams, U. Arz and H. Grabinski. "Characteristic-impedance measurement error on lossy substrates." 2001 Microwave and Wireless Components Letters 11.7 (Jul. 2001 [MWCL]): 299-301.

This paper examines error caused by parasitic inductance in the characteristic impedance measured by the calibration comparison method on lossy silicon substrates.

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Existence of optimum cold FET intrinsic reference plane for active FET small signal modeling

Byung-Sung Kim. "Existence of optimum cold FET intrinsic reference plane for active FET small signal modeling." 2001 Microwave and Wireless Components Letters 11.7 (Jul. 2001 [MWCL]): 302-304.

Cold FET methods have been widely used for active FET modeling assuming the bias independence of parasitic elements. However, the assumption has been merely justified by the resulting modeling accuracy. This paper investigates the consistency of cold FET conditions with active FET through the exact and the error minimizing solutions of cold FET intrinsic reference plane constrained by the feedback condition of active FET model. Additionally, drain bias dependence of parasitic resistances will be presented.

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S-parameter broad-band measurements on-microstrip and fast extraction of the substrate intrinsic properties

J. Hinojosa. "S-parameter broad-band measurements on-microstrip and fast extraction of the substrate intrinsic properties." 2001 Microwave and Wireless Components Letters 11.7 (Jul. 2001 [MWCL]): 305-307.

A broad-band technique for determining the electromagnetic properties of isotropic film-shaped materials, which uses a microstrip line, is presented. Complex permittivity and permeability are computed from analytical equations and S-parameter measurements of microstrip cells propagating the dominant mode. Measured ϵ_r and μ_r data for several materials are presented between 0.05 GHz and 40 GHz. This technique shows a good agreement between measured and predicted data.

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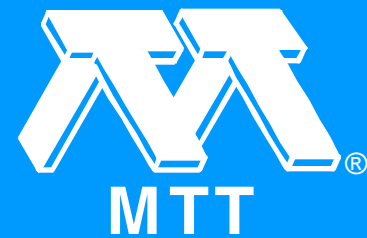


Abstracts

Efficient Krylov-subspace simulation of autonomous RF/microwave circuits driven by digitally modulated carriers

V. Rizzoli, A. Costanzo and F. Matri. "Efficient Krylov-subspace simulation of autonomous RF/microwave circuits driven by digitally modulated carriers." 2001 Microwave and Wireless Components Letters 11.7 (Jul. 2001 [MWCL]): 308-310.

Presents a new approach to the simulation of self-oscillating nonlinear circuits excited by modulated RF/microwave carriers and/or dc sources. The analysis is reduced to the solution of a sequence of coupled harmonic-balance systems. A Krylov-subspace method explicitly developed for autonomous circuits and the suppression of any time-domain integration provide a dramatic speed increase with respect to conventional envelope-oriented techniques.



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Error analysis for the truncation of multipole expansion of vector Green's functions [EM scattering]

Jiming Song and Weng Cho Chew. "Error analysis for the truncation of multipole expansion of vector Green's functions [EM scattering]." 2001 Microwave and Wireless Components Letters 11.7 (Jul. 2001 [MWCL]): 311-313.

One of the most important mathematical formulas in fast multipole algorithms (FMA) is the addition theorem. In the numerical implementation of the addition theorem, the infinite series should be truncated. In this paper, the number of terms needed for the scalar Green's function is derived, and the error analysis for the truncation error in the multipole expansion of the vector Green's functions is given. We have found that the error term in vector Green's functions is proportional to $1/R$. If the scalar Green's function is truncated at the L -th term and the relative error is ϵ , then the relative error in the dyadic Green's function is $\epsilon/4$, if it is truncated at the $(L+2)$ -th term. For the vector Green's function related to MFIE, the relative error is $\epsilon/2$ if it is truncated at the $(L+1)$ -th term.

CPW to waveguide transition with tapered slotline probe

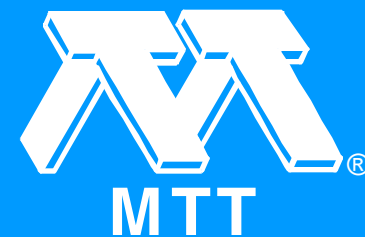
Ting-Huei Lin and Ruey-Beei Wu. "CPW to waveguide transition with tapered slotline probe." 2001 Microwave and Wireless Components Letters 11.7 (Jul. 2001 [MWCL]): 314-316.

A new CPW to waveguide transition is developed based on the concept of tapered slot antenna and E-plane probe coupling. The transition consists of a tapered slotline probe and a slotline to CPW matching section. The current design has the advantages of broad bandwidth, compact size, low fabrication cost, and high reliability. The characteristics of a prototype transition are investigated by numerical simulation on Duroid substrate and WR-90 waveguide. The back-to-back combination is measured to verify the agreement with the simulated results and realization of this design.

Abstracts

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H.C. Bell. "Patent abstracts (Jul. 2001 [MWCL])." 2001 Microwave and Wireless Components Letters 11.7 (Jul. 2001 [MWCL]): 317-324.



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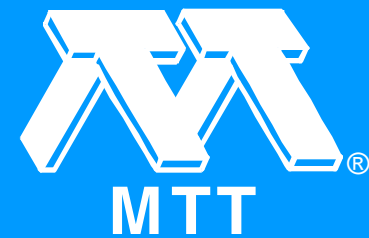
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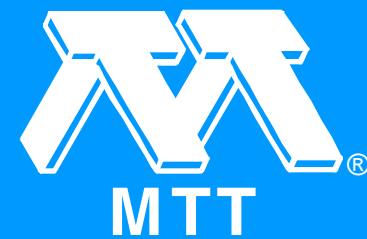
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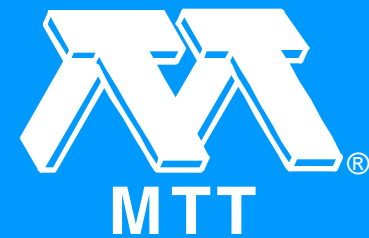
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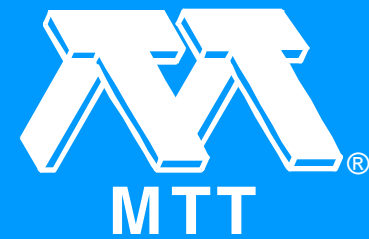
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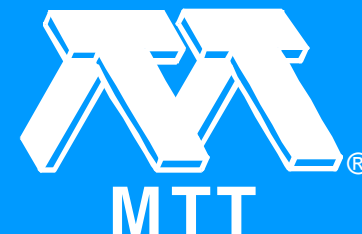


Abstracts

80 GHz MMIC HEMT VCO

V. Radisic, L. Samoska, M. Micovic, Ming Hu, P. Janke, C. Ngo and L. Nguyen. "80 GHz MMIC HEMT VCO." 2001 Microwave and Wireless Components Letters 11.8 (Aug. 2001 [MWCL]): 325-327.

In this letter a monolithic voltage-controlled oscillator (VCO) operating in the 77.5-83.5 GHz range is presented. InP HEMTs are used for both the active device and varactor. The VCO demonstrated a tuning range of 6 GHz and an output power better than 12.5 dBm in the entire tuning range.



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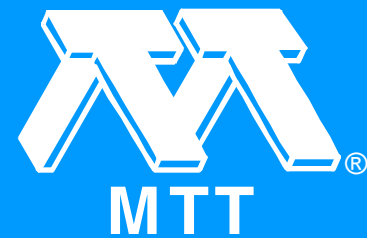
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Compact low-loss monolithic CPW filters using air-gap overlay structures

Hong-Teuk Kim, Jae-Hyoung Park, Yong-Kweon Kim and Youngwoo Kwon. "Compact low-loss monolithic CPW filters using air-gap overlay structures." 2001 Microwave and Wireless Components Letters 11.8 (Aug. 2001 [MWCL]): 328-330.

In this letter, two types of compact low-loss monolithic coplanar waveguide (CPW) filters using air-gap overlay structures are presented. Vertical stacking in overlay structures offers size reduction. Furthermore, air-gap overlay structures do not require additional dielectric process and are free from dielectric losses. An X-band bandpass filter using air-gap overlaid artificial transmission lines showed 67% size reduction. A stepped-impedance low-pass filter using highly separated metal-air-metal (MAM) capacitors as low-impedance lines achieved not only size but also loss reduction. Small size, low loss, and simple process steps make the air-gap overlay structures very promising for monolithic CPW passive devices such as filters.

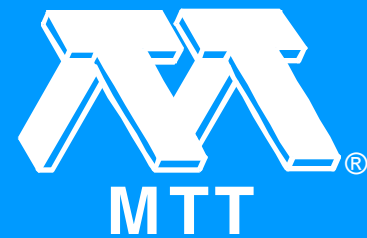
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Active antennas incorporating tunnel diodes-large signal model approach

Kai Liu, S.M. El-Ghazaly, M.R. Deshpande, V. Nair, N. El-Zein and H. Goronkin. "Active antennas incorporating tunnel diodes-large signal model approach." 2001 Microwave and Wireless Components Letters 11.8 (Aug. 2001 [MWCL]): 331-333.

In this letter, a comprehensive dc and RF model of heterostructure interband tunnel diodes (HITDs) is extracted. Active antennas incorporating tunnel diodes are analyzed in the time domain using this tunnel diode model. The simulated and measured results are in good agreement in terms of oscillation frequencies of the active antennas. Phase noise of -114.67 dBc/Hz @1.0 MHz offset is achieved for injection-locked active antennas. The simulated injection locking range of a Ka band active antenna array is investigated.



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Inline capacitive and DC-contact MEMS shunt switches

J.B. Muldavin and G.M. Rebeiz. "Inline capacitive and DC-contact MEMS shunt switches." 2001 Microwave and Wireless Components Letters 11.8 (Aug. 2001 [MWCL]): 334-336.

This paper presents inline capacitive MEMS shunt switches suitable for X/K-band and Ka/V-band applications. The inline switch allows for a low- or high-inductance connection to the ground plane without changing the mechanical characteristics of the MEMS bridge. Excellent isolation and loss are achieved with this design, and the performance is very similar to the standard capacitive MEMS shunt switch. Also, a new metal-to-metal contact MEMS shunt switch is presented. A novel pull-down electrode is used which applies the electrostatic force at the same location as the metal-to-metal contact area. A contact resistance of 0.15-0.35 Ω is repeatable, and results in an isolation of -40 dB at 0.1-3 GHz. The measured isolation is still better than -20 dB at 40 GHz. The application areas are in high-isolation/low-loss switches for telecommunication and radar systems.

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New nonlinear design tools for self-oscillating mixers

S. ver Hoeye, L. Zurdo and A. Suarez. "New nonlinear design tools for self-oscillating mixers." 2001 Microwave and Wireless Components Letters 11.8 (Aug. 2001 [MWCL]): 337-339.

New nonlinear design tools for self-oscillating mixers are presented here, with the aim to increase the designer's control over their behavior. The new tools enable fixing the self-oscillation frequency and selecting the optimum self-oscillation amplitude for maximum conversion gain. They can also be applied for the optimized design of harmonic self-oscillating mixers. Using bifurcation-theory concepts, it has been possible to increase the input-power range with self-oscillating-mixer operation. A self-oscillating mixer with 5.5 GHz input frequency has been designed and simulated obtaining very good agreement with the experimental results.



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A millimeter-wave six-port reflectometer based on the sampled-transmission line architecture

S. Ulker and R.M. Weikle, II. "A millimeter-wave six-port reflectometer based on the sampled-transmission line architecture." 2001 Microwave and Wireless Components Letters 11.8 (Aug. 2001 [MWCL]): 340-342.

This letter presents a proof-of-concept implementation of a millimeter-wave reflectometer for measuring complex reflection coefficients. The reflectometer is based on the six-port architecture and consists of a single section of WR-10 rectangular waveguide and a set of three Schottky power detectors. Design considerations as well as measurements in the 75 to 110 GHz range are described and discussed. Because of its simple architecture, the reflectometer is amenable to scaling for measurements well into the submillimeter-wave region of the spectrum.

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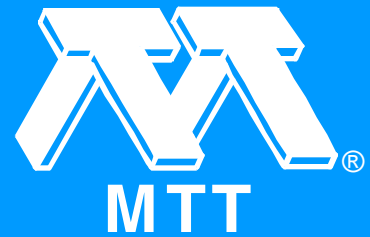


Abstracts

Difference pattern beam steering of coupled, nonlinear oscillator arrays

T. Health. "Difference pattern beam steering of coupled, nonlinear oscillator arrays." 2001 Microwave and Wireless Components Letters 11.8 (Aug. 2001 [MWCL]): 343-345.

In this letter, it is shown how to extend York's phase-shifterless beam steering technique to difference pattern scanning for monopulse applications. By making a simple modification to the coupling between the central elements of a one-dimensional array, the effective equivalence of the steered sum and difference problems is established.



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Leaky coaxial cable with adjustable coupling loss for mobile communications in complex environments

Jun Hong Wang. "Leaky coaxial cable with adjustable coupling loss for mobile communications in complex environments." 2001 Microwave and Wireless Components Letters 11.8 (Aug. 2001 [MWCL]): 346-348.

A new kind of leaky coaxial cable composed of an axially-slotted line covered with periodic metallic patches is proposed. The basic cable sets up a surface wave and does not radiate itself, but excites the patch apertures into radiation. The direction of the radiation field can be changed by adjusting the size and period of the patches according to the environmental application. A combined method that involves FDTD iteration and integration of the equivalent surface magnetic current is introduced in order to determine the radiation field accurately.

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An unconditionally stable 3-D ADI-MRTD method free of the CFL stability condition

Zhizhang Chen and Jiazong Zhang. "An unconditionally stable 3-D ADI-MRTD method free of the CFL stability condition." 2001 Microwave and Wireless Components Letters 11.8 (Aug. 2001 [MWCL]): 349-351.

In this paper, an alternating direction implicit (ADI) technique is applied to the recently developed multiresolution time-domain (MRTD) method, resulting in an unconditionally stable ADI-MRTD scheme free of the Courant-Friedrich-Lecy (CFL) stability condition. The unconditional stability is theoretically proved, and preliminary numerical results are presented to validate the scheme. Because the scheme is now free of the stability condition, its time step is determined only by modeling accuracy. The price for having the unconditional stability is, however, that the required computation memory becomes almost twice of that for the original MRTD.

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Modal MRTD approaches for the efficient analysis of waveguide discontinuities

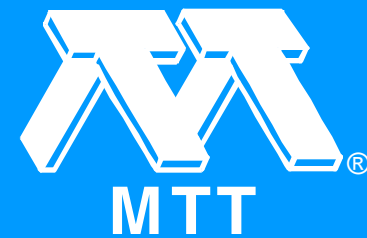
Saehoon Ju, Youngboo Vin and Hyeongdong Kim. "Modal MRTD approaches for the efficient analysis of waveguide discontinuities." *2001 Microwave and Wireless Components Letters* 11.8 (Aug. 2001 [MWCL]): 352-354.

This paper, the multi-resolution time-domain (MRTD) technique is applied to the waveguide discontinuity problem for fast-scattering parameter computation. To improve the computational efficiency, both three-dimensional (3-D) waveguide regions, including discontinuities, and one dimensional (1-D) homogeneous waveguide region, terminated with the modal absorbing boundary condition (ABC), are simulated in the wavelet domain with the mode composition/expansion algorithm from the modal analysis. A WG-90 rectangular waveguide with a thick asymmetric iris is analyzed and the numerical results are compared with conventional finite-difference time-domain (FDTD) results and mode-matching results.

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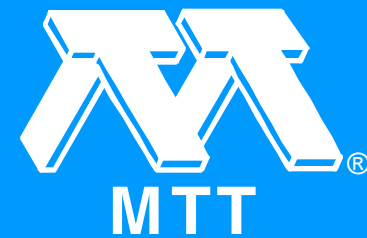
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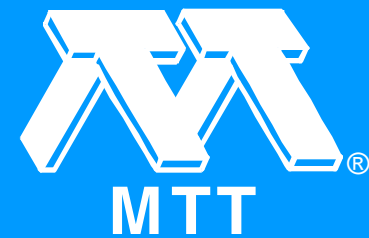
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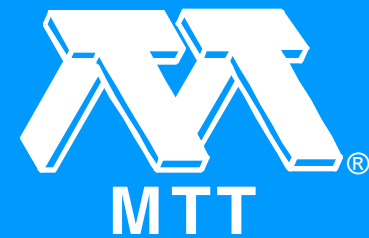
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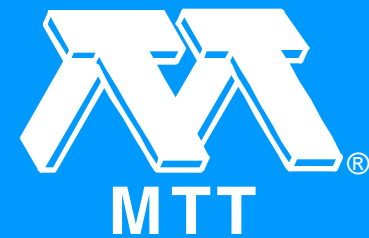
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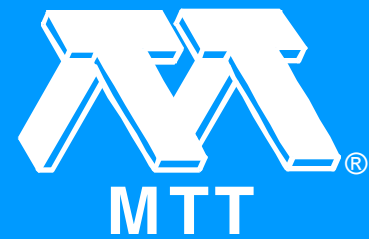
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Highest efficiency, linear X-band performance using InP DHBTs - 48% PAE at 30 dB C/IM3

L. Kehias, T. Jenkins, T. Quach, P. Watson, R. Welch, R. Worley, A.K. Oki, H.C. Yen, A. Gutierrez-Aitken, W. Okamura and E. Kaneshiro. "Highest efficiency, linear X-band performance using InP DHBTs - 48% PAE at 30 dB C/IM3." 2001 Microwave and Wireless Components Letters 11.9 (Sep. 2001 [MWCL]): 361-363.

InP single heterojunction bipolar transistors have previously demonstrated 5-10 dB lower third-order intermodulation products (IM3) compared to GaAs heterojunction bipolar transistors (HBTs) under low voltage (2 V) operation. This paper reports excellent single-tone and two-tone X-band operation, including high two-tone power-added efficiency (PAE), on linear InP double heterojunction bipolar transistors (DHBTs) operated at $V_{ce}/V_{be} = 4$ V. The InP DHBT demonstrated a 30 dB carrier to third-order intermodulation product (C/IM3) output power ratio simultaneously with 48% two-tone PAE. This is the highest known efficiency of an X-band device under linear (30 dB C/IM3) operation. This is especially significant for microwave power amplifiers for satellite communication transmitters, where lower intermodulation distortion is normally accomplished by backing off in RF drive and output power, thus sacrificing PAE performance.



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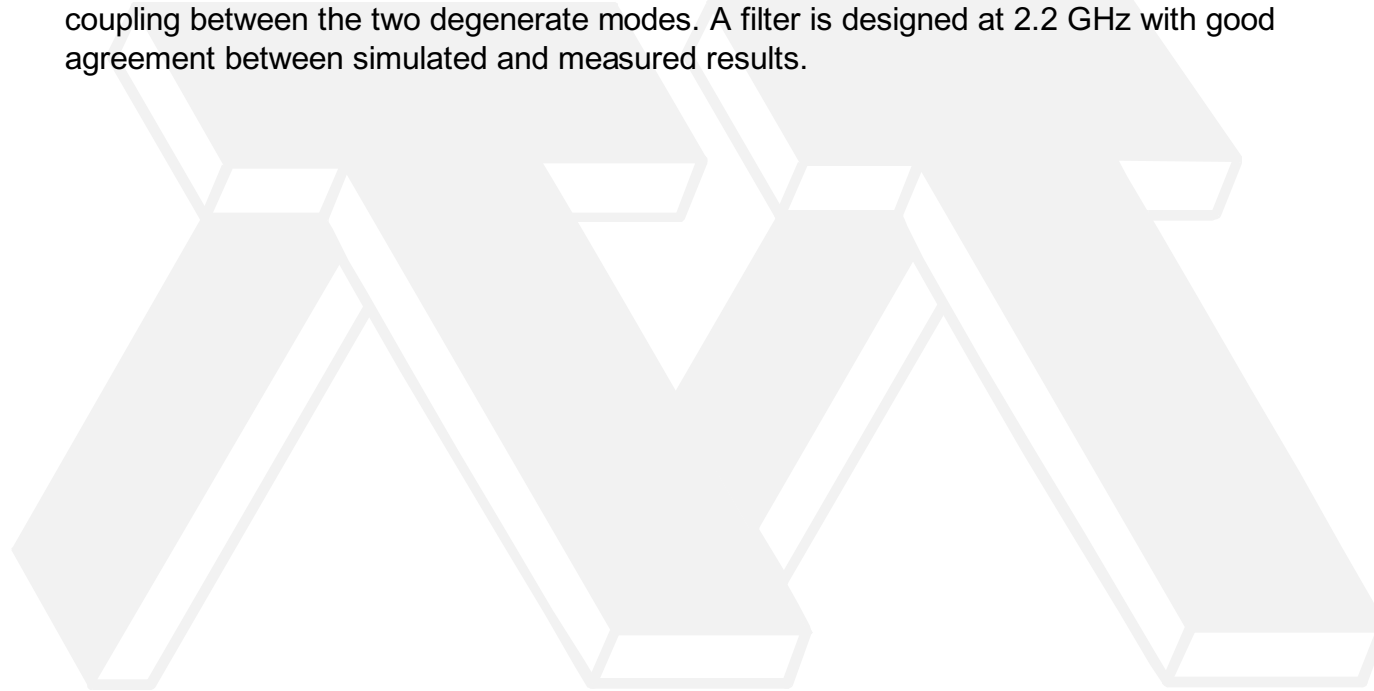
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PBG-excited split-mode resonator bandpass filter

Siou Teck Chew and T. Itoh. "PBG-excited split-mode resonator bandpass filter." 2001 Microwave and Wireless Components Letters 11.9 (Sep. 2001 [MWCL]): 364-366.

Photonic bandgap structure is used as a design parameter for the fundamental passband in a split-mode microstrip square resonator. A defect in the PBG cells under the resonator, allows coupling between the two degenerate modes. A filter is designed at 2.2 GHz with good agreement between simulated and measured results.



[Click on title for a complete paper.](#)



Broadband GaN HEMT push-pull microwave power amplifier

Jong-Wook Lee and K.J. Webb. "Broadband GaN HEMT push-pull microwave power amplifier." 2001 Microwave and Wireless Components Letters 11.9 (Sep. 2001 [MWCL]): 367-369.

We report a broadband, linear, push-pull amplifier that utilizes GaN-based HEMTs grown on SiC substrates. The high power density capabilities of these devices can be enhanced by the high efficiency achievable with push-pull operation. Good amplifier performance is facilitated by use of a new low-loss balun that is implemented with three symmetric coupled lines and which showed insertion loss of less than 0.5 dB per balun. The bias was injected through the baluns, thereby simplifying the amplifier design and reducing loss associated with dc decoupling capacitors. Using two 1.5 mm HEMTs with 0.35- μm gate length, a push-pull amplifier produced a small-signal gain of 8 dB at 5 GHz, a 3 dB bandwidth of 3.5-10.5 GHz, and a PAE of 25%.



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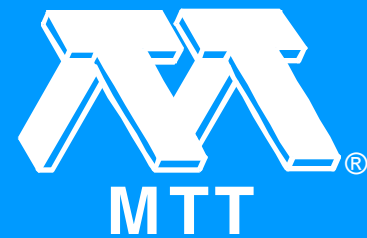
Novel tunable waveguide backshort for millimeter and submillimeter wavelengths

V.S. Mottonen, P. Piironen and A.V. Raisanen. "Novel tunable waveguide backshort for millimeter and submillimeter wavelengths." 2001 Microwave and Wireless Components Letters 11.9 (Sep. 2001 [MWCL]): 370-372.

A new tunable waveguide backshort with low loss and reliable performance has been designed. Based on a fixed short and dielectric phase shifter, it has a simple structure which is easy to design and fabricate. These properties make it a sound alternative for millimeter- and submillimeter-wave applications. A W-band (75-110 GHz) backshort has been designed and tested showing excellent performance with a return loss of less than 0.21 dB.

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All-metal high-isolation series and series/shunt MEMS switches

J.B. Muldavin and G.M. Rebeiz. "All-metal high-isolation series and series/shunt MEMS switches." 2001 Microwave and Wireless Components Letters 11.9 (Sep. 2001 [MWCL]): 373-375.

This paper presents a novel all-metal series switch with several different pull-down electrode geometries. The switch results in an up-state capacitance of 5-9 fF and an isolation of -25 to -30 dB at 10 GHz. The fabrication process is completely compatible with the standard capacitive (or dc-contact) shunt switch. A dc-30 GHz series/shunt switch is also presented with an isolation of -60 dB at 5 GHz and -42 dB at 10 GHz. This is the highest isolation switch available to-date. The performance is limited by radiation in the CPW lines and not by the series/shunt switch characteristics. The application areas are in high-isolation switches for basestations and satellite systems.

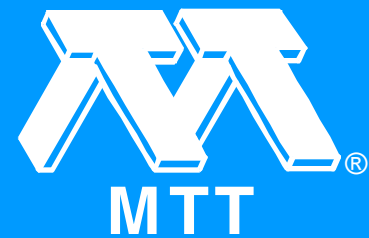
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Analysis of noise effects on the nonlinear dynamics of synchronized oscillators

S. ver Hoeye, A. Suarez and S. Sancho. "Analysis of noise effects on the nonlinear dynamics of synchronized oscillators." 2001 Microwave and Wireless Components Letters 11.9 (Sep. 2001 [MWCL]): 376-378.

The higher sensitivity to noise of nonlinear systems near the onset of instability is analyzed here. The analysis is particularized to synchronized oscillators, studying the influence of the proximity to Hopf and Saddle-Node bifurcations. The calculations are compared with former scaling relationships and with results from time-domain integration. The average shift of bifurcation points due to noise perturbations is also analyzed. Two examples are shown: a cubic-nonlinearity oscillator and a 5 GHz hybrid oscillator, for experimental verifications.



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Analysis of waveguide discontinuities using edge elements in a hybrid mode matching/finite elements approach

D. Arena, M. Ludovico, G. Manara and A. Monorchio. "Analysis of waveguide discontinuities using edge elements in a hybrid mode matching/finite elements approach." 2001 Microwave and Wireless Components Letters 11.9 (Sep. 2001 [MWCL]): 379-381.

A mode matching (MM)/finite element method (FEM) for the analysis of waveguide discontinuities is presented. The hybrid approach described combines the computational efficiency of the modal analysis with the versatility and flexibility of FEM and enables us to accurately model arbitrary cross section waveguides, where modal expansions cannot be derived analytically. The proposed procedure is based on the edge element expansion of the transverse field components for the direct calculation of the coupling integrals involved in the MM formulation. Numerical and experimental results are presented to show the validity and the accuracy of the method.

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3-D FDTD design simulation and experimental measurement of a Ka-band planar antipodal linearly-tapered slot antenna (ALTSA)

Liang-Chen Kuo, Meng-Chung Tsai and Huey-Ru Chuang. "3-D FDTD design simulation and experimental measurement of a Ka-band planar antipodal linearly-tapered slot antenna (ALTSA)." 2001 Microwave and Wireless Components Letters 11.9 (Sep. 2001 [MWCL]): 382-384.

Three-dimensional (3-D) finite-difference time-domain (FDTD) simulation of a planar broadband Ka-band (25-35 GHz) antipodal linearly-tapered slot antenna (ALTSA) and the experimental measurements are presented. The Berenger perfectly matched layer (PML) absorbing boundary condition is used for the FDTD computation. A printed ALTSA has been realized by using the RT/Duroid PCB substrate. Good agreement between simulation and measurement were achieved.

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Propagation characteristics of Schottky contact suspended slow-wave microstrip line

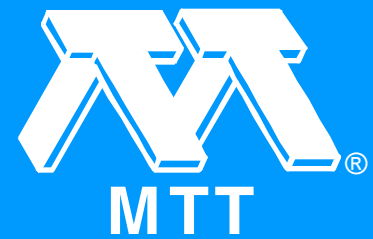
A.K. Verma and Nasimuddin. "Propagation characteristics of Schottky contact suspended slow-wave microstrip line." 2001 Microwave and Wireless Components Letters 11.9 (Sep. 2001 [MWCL]): 385-387.

The single-layer reduction (SLR) model computes the normalized phase constant (β/β_0), dielectric loss (α_d), and conductor loss (α_c) for the Schottky contact slow-wave microstrip (SCSM) line with accuracy about 2.0% for β/β_0 , and within 0.01 dB/mm for the total loss ($\alpha_t = \alpha_d + \alpha_c$) as compared against the experimental results. The SLR model has been further used to analyze the normal and abnormal characteristics of a proposed Schottky contact suspended slow-wave microstrip (SCSSM) line with 22% increase in β/β_0 over the normal SCSM line. The SCSSM line could be useful in the lower range of RF for the development of compact components.

A unified modal analysis of off-centered waveguide junctions with thick iris

Sheng-Li Lin, Le-Wei Li, Tai-Soon Yeo and Mook-Seng Leong. "A unified modal analysis of off-centered waveguide junctions with thick iris." *2001 Microwave and Wireless Components Letters* 11.9 (Sep. 2001 [MWCL]): 388-390.

In this paper, the unified mode-matching technique for concentric waveguide junction analysis is extended to calculate the scattering parameters at off-centered step discontinuities in waveguides. Because the modal fields in both waveguides are expressed accurately by polynomials in mono coordinate system, the analytical expressions of the coupling coefficients are easily obtained. Furthermore, all waveguides are treated in a unified manner. Comparison with the data available in literature demonstrates the accuracy and flexibility of the present method.



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A two-dimensional coupled oscillator array (Correction)

"A two-dimensional coupled oscillator array (Correction)." 2001 Microwave and Wireless Components Letters 11.9 (Sep. 2001 [MWCL]): 391-.

For original paper see R.J.Pogorzelski, IEEE Microwave Guided Wave Lett., vol.10, pp.478-80 (Nov. 2000). In the above paper, it was suggested that the array described represents the first implementation of an agile beam two-dimensional (2-D) array based on mutually injection locked oscillators. It has recently been brought to my attention that a description of an earlier such array was reported by Dr. Ragip Ispir et al. (1997).

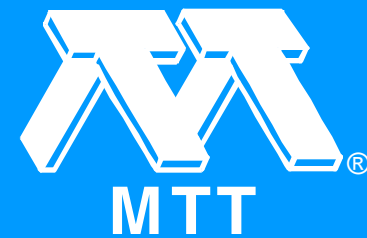
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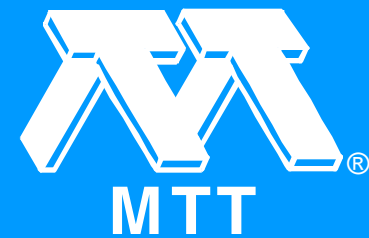
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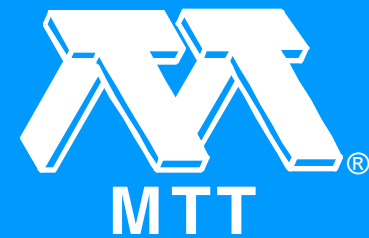
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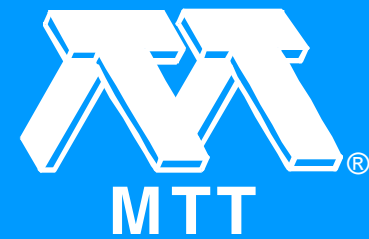
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Reliability of microwave SiGe/Si heterojunction bipolar transistors

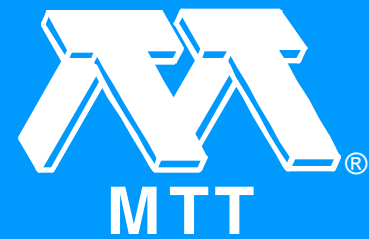
Zhenqiang Ma, P. Bhattacharya, Jae-Sung Rieh, G.E. Ponchak, S.A. Alterovitz and E.T. Croke.
"Reliability of microwave SiGe/Si heterojunction bipolar transistors." 2001 Microwave and Wireless Components Letters 11.10 (Oct. 2001 [MWCL]): 401-403.

The degradation behavior of NPN Si/SiGe/Si heterojunction bipolar transistors, grown by solid-source molecular beam epitaxy (MBE), has been studied by accelerated lifetime testing at different ambient temperatures. The degradations of the dc current gain and the microwave performance of the devices are explained in terms of recombination enhanced impurity diffusion (REID) of boron atoms from the base region and the subsequent formation of parasitic energy barriers at the base-emitter and base-collector junctions.

Amplifier linearization using simultaneous harmonic and baseband injection

Chun-Wah Fan and K.-K.M. Cheng. "Amplifier linearization using simultaneous harmonic and baseband injection." 2001 Microwave and Wireless Components Letters 11.10 (Oct. 2001 [MWCL]): 404-406.

A novel linearization scheme utilizing injection of distortion signal at the input of amplifier is described. Harmonic and baseband signal generated by predistortion circuits is fed to the input of the main amplifier and by controlling the power level of the harmonic and baseband signal properly, mixing products can be made to cancel out with the FET inherent distortion signals. Unlike many other techniques, no precise phase adjustment is required for the RF signal path. For verification, the two-tone performance of a constructed linearized amplifier is measured and a reduction of the third-order IMD power level of about 27 dB is observed.



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Digital reflection-type phase shifter based on a ferroelectric planar capacitor

V. Sherman, K. Astafiev, N. Setter, A. Tagantsev, O. Vendik, I. Vendik, S. Hoffmann-Eifert, U. Bottger and R. Waser. "Digital reflection-type phase shifter based on a ferroelectric planar capacitor." 2001 Microwave and Wireless Components Letters 11.10 (Oct. 2001 [MWCL]): 407-409.

Novel design of an integrated digital reflection-type phase shifter based on a Barium Strontium Titanate thin-film capacitor is presented. Measured characteristics of the phase shifter are compared with the theoretically predicted ones.

Click on title for a complete paper.



A Faraday cage isolation structure for substrate crosstalk suppression

J.H. Wu, J. Scholvin, J.A. del Alamo and K.A. Jenkins. "A Faraday cage isolation structure for substrate crosstalk suppression." 2001 Microwave and Wireless Components Letters 11.10 (Oct. 2001 [MWCL]): 410-412.

We have exploited a recently-developed, through-wafer via technology in silicon to implement a novel Faraday cage scheme for substrate crosstalk suppression in system-on-chip (SOC) applications. The Faraday cage structure consists of a ring of grounded vias encircling sensitive or noisy portions of a chip. The via technology features high aspect ratio, through-wafer holes filled with electroplated Cu and lined with a silicon nitride barrier layer. The new Faraday cage structure has shown crosstalk suppression of 40 dB at 1 GHz and 36 dB at 5 GHz at a distance of 100 μm . This is about 10 dB better than any other isolation technique previously reported.



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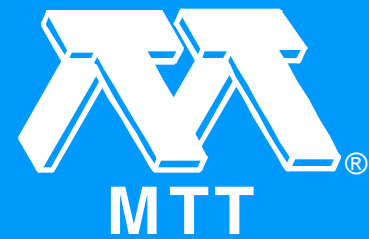
Investigation of microwave propagation in high-temperature superconducting waveguides

G. Yassin, G. Jung, V. Dikovsky, I. Barboy, M. Kambara, D.A. Cardwell and S. Withington.
"Investigation of microwave propagation in high-temperature superconducting waveguides."
2001 Microwave and Wireless Components Letters 11.10 (Oct. 2001 [MWCL]): 413-415.

It is well known that the boundary conditions of the electromagnetic fields on the surface of a superconductor are influenced by the field penetration into the material. In a series of recent publications, it has been suggested that this effect substantially influences the wave propagation in high-temperature superconducting waveguides, to the extent that the mode order becomes different than that predicted for perfect conductor waveguides. In this paper, we present experimental investigation of this effect. We show that the effect of superconductivity on the wave propagation in waveguides is very small for temperatures well below the transition temperature and away from cutoff. We also discuss the behavior of the waveguide near cutoff and very close to the transition temperature.

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Robust multigrid preconditioner for fast finite element modeling of microwave devices

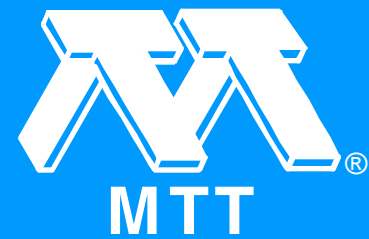
Yu Zhu and A.C. Cangellaris. "Robust multigrid preconditioner for fast finite element modeling of microwave devices." *2001 Microwave and Wireless Components Letters* 11.10 (Oct. 2001 [MWCL]): 416-418.

A robust preconditioning technique is presented for the fast finite element modeling of microwave devices. The proposed preconditioner is based on a multigrid scheme for the vector-scalar potential finite element formulation of electromagnetic problems. Numerical experiments from the application of the new preconditioner to the finite element analysis of microwave devices are used to demonstrate its superior numerical convergence and efficient memory usage.

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Convergence-optimized, higher order vector finite elements for microwave simulations

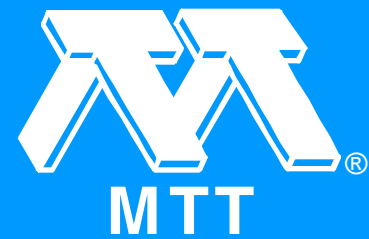
T.V. Yioultsis and T.D. Tsiboukis. "Convergence-optimized, higher order vector finite elements for microwave simulations." 2001 Microwave and Wireless Components Letters 11.10 (Oct. 2001 [MWCL]): 419-421.

We introduce a general class of higher order parameter-dependent Whitney elements, unlike previous approaches that resulted in specific element definitions. All elements of this kind provide the same solution, but their convergence properties may be significantly different. The most essential fact, though, is the introduction of an optimization procedure, which reveals the existence of an optimal, with respect to convergence, element. The produced second order elements are tested in both two-dimensional (2-D) and three-dimensional (3-D) microwave simulations.

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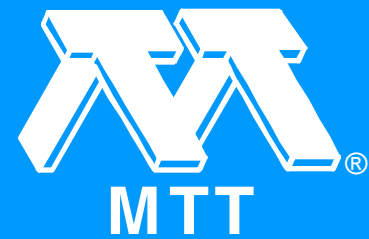
Reduced-order models in FDTD

L. Kulas and M. Morozowski. "Reduced-order models in FDTD." 2001 Microwave and Wireless Components Letters 11.10 (Oct. 2001 [MWCL]): 422-424.

This letter describes a new hybrid technique for enhancing the efficiency of the finite difference time domain method (FDTD) by incorporation with in Yee's mesh a macromodel generated by an order reduction algorithm applied to the finite difference frequency domain (FDFD) wave equation defined on a higher resolution grid. This approach increases the accuracy of the calculations and reduces the overall simulation time.

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Experimental study of large bandwidth three-offset microstripline-fed slot antenna

Yong-Woong Jang. "Experimental study of large bandwidth three-offset microstripline-fed slot antenna." 2001 Microwave and Wireless Components Letters 11.10 (Oct. 2001 [MWCL]): 425-427.

The proposed novel three-offset shaped microstripline-fed slot antenna has a radiation pattern similar to the conventional microstrip slot antenna and the advantage of more bandwidth. The measured bandwidth is approximately 1.796 octave (VSWR/spl les/2.0), Experimental results for the impedance loci and the radiation patterns are also presented.

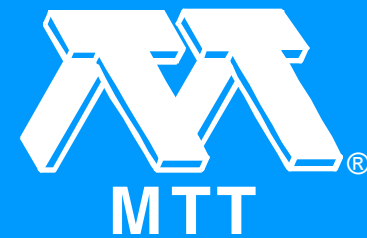
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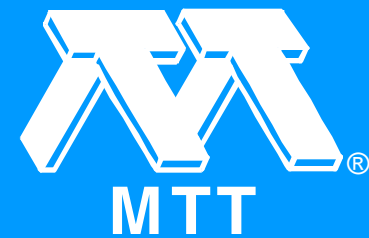
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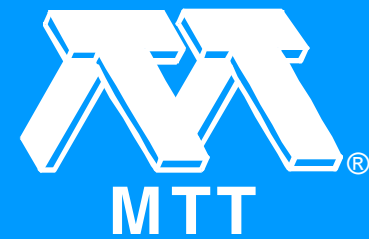
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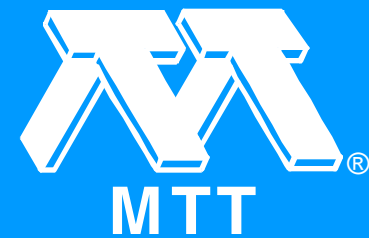
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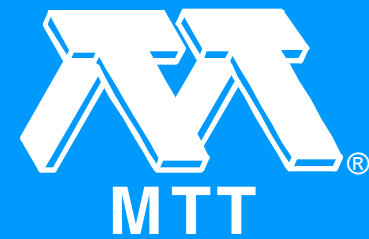
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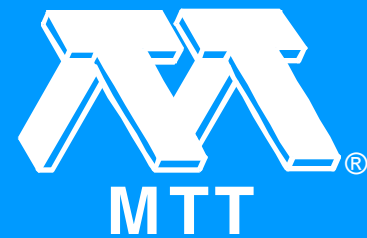
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Phase modulation of a loop phase-locked grid oscillator array

Wenzhang Wang and L.W. Pearson. "Phase modulation of a loop phase-locked grid oscillator array." 2001 Microwave and Wireless Components Letters 11.11 (Nov. 2001 [MWCL]): 441-443.

In this letter, we describe a method for phase modulation of a loop phase-locked grid oscillator array and report results obtained in a test bed implementation of the method. The key to the scheme lies in introducing the phase-locked loop (PLL) in such a way that the modulating data stream is introduced in parallel with the loop rather than through it, thereby circumventing the bandwidth limitation of the PLL. The experiment was performed at 4.7 GHz with a phase-locked grid oscillator array. The grid oscillator was successfully modulated by a 1 MHz signal, which is ten times higher than the bandwidth of the phase-locked loop.

Click on title for a complete paper.



THz interconnect with low-loss and low-group velocity dispersion

R. Mendis and D. Grischkowsky. "THz interconnect with low-loss and low-group velocity dispersion." 2001 Microwave and Wireless Components Letters 11.11 (Nov. 2001 [MWCL]): 444-446.

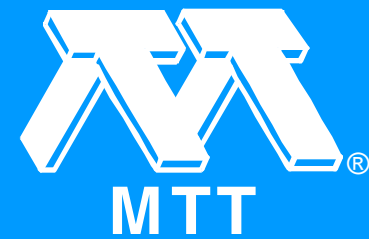
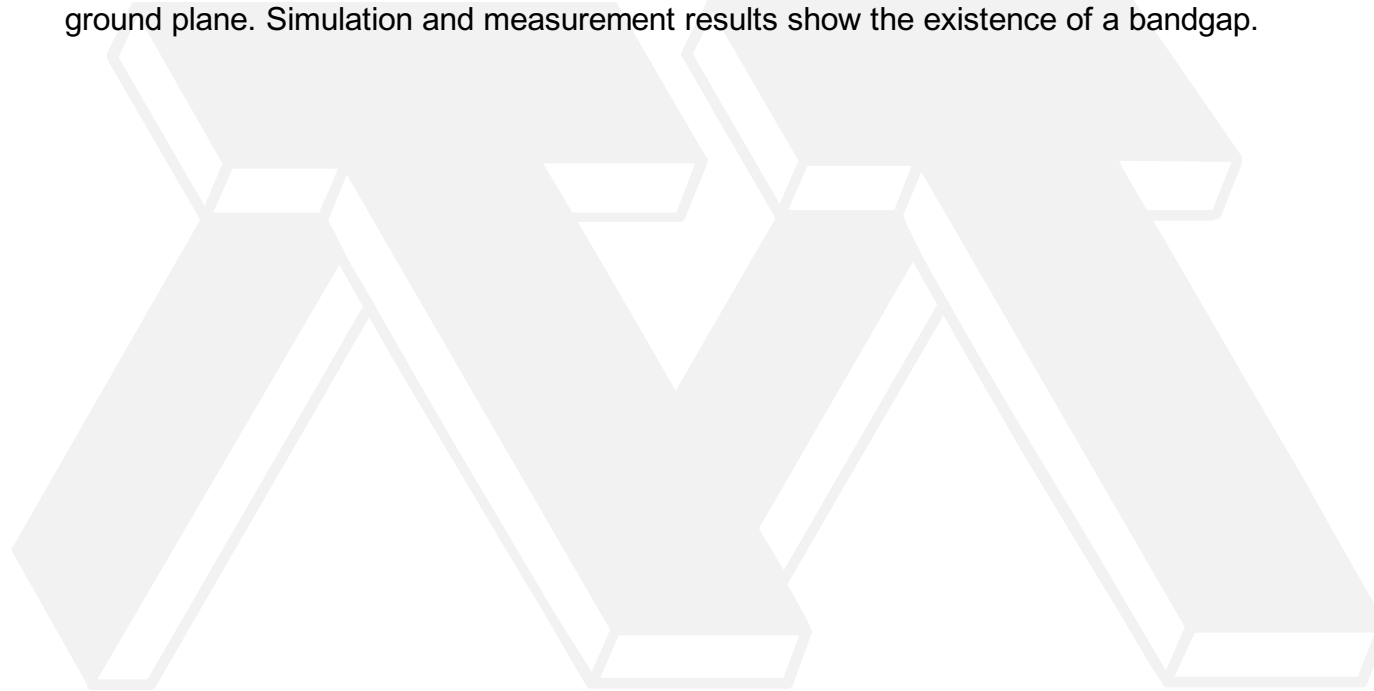
We report the demonstration of a physically flexible, practicable THz interconnect with minimal pulse distortion and loss. The interconnect is a parallel-plate waveguide, with the TEM mode excited, constructed of two thin copper strips. The incoming 0.22 ps THz pulse broadens to 0.39 ps after propagating 250 mm in the waveguide and is also attenuated by a factor of ten. We show that this attenuation is mainly due to the finite conductivity of copper with some additional loss caused by the beam spread in the unguided dimension. The pulse broadening is due to the frequency-dependent loss since the group velocity dispersion is negligible.

Abstracts

A novel PBG coplanar waveguide

Yun-Qi Fu, Guo-Hua Zhang and Nai-Chang Yuan. "A novel PBG coplanar waveguide." 2001 Microwave and Wireless Components Letters 11.11 (Nov. 2001 [MWCL]): 447-449.

A novel coplanar waveguide with photonic bandgap structure is proposed and is implemented by etching holes in the ground plane with an open connected with the gap between strip line and ground plane. Simulation and measurement results show the existence of a bandgap.



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Improvement of broadband feedforward amplifier using photonic bandgap

Jinho Yoon and Chulhun Seo. "Improvement of broadband feedforward amplifier using photonic bandgap." 2001 Microwave and Wireless Components Letters 11.11 (Nov. 2001 [MWCL]): 450-452.

In this paper, the photonic bandgap, the predistortion, and the secondary harmonic tuning are simultaneously employed in a feedforward amplifier to maximize the power added efficiency (PAE) and the operating bandwidth for in IMT-2000 band. In this case, the secondary harmonic tuning and the predistortion linearizer can cancel the second and the third harmonics, respectively. The PBG prevented any more harmonics appearing over 6 GHz. The feedforward amplifier was improved by 4%, and 15 dBc in the PAE and the IMD (intermodulation distortion), respectively. The operation bandwidth achieved was twice as wide as the conventional feedforward amplifier.



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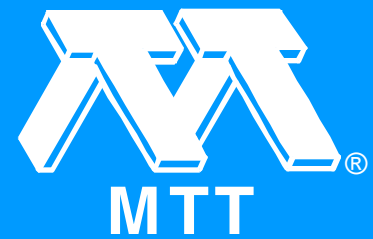
Picosecond time-domain characterization of CPW bends using a photoconductive near-field mapping probe

Jongjoo Lee, Jingook Kim, Sungkyu Yu and Joungho Kim. "Picosecond time-domain characterization of CPW bends using a photoconductive near-field mapping probe." 2001 Microwave and Wireless Components Letters 11.11 (Nov. 2001 [MWCL]): 453-455.

Propagation and reflection characteristics of right-angle coplanar waveguide (CPW) bends were measured using a novel photoconductive near-field probe with picosecond temporal resolution and pin spatial resolution. The probe can measure the transverse electric-field components existing over devices under test. Time-varying transverse electric field maps for different CPW bending structures were acquired by varying the probe position. The CSL mode generation and a difference in flight time of propagating pulses on two slots of the CPW bends were observed. Further, it was found that there exists a considerable unexpected pulse caused by the bent line structure, which has opposite polarity to the input pulse and exists only at the inner ground plane. The undesirable phenomena originated from the bend discontinuity were adequately reduced by bend smoothing techniques.

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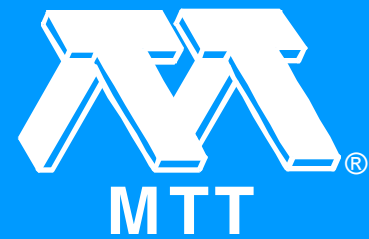
Input impedance of rectangular microstrip patch antenna with iso/anisotropic substrate-superstrate

A.K. Verma. "Input impedance of rectangular microstrip patch antenna with iso/anisotropic substrate-superstrate." 2001 Microwave and Wireless Components Letters 11.11 (Nov. 2001 [MWCL]): 456-458.

The modified Wolff model (MWM), which is an improved version of the cavity model, is presented to compute the resonance frequency and input impedance of a rectangular microstrip patch antenna under the isotropic/anisotropic substrate-superstrate configuration. The model has accuracy better than 1.5% for both the resonance frequency and resonant resistance, as compared against the results of the method of moments (MOM) and experimental results.

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A reduced surface-wave twin arc-slot antenna for millimeter-wave applications

M.A. Hickey, Meide Qiu and G.V. Eleftheriades. "A reduced surface-wave twin arc-slot antenna for millimeter-wave applications." 2001 Microwave and Wireless Components Letters 11.11 (Nov. 2001 [MWCL]): 459-461.

A simple, uniplanar, reduced surface-wave twin arc-slot antenna element for millimeter-wave (mm-wave) integrated circuit antenna systems is presented. This design allows for almost complete surface-wave cancellation and resonance to be achieved simultaneously. Measured far-field radiation patterns on an electrically thick substrate are in very good agreement with theory and show little evidence of surface-wave propagation.

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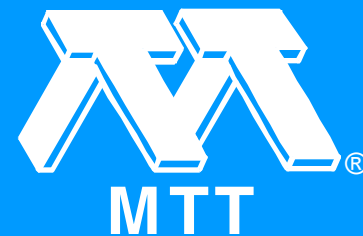


Abstracts

A hybrid fourth-order FDTD utilizing a second-order FDTD subgrid

S.V. Georgakopoulos, R.A. Renaut, C.A. Balanis and C.R. Birtcher. "A hybrid fourth-order FDTD utilizing a second-order FDTD subgrid." 2001 Microwave and Wireless Components Letters 11.11 (Nov. 2001 [MWCL]): 462-464.

A hybrid method utilizing the second-order accurate in time and fourth-order accurate in space FDTD (2, 4) coupled with the standard second-order accurate both in time and space FDTD (2, 2) on a subgrid is presented. The accuracy of the method is tested by computing the S-parameters of two monopoles mounted on a ground plane and it is found to be very satisfactory. Significant computational savings both in memory and time are accomplished by using this hybrid method.



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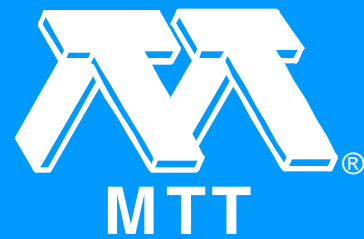


Abstracts

A new temporal basis function for the time-domain integral equation method

Jin-Lin Hu, C.H. Chan and Yuan Xu. "A new temporal basis function for the time-domain integral equation method." 2001 Microwave and Wireless Components Letters 11.11 (Nov. 2001 [MWCL]): 465-466.

A new temporal basis function that has all-order continuous derivative has been constructed using a nonlinear optimization scheme. This new basis function provides a much more stable explicit marching-on-in-time (MOT) solution, based on the time-domain integral equation (TDIE) method, than that presently available. Two examples are presented to illustrate the superior stability of the proposed temporal basis function.



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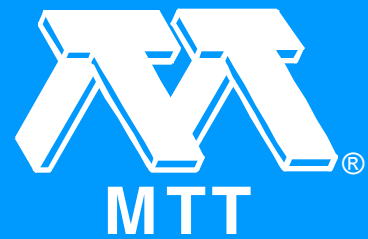
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Abstracts

Generalized quasi-tem approximation and telegrapher equations for nonreciprocal ferrite-loaded transmission lines (Correction)

R. Marques, F. Mesa and F. Medina. "Generalized quasi-tem approximation and telegrapher equations for nonreciprocal ferrite-loaded transmission lines (Correction)." 2001 Microwave and Wireless Components Letters 11.11 (Nov. 2001 [MWCL]): 467-467.



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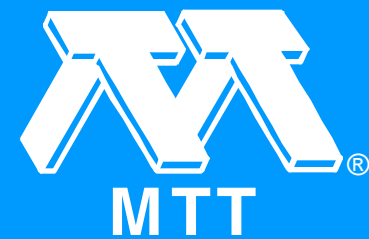
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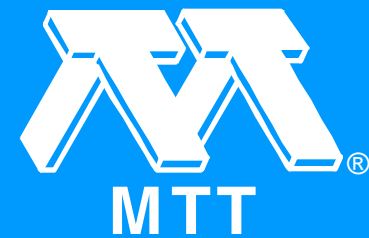
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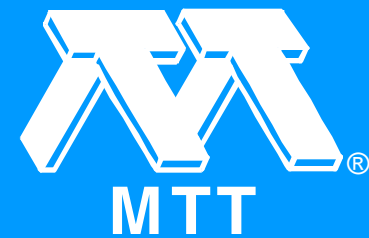
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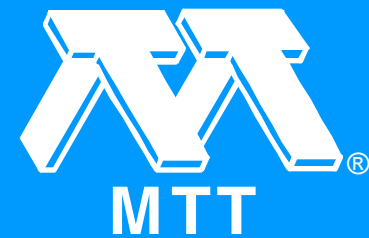
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Information for Authors Submitting Manuscripts in Electronic Form (Dec. 2001 [MWCL])

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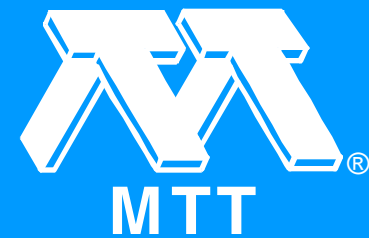
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A planar orthomode transducer

R.W. Jackson. "A planar orthomode transducer." 2001 Microwave and Wireless Components Letters 11.12 (Dec. 2001 [MWCL]): 483-485.

The planar orthomode transducer (OMT) described in this paper couples two microstrip inputs to two orthogonal modes in a square waveguide. One microstripline feeds a 180/spl deg/ hybrid that in turn excites two waveguide probes. A second microstrip directly feeds a third waveguide probe. Mode symmetry provides isolation between the two feeds. All circuitry and probes are fabricated on a single substrate to minimize fabrication cost. An experimental prototype has 30 to 40 dB isolation at millimeter wave frequencies. The low cost and small size of this structure make it appropriate for use in commercial communications applications.

Chirped delay lines in microstrip technology

M.A.G. Laso, T. Lopetegi, M.J. Erro, D. Benito, M.J. Garde, M.A. Muriel, A. Sorolla and M. Guglielmi. "Chirped delay lines in microstrip technology." 2001 Microwave and Wireless Components Letters 11.12 (Dec. 2001 [MWCL]): 486-488.

In this paper, we report on a design method for chirped delay lines (CDLs) in microstrip technology. They consist in a continuously varying strip width, so that the coupling location between the quasi-TEM microstrip mode and the same but counter-propagating mode is linearly distributed in frequency. High delay/spl times/bandwidth products, over frequency ranges of several gigahertz, can be obtained following this procedure. Experimental data confirm the design method. Real-time Fourier analysis of wideband pulses can be performed using these CDLs.



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Coaxial continuous transverse stub (CTS) array

M.F. Iskander, Zhijun Zhang, Zhengqing Yun and R. Isom. "Coaxial continuous transverse stub (CTS) array." 2001 Microwave and Wireless Components Letters 11.12 (Dec. 2001 [MWCL]): 489-491.

A new coaxial continuous transverse stub (CTS) array is proposed, designed, constructed, and tested. It is an omni-directional low cost antenna array which provides good impedance matching characteristics and good tolerance to manufacturing errors. It can be simply fed by a coaxial connector and is particularly suitable for millimeter wave personal communication systems (PCS). It is shown that this type of radiating element provides high percentage of radiation, and for the simulated design of single- and multiple-element arrays, S_{11} was below -10 dB across a 6 GHz frequency span at the Ka band. A three-element prototype coaxial CTS antenna array was designed, constructed, and tested in the X-band. Experimental results were in good agreement with the simulated performance. Potential application of this new antenna array in multiband operation is also described.

Click on title for a complete paper.



A dual-beam asymmetrically scanning leaky-wave antenna by utilizing a HEMT resistive upconverter

Chien-Jen Wang, Yu-Hau Sheu and C.F. Jou. "A dual-beam asymmetrically scanning leaky-wave antenna by utilizing a HEMT resistive upconverter." 2001 Microwave and Wireless Components Letters 11.12 (Dec. 2001 [MWCL]): 492-494.

A dual-beam asymmetrical scanning microstrip leaky-wave antenna (LWA) has been demonstrated in this paper. A HEMT resistive upconverter output is connected to one terminal of the LWA, and a local oscillator (LO) signal is connected to the other terminal. In this experiment, we set the LO frequency at 9.5 GHz so that the right beam is fixed at 48/spl deg/. By changing the IF frequency from 0.7 GHz to 1.5 GHz, the module of the LWA can steer the left main beam of the far-field pattern from 136/spl deg/ to 158/spl deg/ (the total scanning angle of 22/spl deg/). Comparisons between the measured and theoretical results indicate that the design can achieve the asymmetrically scanning capability and agree well over the tuning bandwidth of 0.8 GHz.

Cross-coupled differential oscillator MMICs with low phase-noise performance

Sang-Woong Yoon, Eun-Chul Park, Chang-Ho Lee, Sanghoon Sim, Sang-Goog Lee, Euisik Yoon, J. Laskar and Songcheol Hong. "Cross-coupled differential oscillator MMICs with low phase-noise performance." 2001 Microwave and Wireless Components Letters 11.12 (Dec. 2001 [MWCL]): 495-497.

LC-tank oscillators in the 5/spl sim/6 GHz frequency range have been designed and implemented in a commercial 0.6 /spl mu/m GaAs MESFET technology. One is a voltage-controlled oscillator (VCO), and the other is an oscillator without a controlling element. The output frequency range of the VCO is from 5.44 to 6.14 GHz, and the measured phase-noise is -101.67 dBc/Hz at an offset frequency of 600 KHz from the 5.44 GHz carrier. The phase-noise of the 6.44 GHz oscillator is -108 dBc/Hz at an offset frequency of 600 KHz, and the phase-noise curve, in the offset frequency range between 100 KHz and 1 MHz, shows a -20 dB/decade slope. These phase-noise characteristics are comparable to, or better than, those of the reported 5/spl sim/6 GHz-band CMOS oscillators. To our knowledge, this is the first GaAs MESFET-based oscillator which has a cross-coupled differential topology and a capacitive coupling feedback to suppress the up-conversion of 1/f noise. Also, it is first reported that the GaAs MESFET-based oscillator shows 1/f/sup 2/ phase-noise behavior across the offset frequency range from 100 KHz to 1 MHz.



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Monolithic coplanar transmission lines loaded by heterostructure barrier varactors for a 60 GHz tripler

M. Fernandez, E. Delos, X. Melique, S. Arscott and D. Lippens. "Monolithic coplanar transmission lines loaded by heterostructure barrier varactors for a 60 GHz tripler." 2001 Microwave and Wireless Components Letters 11.12 (Dec. 2001 [MWCL]): 498-500.

Nonlinear transmission lines (NLTLs) loaded by InP-based heterostructure barrier varactors (HBVs) have been fabricated in a monolithic coplanar technology for the first time. The devices were designed for a tripler with a 60 GHz; output frequency. The single HBV diodes, fabricated in a dual barrier scheme, exhibit a capacitance ratio of 6:1, a normalized capacitance of 1.4 fF/ $\mu\text{m}/\text{m}/\text{sup } 2/$ and a voltage breakdown in excess of 10 V. Under moderate pumping (20 dBm), a tripling operation with 30% bandwidth was demonstrated with unsaturated conversion efficiency (1%) for a eight-HBV prototype.

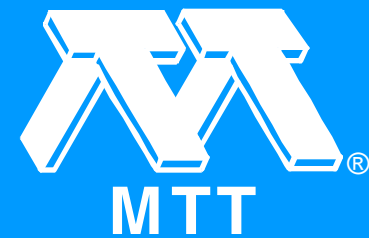
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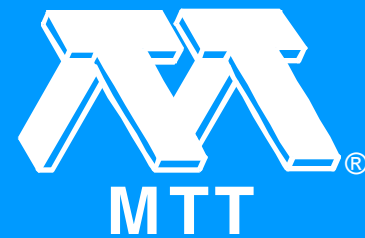
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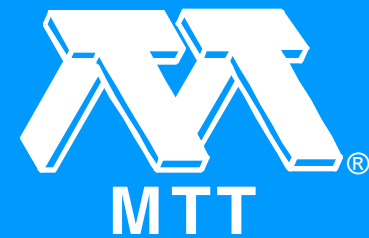
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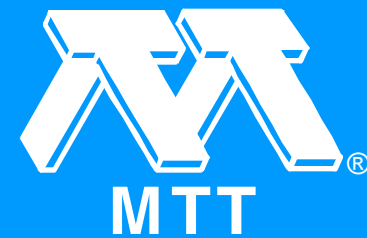
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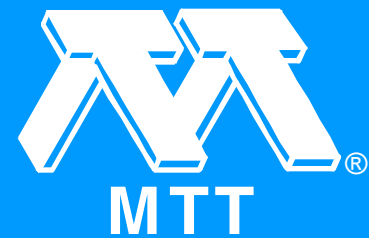
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Front Cover (2001 Vol. I [MWSYM])

"Front Cover (2001 Vol. I [MWSYM])." 2001 MTT-S International Microwave Symposium Digest 01.1 (2001 Vol. I [MWSYM]): I-ii.

The following topics were covered: techniques for system level nonlinear analysis and simulation; power combiners/dividers and directional couplers; microwave photonics; frequency convertors; smart antennas; biological effects and medical applications; baluns, spiral inductors and resonators; MEMS for antenna applications; control devices; phased array antennas; low noise amplifiers; MEMS control circuits; acoustic devices for wireless communications and sensing; novel antennas and applications.

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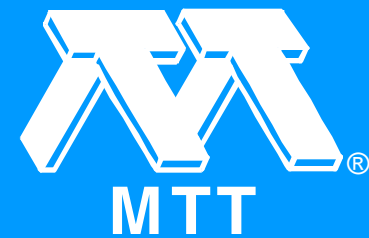
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Technical Program Schedule (2001 Vol. I [MWSYM])

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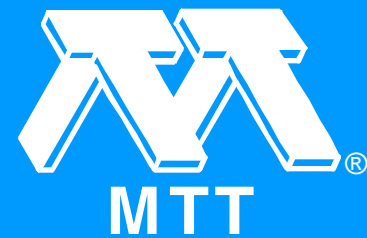


Abstracts

Analysis of CDMA signal spectral regrowth and waveform quality (2001 Vol. I [MWSYM])

V. Aparin. "Analysis of CDMA signal spectral regrowth and waveform quality (2001 Vol. I [MWSYM])." 2001 MTT-S International Microwave Symposium Digest 01.1 (2001 Vol. I [MWSYM]): 5-8 vol.1.

Spectral regrowth and waveform quality of a reverse-link CDMA signal passed through a weakly nonlinear circuit are analyzed using the power series and statistical methods. The analysis is based on a time-domain model of the signal that gives more accurate distortion estimates than the widely used Gaussian noise assumption. The model is also used to derive the probability density function of the CDMA signal to show its difference from that of the Gaussian noise.



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Generalized autocorrelation analysis of spectral regrowth from bandpass nonlinear circuits

K. Gard, M.B. Steer and L.E. Larson. "Generalized autocorrelation analysis of spectral regrowth from bandpass nonlinear circuits." 2001 MTT-S International Microwave Symposium Digest 01.1 (2001 Vol. 1 [MWSYM]): 9-12 vol.1.

Estimation of spectral regrowth generated by a digitally modulated carrier passed through a nonlinear RF circuit is analyzed using a formulation of the output autocorrelation function. The estimation is based on developing an analytical expression for the output power spectrum when the nonlinearity is modeled as a complex power series model extracted from measured amplitude-to-amplitude (AM-AM) and amplitude-to-phase (AM-PM) characteristics. An analytical expression of the output power spectrum is developed from statistical moments for a complex Gaussian input signal. Comparisons are presented of measured versus predicted ACPR values for a CDMA amplifier.

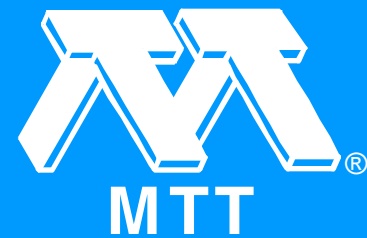


Abstracts

Application of polyspectral techniques to nonlinear modeling and compensation

C.P. Silva, A.A. Moulthrop, M.S. Muha and C.J. Clark. "Application of polyspectral techniques to nonlinear modeling and compensation." 2001 MTT-S International Microwave Symposium Digest 01.1 (2001 Vol. 1 [MWSYM]): 13-16 vol.1.

This paper introduces polyspectral techniques to the microwave community by describing their application to nonlinear component and system modeling, as well as compensation design. Basic features of the method are provided, and a specific application is given to the blackbox modeling of a commercial 20-GHz traveling-wave tube amplifier using 9.6 Gbps, 16-APK input signals.



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Estimation of error vector magnitude using two-tone intermodulation distortion measurements [power amplifier]

Hyunchul Ku and J.S. Kenney. "Estimation of error vector magnitude using two-tone intermodulation distortion measurements [power amplifier]." 2001 MTT-S International Microwave Symposium Digest 01.1 (2001 Vol. 1 [MWSYM]): 17-20 vol. 1.

In this paper, a new method for estimating error vector magnitude (EVM) degradation of a power amplifier using the intrinsic kernel function derived from two-tone intermodulation distortion (IMD) measurements is presented. The kernel function represents the incremental distortion characteristics of the power amplifier driven by a signal with small amplitude deviation. With a knowledge of the complementary cumulative distribution function (CCDF) of an arbitrary input signal, the Carrier-to-Interference Ratio (CIR) of the power amplifier can be derived and the EVM degradation of the power amplifier may be calculated. For the experimental validation, the EVM of the 16-QAM signals passed through 1.9 GHz HFET nonlinear amplifier is derived by the suggested method and compared with the measured results. The derived EVM shows a good agreement with measured results. The r.m.s. error between the two results over a 20 dB input range is less than 2%.

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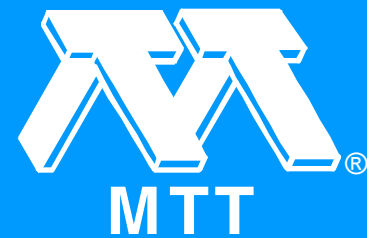


Abstracts

Investigation of behavioral model accuracy using a state-space and convolution-based transient simulator

Anding Zhu and T.J. Brazil. "Investigation of behavioral model accuracy using a state-space and convolution-based transient simulator." 2001 MTT-S International Microwave Symposium Digest 01.1 (2001 Vol. 1 [MWSYM]): 21-24 vol.1.

Behavioral modeling of high-frequency systems offers the prospect of more efficient simulation at the expense of some loss of accuracy. In this work, a new state-space/convolution type transient simulator is introduced which provides a large-signal amplifier analysis capability featuring extremely high accuracy and robustness. This simulator is used to "benchmark" the accuracy performance of different forms of behavioral model for a realistic PHEMT single-ended amplifier, with distributed matching circuitry.



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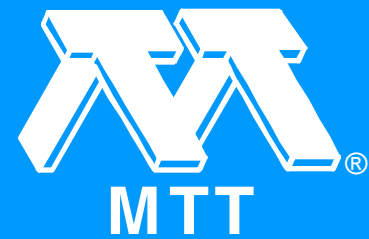
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Efficient circuit-level analysis of large microwave systems by Krylov-subspace harmonic balance

V. Rizzoli, A. Lipparini, D. Masotti and F. Matri. "Efficient circuit-level analysis of large microwave systems by Krylov-subspace harmonic balance." 2001 MTT-S International Microwave Symposium Digest 01.1 (2001 Vol. 1 [MWSYM]): 25-28 vol. 1.

The paper proposes a rigorous harmonic balance technique for the circuit-level simulation of complex microwave systems consisting of many interconnected functional blocks. The voltages at the interface ports between building blocks are used as auxiliary unknowns, and are determined simultaneously with the block state variables by a Krylov-subspace inexact Newton iteration. This provides exact results and allows large savings of both memory and CPU time.

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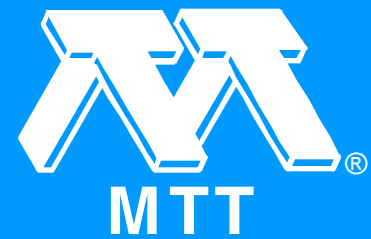


Abstracts

A novel 3-way hybrid combiner/divider for high power C-class microwave amplifiers

M. Catoiu. "A novel 3-way hybrid combiner/divider for high power C-class microwave amplifiers." 2001 MTT-S International Microwave Symposium Digest 01.1 (2001 Vol. I [MWSYM]): 31-34 vol.1.

Theoretical and experimental results of a novel 3-way tandem divider/combiner are presented. The device has hybrid properties and can be implemented on a low dielectric constant microwave substrate. The main advantages of the novel design are high power capability, low loss and good active return loss.



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A novel Ka-band 1 to 8 power divider/combiner

Xin Jiang, S. Ortiz and A. Mortazawi. "A novel Ka-band 1 to 8 power divider/combiner." 2001 MTT-S International Microwave Symposium Digest 01.1 (2001 Vol. 1 [MWSYM]): 35-38 vol. 1.

In this paper, a 1-to-8 traveling wave power divider/combiner design at Ka-band is presented. This power divider/combiner is composed of eight units coupling power from rectangular waveguide to microstrip lines. Coupling is achieved through longitudinal slots in the broad wall of the waveguide. Shorting posts inside the waveguide are used to adjust the coupling values. Experiments on the eight-way passive divider/combiner back-to-back design demonstrates a minimum overall insertion loss of 1.8 dB at 32.5 GHz with a 3 dB bandwidth of 15%.



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A low-loss serial power combiner using novel suspended stripline couplers

Y. Tahara, H. Oh-Hashi, T. Ban, K. Totani and M. Miyazaki. "A low-loss serial power combiner using novel suspended stripline couplers." 2001 MTT-S International Microwave Symposium Digest 01.1 (2001 Vol. 1 [MWSYM]): 39-42 vol.1.

This paper describes a serial power combiner which consists of novel suspended stripline couplers. The suspended stripline couplers have additional parallel capacitances to improve their directivities. The fabricated three-way power combiner has realized a good performance in insertion loss which is less than 0.23 dB over a bandwidth of 10% in the S-band.

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A compact coaxial waveguide combiner design for broadband power amplifiers

Pengcheng Jia and R.A. York. "A compact coaxial waveguide combiner design for broadband power amplifiers." 2001 MTT-S International Microwave Symposium Digest 01.1 (2001 Vol. 1 [MWSYM]): 43-46 vol. 1.

We report an enhanced broadband passive combiner structure using a dense slot-line antenna array in an oversized coaxial waveguide. A significant reduction in size has been achieved while maintaining a 6-18 GHz bandwidth and capacity for 32 MMIC amplifiers. A broadband slotline to microstrip line transition is developed and monolithically integrated with the slotline antennas, to eliminate a troublesome bond-wire transition in an earlier design and provide better compatibility with commercial MMICs. The Spectral Domain Method (SDM) is applied to compute the field in the structure, and the small reflection theory is extended to synthesize the waveguide taper and optimized slotline taper array.

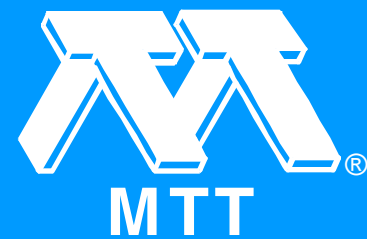
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Broadband lumped-element 180-degree hybrids utilizing lattice circuits

T. Kawai, Y. Kokubo and I. Ohta. "Broadband lumped-element 180-degree hybrids utilizing lattice circuits." 2001 MTT-S International Microwave Symposium Digest 01.1 (2001 Vol. 1 [MWSYM]): 47-50 vol. 1.

This paper suggests a novel lumped-element 180/spl deg/ hybrid utilizing lattice circuits. The present hybrid possesses a wide-band property differently from ordinary lumped-element hybrids composed of /spl Pi/ or/and T networks. The bandwidth ratio is 2.4 for a regular type and can be increased to 7.13 by adding a lattice type impedance transformer at each port. The validity and usefulness of this idea also are demonstrated by electromagnetic simulation for a uniplanar circuit pattern.



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Design of high directivity directional couplers in multilayer ceramic technologies

S. Al-Taei, P. Lane and G. Passiopoulos. "Design of high directivity directional couplers in multilayer ceramic technologies." 2001 MTT-S International Microwave Symposium Digest 01.1 (2001 Vol. 1 [MWSYM]): 51-54 vol.1.

Greater amalgamation of transceiver functionality is a way of addressing the commercial viability of forthcoming architectures. Multilayer Cofired Ceramics (e.g. LTCC/HTCC) is seen, as a potential integration platform offering size, cost and performance advantages. Monolithic integration of passive components, such as directional couplers, in Multilayer Integrated Circuit technologies is highly desirable. Microstrip broadside-coupled structures are well suited for tight coupling in a multilayer high integration environment. However, it is well known that such hybrids suffer from poor directivity due to the inhomogeneous nature of the substrate. Numerous compensation techniques have been proposed in the literature, which attempt to equalize the normal mode phase velocities. In this paper we address the equalization of couplers where the even mode phase velocity is greater than the odd mode, a case typically encountered in broadside-coupled microstrip structures. Simulation and measurement results of practical structures on LTCC technology show that the technique is well suited for multilayer design.





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Three-dimensional millimeter-wave photonic integrated circuits on Si

T. Minotani, Y. Royter, H. Ishii, A. Hirata, K. Machida, A. Sasaki and T. Nagatsuma. "Three-dimensional millimeter-wave photonic integrated circuits on Si." 2001 MTT-S International Microwave Symposium Digest 01.1 (2001 Vol. 1 [MWSYM]): 57-60 vol. 1.

We have demonstrated two millimeter-wave photonic integrated circuits: a coplanar waveguide (CPW) and a patch antenna, each of which is monolithically integrated with a high-speed InP/InGaAs photodiode on Si substrate. The passive elements are made on a thick low-k interlayer dielectric which makes the attenuation of the CPW much lower than that for a CPW on Si and constant from DC to 100 GHz. Furthermore, we optimized the via geometry to maintain signal waveform integrity. For the patch antenna, we demonstrated the radiation of millimeter-wave signal with power of over 0.1 mW at 120 GHz.

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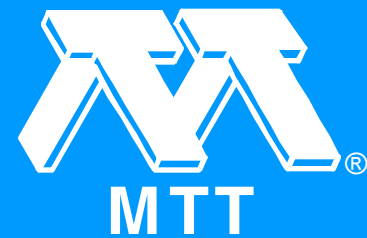


Abstracts

Wide bandwidth traveling-wave InGaAsP/InP electroabsorption modulator for millimeter wave applications

G.L. Li, S.A. Pappert, C.K. Sun, W.S.C. Chang and P.K.L. Yu. "Wide bandwidth traveling-wave InGaAsP/InP electroabsorption modulator for millimeter wave applications." 2001 MTT-S International Microwave Symposium Digest 01.1 (2001 Vol. 1 [MWSYM]): 61-64 vol.1.

Traveling wave electroabsorption modulators (TW-EAMs) can provide large modulation bandwidth and high efficiency features for both analog and digital fiber-optic links. Here, high efficiency TW-EAMs with modulation bandwidths in excess of 40 GHz have been demonstrated. Observing the predicted bandwidth reduction for counter-propagating optical and microwave fields along the waveguide has validated the traveling-wave nature of the modulator.



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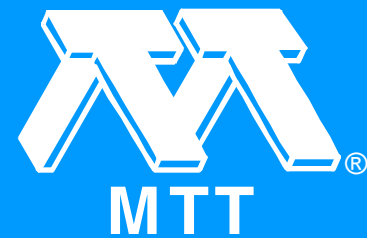
High-power photonic microwave generation at K- and Ku-bands using a uni-traveling-carrier photodiode

H. Ito, H. Fushimi, Y. Muramoto, T. Furuta and T. Ishibashi. "High-power photonic microwave generation at K- and Ku-bands using a uni-traveling-carrier photodiode." 2001 MTT-S International Microwave Symposium Digest 01.1 (2001 Vol. 1 [MWSYM]): 65-68 vol.1.

A K- to Ka-band photonic microwave generator (PMG) consisting of a uni-traveling carrier photodiode (UTC-PD) and a monolithically integrated bias circuit utilizing a 1/4-wavelength coplanar waveguide is presented. The device exhibits a high saturation-output-power of +14 dBm at 26 GHz for a bias voltage of -4 V. The output power is almost constant within a frequency range from 23 to 29 GHz. The 3-dB down bandwidth of the generator is as wide as 20 GHz, which is in good agreement with the circuit model calculation. Two types of device, one with and without a DC-cut capacitor, exhibit almost the same input-output characteristics. The PMG is a suitable device for the broadband high-output fiber-radio applications.

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Direct opto-electronic synthesis of mW-level millimeter wave signals using an optical frequency comb generator and a uni-traveling-carrier photodiode

S. Fukushima, C.F.C. Silva, Y. Muramoto and A.J. Seeds. "Direct opto-electronic synthesis of mW-level millimeter wave signals using an optical frequency comb generator and a uni-traveling-carrier photodiode." 2001 MTT-S International Microwave Symposium Digest 01.1 (2001 Vol. 1 [MWSYM]): 69-72 vol. 1.

The first experimental demonstration of direct 60 GHz opto-electronic synthesis of mW-level millimeter-wave signals using an optical frequency comb generator is reported. We obtained signals from 10 to 60 GHz with a maximum power of +3 dBm at 60 GHz using a uni-traveling-carrier photodiode.

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Photodetection, photonic feeding coplanar patch antenna and transmitting experiment for radio-on-fiber system

K. Li and H. Izutsu. "Photodetection, photonic feeding coplanar patch antenna and transmitting experiment for radio-on-fiber system." 2001 MTT-S International Microwave Symposium Digest 01.1 (2001 Vol. 1 [MWSYM]): 73-76 vol.1.

We present an experiment on optical modulation, photodetection, photonic feeding and RF transmitting radiation system. The experiment showed an RF power of more than 10 dBm at both 10 GHz and 20 GHz from a photodetector (PD). A coplanar patch antenna has been used as radiating antenna, which has a CPW fed line and then easy to connect with the PD and has been designed based on a concept of coplanar patch. The transmitting experiment demonstrated the effectiveness of the direct photonic feeding antenna and its potential application to real radio-on-fiber system.

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Experimental reduction of dispersion-induced effects in microwave/millimeter-wave optical systems employing SOA boosters

F. Ramos, J. Herrera and J. Marti. "Experimental reduction of dispersion-induced effects in microwave/millimeter-wave optical systems employing SOA boosters." 2001 MTT-S International Microwave Symposium Digest 01.1 (2001 Vol. 1 [MWSYM]): 77-79 vol.1.

A novel approach to reduce the dispersion induced effects in microwave/millimeter-wave optical links based on the combination of chirp generated by semiconductor optical amplifiers (SOA's) and fiber-induced self-phase modulation has been proposed and experimentally demonstrated. The results show that the dispersion-induced RF carrier suppression effect may be alleviated by more than 20 dB when the SOA is operated under saturation. However, the SOA input power must be carefully controlled in order to avoid significant nonlinear distortion.

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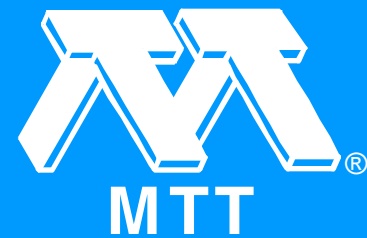


Abstracts

RF mixers using standard digital CMOS 0.35 $\mu\text{m}/\text{m}$ process

V. Geffroy, G. De Astis and E. Bergeault. "RF mixers using standard digital CMOS 0.35 $\mu\text{m}/\text{m}$ process." 2001 MTT-S International Microwave Symposium Digest 01.1 (2001 Vol. I [MWSYM]): 83-86 vol.1.

The performance of doubly-balanced active and resistive RF CMOS mixers is presented following measurements at 1.8-GHz RF frequency. The active mixer has demonstrated 10.4-dB gain, 7-dB SSB NF, -6 dBm IIP3 and consumes 9.7 mA under 3 V. The passive mixer has demonstrated 7.5-dB loss, 10-dB SSB NF and +16-dBm of input IP3.



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Broadband and compact SiBJT balanced up-converter MMIC using Si 3-D MMIC technology

K. Nishikawa, K. Kamogawa, T. Nakagawa, B. Piernas and K. Araki. "Broadband and compact SiBJT balanced up-converter MMIC using Si 3-D MMIC technology." 2001 MTT-S International Microwave Symposium Digest 01.1 (2001 Vol. I [MWSYM]): 87-90 vol.1.

This paper presents a broadband and compact SiBJT balanced up-converter MMIC using Si 3-D MMIC technology. The balanced up-converter consists of newly designed Marchand-type balun, and two unit mixers that have stacked matching circuits. The fabricated balanced upconverter MMICs occupies just 1 mm² but achieves a conversion gain of 2.5 dB/spl plusmn/2.5 dB and LO signal suppression of more than 30 dB at an RF port from 12 GHz to 27 GHz. The power consumption is 9.8 mW with 1 V supply voltage. The broadband performance factor of the fabricated MMIC is twice those of previously reported balanced up-converter MMICs.

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A highly linear single balanced mixer based on heterojunction interband tunneling diode (2001 Vol. I [MWSYM])

A. Cidronali, G. Collodi, C. Toccafondi, M. Deshpande, N. El-Zein, G. Manes, V. Nair and H. Goronkin. "A highly linear single balanced mixer based on heterojunction interband tunneling diode (2001 Vol. I [MWSYM])." 2001 MTT-S International Microwave Symposium Digest 01.1 (2001 Vol. I [MWSYM]): 91-94 vol.1.

In this paper a compact and highly linear MMIC single balanced mixer based on heterojunction interband tunnel diode (HITD) technology working at 1.8 GHz, is described. The prototype consisted of a pair of HITDs biased at zero volts and a lumped element directional coupler with arbitrary impedance terminations. The salient feature of the mixer is the linearity due to the quasi square law DC characteristics exhibited by the device around zero voltage. The design techniques along with a detailed experimental validation are provided. The prototype exhibited an IIP3 power level of 17 dBm and a 1 dB compression point of 7.5 dBm.

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A 60 GHz uniplanar MMIC 4X subharmonic mixer

M.W. Chapman and S. Raman. "A 60 GHz uniplanar MMIC 4X subharmonic mixer." 2001 MTT-S International Microwave Symposium Digest 01.1 (2001 Vol. 1 [MWSYM]): 95-98 vol.1.

A uniplanar GaAs MMIC subharmonic mixer has been designed and fabricated using an antiparallel diode pair in finite ground coplanar (FGC) waveguide technology. This mixer is designed to operate over an RF range of 58.5-60.5 GHz, an IF range of 1.5-2.5 GHz, and an LO frequency range of 14-14.5 GHz. Of several mixer configurations tested, the best results show a maximum conversion loss of 13.2 dB over the specified frequency range with a minimum LO power of 3 dBm. The minimum upper sideband conversion loss is 11.3 dB at an RF of 58.5 GHz and an IF of 2.5 GHz. This represents excellent performance for a 4X subharmonic mixer operating at 60 GHz.

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A monolithic HEMT diode balanced mixer for 100-140 GHz

M. Morgan and S. Weinreb. "A monolithic HEMT diode balanced mixer for 100-140 GHz." 2001 MTT-S International Microwave Symposium Digest 01.1 (2001 Vol. 1 [MWSYM]): 99-102 vol.1.

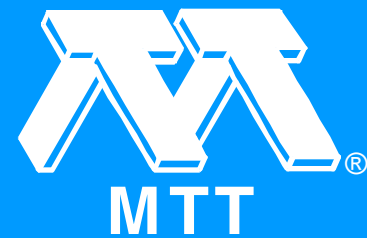
We report the design and evaluation of a broadband, balanced mixer for 100-140 GHz using a HEMT MMIC process on a 75 μm InP substrate. The circuit uses Schottky diodes as mixing elements. It demonstrates a conversion loss of 15 $\pm$ 2 dB from 100-130 GHz with 5 dBm LO drive at 80 GHz. Measurements indicate a wide IF bandwidth extending beyond 50 GHz. This is the first demonstration of a monolithic HEMT diode balanced mixer in this frequency range.

Abstracts

A full waveguide band MMIC tripler for 75-110 GHz

M. Morgan and S. Weinreb. "A full waveguide band MMIC tripler for 75-110 GHz." 2001 MTT-S International Microwave Symposium Digest 01.1 (2001 Vol. I [MWSYM]): 103-106 vol. 1.

Design and test data for a full waveguide band MMIC tripler using anti-parallel Schottky diodes are reported in this paper. The circuit outputs between -3.7 dBm and +2.0 dBm from 75 to 110 GHz. When tuned for power flatness, the output is between -4.6 dBm and -1.3 dBm across the band. The conversion efficiency is about 1.5% in both cases. To the authors' knowledge, this is the first reported MMIC frequency tripler to cover the entire W-band.



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High gain PHEMT frequency doubler for 76 GHz automotive radar

A. Werthof, H. Tischer and T. Grave. "High gain PHEMT frequency doubler for 76 GHz automotive radar." 2001 MTT-S International Microwave Symposium Digest 01.1 (2001 Vol. I [MWSYM]): 107-109 vol.1.

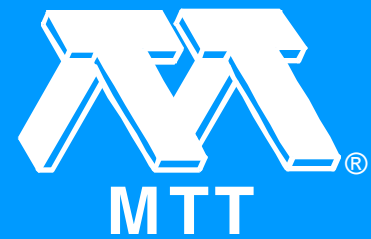
A one-stage 38.25/76.5 GHz frequency doubler has been developed with a maximum conversion gain of 1 dB. The doubler achieves a saturated output power of 9 dBm for 12 dBm input power. Two complex transmit MMICs consisting of a 38 GHz amplifier, the frequency doubler and 76 GHz amplifiers with increased output power of 14 dBm and 10 dB conversion gain have been developed for automotive applications.

Abstracts

A stability ensuring design approach for frequency triplers

B. Bunz and G. Kompa. "A stability ensuring design approach for frequency triplers." 2001 MTT-S International Microwave Symposium Digest 01.1 (2001 Vol. 1 [MWSYM]): 111-114 vol.1.

A novel design procedure for frequency triplers is presented. After first determining optimum bias conditions for frequency triplication, stable regions of operation are determined. The dependency of output power and conversion gain as functions of terminating stubs at all frequencies is examined. An experimental validation is finally carried out.



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A family of Q, V and W-band monolithic resistive mixers

M. Kimishima, T. Ataka and H. Okabe. "A family of Q, V and W-band monolithic resistive mixers." 2001 MTT-S International Microwave Symposium Digest 01.1 (2001 Vol. I [MWSYM]): 115-118 vol.1.

This paper presents the design, fabrication, and testing results of Q, V, and W-band monolithic broadband resistive mixers for measurement instruments. Low conversion loss and good flatness of the frequency response across a wide frequency range were achieved using an InGaP-InGaAs HEMT biased in the resistive mode. Three mixers in Q, V, and W-band show similar excellent measured performance. Q and V-band mixers were designed using two Lange couplers. The Q-band mixer exhibits a conversion loss of 11.7 dB and a loss flatness of 1.2 dB for 11 GHz IF frequency over 42-56 GHz RF frequency band. The V-band mixer exhibits a conversion loss of 12.8 dB and a loss flatness of 1.0 dB for 18 GHz IF frequency over 56-72 GHz RF frequency band. On the other hand, the W-band mixer using a 180-degree balun, shows a conversion loss of 10.6 dB and a loss flatness of 1.2 dB for 30 GHz IF frequency over a 72-84 GHz RF frequency band.

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A novel planar array smart antenna system with hybrid analog-digital beamforming

Seong-Sik Jeon, Yuanxun Wang, Yongxi Qian and T. Itoh. "A novel planar array smart antenna system with hybrid analog-digital beamforming." 2001 MTT-S International Microwave Symposium Digest 01.1 (2001 Vol. 1 [MWSYM]): 121-124 vol.1.

In this paper, a novel design of a smart antenna system based on hybrid analog-digital beamforming is proposed. The goal of the design is to construct smart antenna beamforming systems with high data rate throughput. The speed bottleneck in DSP I/O congestion is relieved using analog beamforming at the IF frequency, while the advanced signal processing capability of the DSP chip is retained. The data throughput of 20 Mbps for BPSK is reported for an 8-element adaptive array. DOA estimation and the beamforming result based on this new beamforming concept is demonstrated.

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Digital beamforming for smart antennas

T.W. Nuteson and G.S. Mitchell. "Digital beamforming for smart antennas." 2001 MTT-S International Microwave Symposium Digest 01.1 (2001 Vol. I [MWSYM]): 125-128 vol. 1.

An 8-channel digital phased array antenna (PAA) is designed and evaluated for a smart antenna application in the cellular PCS band (1850 MHz to 1990 MHz). Each channel is digitized at the RF carrier frequency using bandpass sampling clocking up to 1.5 Gsps with a 140 MHz bandwidth. The beamforming and additional signal processing is implemented digitally using field programmable gate arrays (FPGAs). This paper characterizes the PAA system for effects on loading analog-to-digital converters (ADCs) including automatic gain control (AGC) techniques and cochannel interference.

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Smart lens antenna arrays

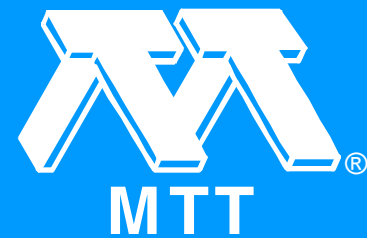
J. Vian and Z. Popovic. "Smart lens antenna arrays." 2001 MTT-S International Microwave Symposium Digest 01.1 (2001 Vol. 1 [MWSYM]): 129-132 vol. 1.

This paper describes a smart lens antenna array in which a portion of the signal processing is implemented at the analog front end, resulting in reduced processing load. The design of constrained lens arrays is described, and simulations of optimal receiver placement in the array are shown. As an example, the signal-to-noise ratio (SNR) is calculated when a least-mean-square (LMS) adaptive algorithm is applied to different-size lens arrays. The complex weight trajectories are compared to those in a standard planar antenna array, and it is shown that fewer weights are needed in the case of a lens array. The resulting adapted radiation patterns in multi-user and multi-path communication environments are calculated for realistic antenna elements, and a reduction in processing load is shown as compared to standard arrays.

Adaptive beamforming of ESPAR antenna using sequential perturbation

Jun Cheng, Y. Kamiya and T. Ohira. "Adaptive beamforming of ESPAR antenna using sequential perturbation." 2001 MTT-S International Microwave Symposium Digest 01.1 (2001 Vol. 1 [MWSYM]): 133-136 vol.1.

A technique for adaptively controlling the loaded reactances on the passive radiators, thus forming both beam and nulls is presented, for the first time, for the electronically steerable passive array radiator (ESPAR) antenna. Conventional adaptive array antenna processing must access signals on all of the array antenna elements. However, because the low-cost ESPAR antenna only has a single-port output, all of the signals on the antenna elements cannot be observed. The adaptive algorithm proposed in this paper is based on the steepest gradient theory, where the reactances are sequentially perturbed to determine the gradient vector. Simulations show that the ESPAR antenna can be adaptive. The statistical performance of the output SIR of the ESPAR antenna is also given.



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Microwave device combining filtering and radiating functions for telecommunication satellites

H. Blondeaux, D. Baillargeat, P. Leveque, S. Verdeyme, P. Vaudon, P. Guillon, A. Carlier and Y. Caillorce. "Microwave device combining filtering and radiating functions for telecommunication satellites." 2001 MTT-S International Microwave Symposium Digest 01.1 (2001 Vol. I [MWSYM]): 137-140 vol.1.

An original new design of microwave structure for integrating filter and antenna functions on a single device is presented. The structure is composed of a partially metallized dielectric plate enclosed in a parallelepipedic cavity. This topology allows a high integration in a planar environment type, and is suitable for high frequency filtering and power applications. In order to validate the multilayer radiant filter concept, an open two-pole filter using two superposed cavities coupled by a metallic iris is presented. Its filtering and radiating functions are optimized at the same time to present some required electrical performances. Moreover, to show the variety of uses of the antenna, two examples are described. The first one presents a coupled array of two radiant filters, and the second one an antenna with circular polarization radiation.

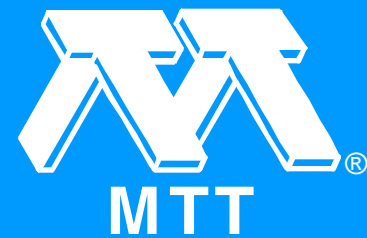


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An Internet controlled calibration system for TDMA smart antenna wireless base stations

J.H. Sinsky. "An Internet controlled calibration system for TDMA smart antenna wireless base stations." 2001 MTT-S International Microwave Symposium Digest 01.1 (2001 Vol. I [MWSYM]): 141-144 vol.1.

Smart antenna base stations are receiving considerable attention in the wireless marketplace due to their potential for increasing system capacity. These antenna arrays usually require accurate calibration in order to produce high quality steerable beams and direction of arrival measurements. The following work describes the design and measurement results of a new approach to array calibration consisting of a tower top Internet controllable high dynamic range data collection system combined with remote data processing. Measurements acquired during a sequence of time slots are used to obtain calibration accuracy of better than 1 degree for phase and better than 1.5% for amplitude. All data was taken on a smart antenna system prototype designed for advanced wireless access applications at our Crawford Hill Laboratory.



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Temperature rise for the human head for cellular telephones and for peak SARs prescribed in safety guidelines (2001 Vol. I [MWSYM])

O.P. Gandhi, Qing-Xiang Li and Gang Kang. "Temperature rise for the human head for cellular telephones and for peak SARs prescribed in safety guidelines (2001 Vol. I [MWSYM])." 2001 MTT-S International Microwave Symposium Digest 01.1 (2001 Vol. I [MWSYM]): 147-150 vol.1.

The bioheat equation is solved for an anatomically-based model of the human head with resolution of 3/spl times/3 mm to study the thermal implications of exposure to EM fields typical of cellular telephones both at 835 and 1900 MHz. Up to 4.5/spl deg/C temperature elevation may be caused for some locations of the pinna by a cellular telephone warmed by electronic circuitry to temperatures as high as 39/spl deg/C, with temperature increases for the internal tissues such as the brain and the eye that are no more than 0.1-0.2/spl deg/C higher than the basal values. Another objective was to study the thermal implications of the SAR limits for the occupational exposures of 8 W/kg for any 1-g, or 10 W/kg for any 10-g of tissue suggested in the commonly used safety guidelines. Such SARs would lead to temperature elevations for the electromagnetically exposed parts of the brain up to 0.5/spl deg/C, with 10 W/kg for any 10-g of tissue resulting in somewhat higher temperatures for larger volumes.

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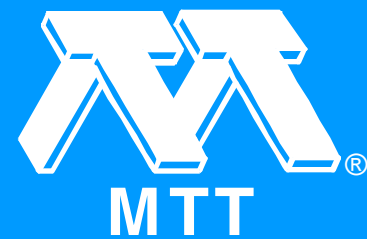
Power absorption and temperature elevations induced in the human head by dual-band phones

P. Bernardi, M. Cavagnaro, S. Pisa and E. Piuzzi. "Power absorption and temperature elevations induced in the human head by dual-band phones." 2001 MTT-S International Microwave Symposium Digest 01.1 (2001 Vol. I [MWSYM]): 151-154 vol.1.

A numerically efficient way to evaluate SAR deposition and temperature elevation inside the head of a user of a cellular phone equipped with a dual-band helical antenna is proposed. The results obtained for a given radiated power show that, although the maximum SAR value as averaged over 1 g in the brain is higher at 900 MHz than at 1800 MHz, the maximum temperature increase in the brain is higher at 1800 MHz. In fact, at 1800 MHz the thermal diffusion process moves heat from the external layers, where SAR values higher than those obtained at 900 MHz are present, toward the brain.

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Miniature sensor for measurement and control of temperatures by microwave radiometry in medical applications

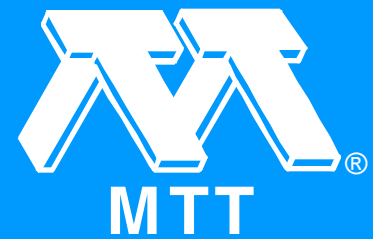
C. Vanoverschelde, L. Dubois, V. Thomy, J.P. Sozanski, J.-C. Camart, M. Chive and J. Pribetich. "Miniature sensor for measurement and control of temperatures by microwave radiometry in medical applications." 2001 MTT-S International Microwave Symposium Digest 01.1 (2001 Vol. 1 [MWSYM]): 155-158 vol.1.

In order to improve non-invasive measurement microwave radiometry in medical and industrial applications, we propose a new generation of sensors realized from a metallic sheet laid on a dielectric substrate. It allows the realization of sensors of small sizes and very light weight for medical applications such as neonate's temperature control.

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Analysis of planar strip array antenna for MRI

R.F. Lee and C.R. Westgate. "Analysis of planar strip array antenna for MRI." 2001 MTT-S International Microwave Symposium Digest 01.1 (2001 Vol. 1 [MWSYM]): 159-162 vol. 1.

Sequential MRI data acquisition could become a parallel process, thus reducing scan time significantly. PSA provides a means for such massive parallel detection. The theoretical analyses of the reactive field, coupling, and Q-factors of PSA are presented, and they were validated by the experimental measurements of in vivo MRI with PSA.

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Resonant slot antennas as transducers of DNA hybridization: a computational feasibility study

C. Wichaidit, J.R. Peck, Zhang Lin, R.J. Hamers, S.C. Hagness and D.W. Van Der Weide.
"Resonant slot antennas as transducers of DNA hybridization: a computational feasibility study."
2001 MTT-S International Microwave Symposium Digest 01.1 (2001 Vol. I [MWSYM]): 163-166
vol.1.

We propose and simulate a resonant slot antenna for sensing DNA hybridization. Using simple geometric arguments for water displacement from a DNA-functionalized surface, we predict the changes in dielectric constants caused by hybridization. We conclude that these changes are significant enough to be detected in measurements of the resonant frequency and the surface currents of a slot antenna. These results motivate experimental work using these antennas as alternatives to current fluorescence probes.

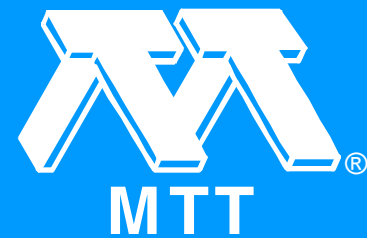
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A Zeeman-Stark/Markov model approach to study the EM-RF exposure of a potassium channel

S. Bruna, M. Liberti, S. Giordano, E. Moggia, B. Bianco and G. D'Inzeo. "A Zeeman-Stark/Markov model approach to study the EM-RF exposure of a potassium channel." 2001 MTT-S International Microwave Symposium Digest 01.1 (2001 Vol. 1 [MWSYM]): 167-170 vol.1.

The extraordinary increase in the use of electromagnetic (EM) radiofrequency (RF) radiation has stimulated new researches concentrated on the study of the early steps of the EM interaction mechanisms. As most of the effects due to the exogenous exposure of biosystem has been associated with the cell membrane, these researches are mainly oriented toward the study of the molecular aspects of the interaction. Here, the authors introduce an integrated methodology of analysis, which involves cascading steps such as quantum modelling of the system constituted by a ligand ion (Ca^{2+}) and a protein receptor (Calmodulin) of the cell membrane and analysis of the protein channel activity by means of a stochastic model of the channel.



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Non-invasive measurement of blood sugar level by millimeter waves

Y. Nikawa and D. Someya. "Non-invasive measurement of blood sugar level by millimeter waves." 2001 MTT-S International Microwave Symposium Digest 01.1 (2001 Vol. I [MWSYM]): 171-174 vol.1.

Measurement of blood sugar level by noninvasive method is highly desirable. Nevertheless, a practical non-invasive technique has not been reported. In this paper, to measure blood sugar level using millimeter wave noninvasively, complex permittivity of glucose and sodium chloride solution is measured and the change of transmission coefficient in millimeter wave region is obtained. An applicator system to measure blood sugar level in vivo is designed and optimized by simulation using transmission line modeling (TLM) method.

Click on title for a complete paper.



A microwave radio for Doppler radar sensing of vital signs

A. Droitcour, V. Lubecke, Jenshan Lin and O. Boric-Lubecke. "A microwave radio for Doppler radar sensing of vital signs." 2001 MTT-S International Microwave Symposium Digest 01.1 (2001 Vol. 1 [MWSYM]): 175-178 vol.1.

A microwave radio for Doppler radar sensing of vital signs is described. This radio was developed using custom DCS1800/PCS1900 base station RFICs. It transmits a single tone signal, demodulates the reflected signal, and outputs a baseband signal. If the object that reflects the signal has periodic motion, the magnitude of the baseband output signal is directly proportional to the periodic displacement of the object. When the signal is reflected off a person's chest, this radio with appropriate baseband filters can detect heart and respiration rates from a distance as large as one meter from the target.



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Sandwich type ferromagnetic RF integrated inductor (2001 Vol. I [MWSYM])

M. Yamaguchi, R. Baba and K. Arai. "Sandwich type ferromagnetic RF integrated inductor (2001 Vol. I [MWSYM])." 2001 MTT-S International Microwave Symposium Digest 01.1 (2001 Vol. I [MWSYM]): 185-188 vol.1.

The first microfabrication of a sandwich type ferromagnetic RF integrated spiral inductor for the 2 GHz range is demonstrated. The two ferromagnetic CoNbZr films sandwich the spiral to enhance the magnetic flux linkage across the coil current. The inductance, L , of 7.9 nH and the quality factor, Q , of 12.7 were obtained for a 200 /spl mu/m/spl times/400 /spl mu/m size 4-turn rectangular spiral at $f=2$ GHz. The inductance was better than that of an air core of the same coil size by 19%, and the Q was better by 23%.

Click on title for a complete paper.



Improved three-dimensional GaAs inductors

B. Piernas, K. Nishikawa, K. Kamogawa, T. Nakagawa and K. Araki. "Improved three-dimensional GaAs inductors." 2001 MTT-S International Microwave Symposium Digest 01.1 (2001 Vol. 1 [MWSYM]): 189-192 vol.1.

This paper clarifies the state-of-the-art GaAs inductors fabricated using three-dimensional (3-D) MMIC technology. A novel 3-D inductor is proposed and evaluated experimentally. Our 4.9 nH inductance achieves a peak Q factor of 35.93 with a resonant frequency of 8.07 GHz. To the knowledge of the authors, this performance is the highest yet reported for GaAs on-chip inductors. A 0.6-4 GHz band LNA is fabricated using 0.15 μm GaAs PHEMT devices ($f_{\text{sub max}}=120$ GHz) and the 3-D inductors. The fabricated LNA offers 12.3 dB gain and a noise figure under 1.5 dB with a d.c. power consumption of 27.84 mW.



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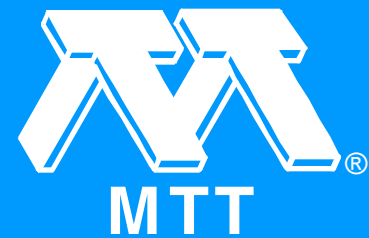
Development of vertical planar coil inductors using plastic deformation magnetic assembly (PDMA)

Jun Zou, J.G. Nickel, D. Trainor, Chang Liu and J.E. Schutt-Aine. "Development of vertical planar coil inductors using plastic deformation magnetic assembly (PDMA)." 2001 MTT-S International Microwave Symposium Digest 01.1 (2001 Vol. I [MWSYM]): 193-196 vol.1.

This paper presents the results of the development of a vertical planar coil inductor. The planar coil inductor is first fabricated on a silicon substrate and then assembled to the vertical position by using a novel 3-dimensional bath-scale self-assembly process called Plastic Deformation Magnetic Assembly (PDMA). Inductors of different dimensions are fabricated and tested. The S-parameters of the inductors before and after PDMA are measured and compared, demonstrating superior performance due to reduced substrate effects and also increased substrate space savings for the vertical planar coil inductors.

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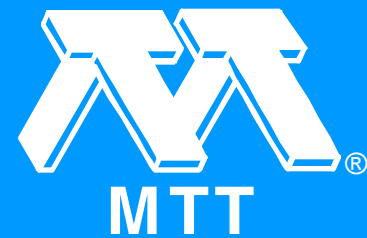
A low-loss planar microwave balun with an integrated bias scheme for push-pull amplifiers

Jong-Wook Lee and K.J. Webb. "A low-loss planar microwave balun with an integrated bias scheme for push-pull amplifiers." 2001 MTT-S International Microwave Symposium Digest 01.1 (2001 Vol. 1 [MWSYM]): 197-200 vol. 1.

We report a new planar low loss microstrip balun with radial stub RF grounding. This structure achieves a good RF ground for a Marchand-type balun and facilitates microstrip balun characterization. Moreover, a simplified biasing scheme for a push-pull amplifier was designed using this concept and this approach has been used successfully in a push-pull amplifier. The measured balun insertion loss was less than 0.5 dB over a 5-11 GHz band.

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Graphical design of air-gap stacked Marchand balun

Gi-Hyon Ryu, Dae-Hyun Kim, Jae-Hak Lee and Kwang-Seok Seo. "Graphical design of air-gap stacked Marchand balun." 2001 MTT-S International Microwave Symposium Digest 01.1 (2001 Vol. 1 [MWSYM]): 201-204 vol.1.

A new Marchand balun for MMIC is proposed which uses air-gap stacked structures and does not need any dielectric process. To design the newly proposed Marchand balun, simple graphical design method was used, which is based on Tsai and Gupta's generalized coupled lines model. The simple design results were compared with a general full-wave analysis. In this case, HP-Momentum simulator was used.

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High-Q frequency stable dual-mode whispering gallery sapphire resonator

M.E. Tobar, E.N. Ivanov, J.G. Hartnett and D. Cros. "High-Q frequency stable dual-mode whispering gallery sapphire resonator." 2001 MTT-S International Microwave Symposium Digest 01.1 (2001 Vol. 1 [MWSYM]): 205-208 vol. 1.

The design and experimental test of a dual mode high-Q Whispering Gallery (WG) sapphire resonator is presented. Dual mode operation is realized by designing the WGE/sub 7,0,0/ and the WGH/sub 9,0,0/ mode near 9 GHz and separated in frequency by approximately 80 MHz. Design was achieved by implementing finite element software, which is shown to agree very well with measurement. Due to the anisotropy of sapphire, WGH and WGE modes have different temperature coefficient of frequency (TCF). We show that the difference frequency can be used to stabilize the temperature, resulting in a temperature limited frequency stability of better than one part in 10^{13} . This type of resonator has the potential to improve substantially the close to the carrier phase noise in current state-of-the-art low noise oscillators.

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2-D mechanical beam steering antenna fabricated using MEMS technology

Chang-Wook Baek, Seunghyun Song, Changyul Cheon, Yong-Kweon Kim and Youngwoo Kwon. "2-D mechanical beam steering antenna fabricated using MEMS technology." 2001 MTT-S International Microwave Symposium Digest 01.1 (2001 Vol. 1 [MWSYM]): 211-214 vol.1.

A mechanical beam steering antenna capable of beam steering with two degrees of freedom is proposed and fabricated using MEMS technology. The V-band antenna element is implemented on the polymer platform which is capable of rotation with two degrees of freedom so that the beam can be directed to any desired direction. Radiation pattern of the fabricated antenna was measured and was in good agreement with the simulation results.

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Microelectromechanical systems (MEMS) actuators for antenna reconfigurability

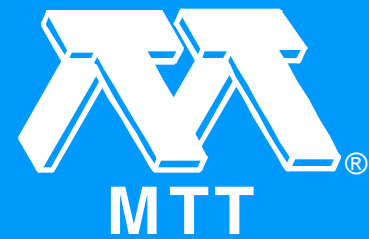
R.N. Simons, Donghoon Chun and L.P.B. Katehi. "Microelectromechanical systems (MEMS) actuators for antenna reconfigurability." 2001 MTT-S International Microwave Symposium Digest 01.1 (2001 Vol. 1 [MWSYM]): 215-218 vol.1.

A novel microelectromechanical systems (MEMS) actuator for patch antenna reconfiguration is presented for the first time. A key feature is the capability of multi-band operation without greatly increasing the antenna element dimensions. Experimental results demonstrate that the center frequency can be reconfigured from few hundred MHz to few GHz away from the nominal operating frequency.

2 and 4-bit DC-18 GHz microstrip MEMS distributed phase shifters

J.S. Hayden, A. Malczewski, J. Kleber, C.L. Goldsmith and G.M. Rebeiz. "2 and 4-bit DC-18 GHz microstrip MEMS distributed phase shifters." 2001 MTT-S International Microwave Symposium Digest 01.1 (2001 Vol. 1 [MWSYM]): 219-222 vol.1.

Two and four-bit wideband distributed microstrip phase shifters have been developed on a 21 mil (533 /spl mu/m) silicon substrate for DC-18 GHz operation. Presented here is the first demonstration of microstrip distributed MEMS transmission line (DMTL) designs, periodically loaded by MEMS varactors in series with a fixed value microstrip radial stub. The two-bit design results in a reflection coefficient less than -10 dB, an average insertion loss of -2.8 dB, and a maximum phase shift of 262/spl deg/ at 16 GHz. The four-bit design results in a reflection coefficient less than -9 dB, an average insertion loss of -3.0 dB, and a maximum phase shift of 333/spl deg/ at 16 GHz.



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Lifetime characterization of capacitive RF MEMS switches

C. Goldsmith, J. Ehmke, A. Malczewski, B. Pillans, S. Eshelman, Z. Yao, J. Brank and M. Eberly. "Lifetime characterization of capacitive RF MEMS switches." 2001 MTT-S International Microwave Symposium Digest 01.1 (2001 Vol. I [MWSYM]): 227-230 vol.1.

The first experimental characterization of dielectric charging within capacitive RF MEMS switches has been demonstrated. Standard devices have been inserted into a time domain setup and their lifetimes have been characterized as a function of actuation voltage. Switch lifetimes were measured using a dual-pulse waveform with 30 to 65 V of actuation voltage. Resulting lifetimes were between $10/\text{sup } 4/$ and $10/\text{sup } 8/$ switch actuations, demonstrating an exponential relationship between lifetime and actuation voltage.

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Design of a novel digital phase shifter at X-band

Zhang Jin, S. Ortiz and A. Mortazawi. "Design of a novel digital phase shifter at X-band." 2001 MTT-S International Microwave Symposium Digest 01.1 (2001 Vol. 1 [MWSYM]): 233-236 vol. 1.

A novel digital phase shifter design at X-band is presented. The phase shift is realized by converting a microstrip line to a rectangular waveguide and thus switching the propagation constant of the line. A 3-bit phase shifter has been constructed using passive components in lieu of diode switches for theoretical verification. For this design a maximum insertion loss of 1.4 dB at 11 GHz was achieved. The size of the 3-bit phase shifter is 1.2/spl times/0.3 inch/sup 2/. In addition, a 90 degree phase shifter has been built using PIN diodes as switches, giving an insertion loss of 0.9 dB at 11 GHz with the size of 0.24/spl times/0.26 inch/sup 2/.

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An ultra broad band reflection type 180/spl deg/ phase shifter with series and parallel LC circuits

K. Miyaguchi, M. Hieda, K. Nakahara, H. Kurusu, M. Nii, M. Kasahara and T. Takagi. "An ultra broad band reflection type 180/spl deg/ phase shifter with series and parallel LC circuits." 2001 MTT-S International Microwave Symposium Digest 01.1 (2001 Vol. 1 [MWSYM]): 237-240 vol.1.

An ultra broad band reflection type 180/spl deg/ phase shifter is proposed. It is composed of a 3-dB Lange coupler and a pair of novel reflective terminating circuits. The reflective terminating circuit switches two states of series and parallel LC circuits and it can achieve a 180/spl deg/ phase difference independently of frequency. Using a simplified circuit model without parasitic circuit elements, we have derived the determining condition of circuit elements to achieve 180/spl deg/ phase difference for all frequencies. The fabricated reflective terminating circuit MMIC has achieved a phase difference of 183 +/- 3/spl deg/ over 0.5 to 30 GHz. The 180/spl deg/ phase shifter MMIC has demonstrated a phase shift of 187 +/- 7/spl deg/ over 0.5 to 20 GHz band.

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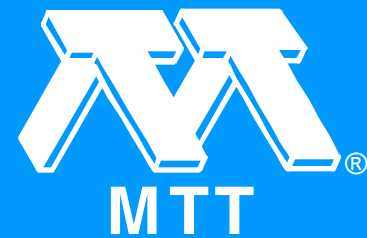
A high-performance GaAs SP3T switch for digital cellular systems

Zeji Gu, Shuyun Zhang, D. Johnson, S. Belletete, M. Ayvazian and D. Fryklund. "A high-performance GaAs SP3T switch for digital cellular systems." 2001 MTT-S International Microwave Symposium Digest 01.1 (2001 Vol. 1 [MWSYM]): 241-244 vol.1.

A high-performance GaAs SP3T switch has been developed using asymmetrical design of the transmit and receive paths. A combination of stacked FETs and multi-gate PHEMT FETs with high breakdown voltages and large peripheries was implemented in this design. Insertion loss of less than 0.8 dB and isolation greater than 25 dB to 2 GHz were obtained. With a positive 3-V control voltage, power handling of the device exceeded 34 dBm while maintaining second and third harmonic levels better than 65 dBc.

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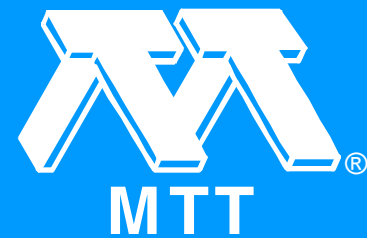
High isolation V-band SPDT switch MMIC for high power use [HEMTs application]

T. Shimura, Y. Mimino, K. Nakamura, Y. Aoki and S. Kuroda. "High isolation V-band SPDT switch MMIC for high power use [HEMTs application]." 2001 MTT-S International Microwave Symposium Digest 01.1 (2001 Vol. 1 [MWSYM]): 245-248 vol.1.

This paper presents design and performance of a V-band SPDT switch MMIC for high power use. The switch design utilizes distributed 5-shunt diodes. The developed SPDT switch shows an isolation of greater than 32 dB and an insertion loss of less than 1.8 dB in a broadband frequency range from 50 GHz to 70 GHz. Input and output return losses are better than 9 dB in ON-state. The chip size is 2.65 mm /spl times/1.33 mm. The power-handling capability was confirmed to be higher than 10 dBm of input power at 60 GHz. To our knowledge, this total broadband performance of high isolation and low insertion loss, as well as the high power-handling capability is the best among V-band SPDT switch MMICs so far.

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Switches with capacitor cancelled parasitic inductance of FET

K. Nakahara, K. Miyaguchi, M. Hieda, H. Kurusu, Y. Iyama and T. Takagi. "Switches with capacitor cancelled parasitic inductance of FET." 2001 MTT-S International Microwave Symposium Digest 01.1 (2001 Vol. 1 [MWSYM]): 249-252 vol.1.

GaAs SPDT FET switches have been developed with capacitor cancelled parasitic inductance of FET. The switches employed series-shunt configuration. The switches have been shown to have significantly higher isolation and higher frequency operation compared to conventional switch. Isolation of 28.9 dB at 18 GHz and 30 GHz has been achieved.

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A V-Band MMIC SPDT passive HEMT switch using impedance transformation networks

Yu-Jiu Wang, Kun-You Lin, Dow-Chih Niu and Huei Wang. "A V-Band MMIC SPDT passive HEMT switch using impedance transformation networks." 2001 MTT-S International Microwave Symposium Digest 01.1 (2001 Vol. 1 [MWSYM]): 253-256 vol.1.

A V-Band MMIC single pole double throw (SPDT) switch using GaAs PHEMT process is designed, fabricated and tested. In contrast to the conventional resonant-type switch design method, this passive FET switch circuit utilizes impedance transformation to compensate the drain-source capacitance effect for the off-state in millimeter-wave frequency range. This SPDT switch has a measured isolation better than 30 dB for the off-state and 4 dB insertion loss for the on-state from 53 GHz to 61 GHz. The isolation performance of this design approach outmatches previously published FET switches in this frequency range.

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New phase shifters and phased antenna array designs based on ferroelectric materials and CTS technologies (2001 Vol. I [MWSYM])

M.F. Iskander, Zhijun Zhang, Z. Yun, R. Isom, M. Hawkins, R. Emrick, B. Bosco, J. Synowczynski and B. Gersten. "New phase shifters and phased antenna array designs based on ferroelectric materials and CTS technologies (2001 Vol. I [MWSYM])." 2001 MTT-S International Microwave Symposium Digest 01.1 (2001 Vol. I [MWSYM]): 259-262 vol.1.

As the search continues for low-cost and high-performance components for the front-end devices for wireless communications systems, the focus has been on the use of MEMS technology; but some attention has recently been given to exploring new and innovative designs based on the Ferroelectric and the Continuous Transverse Stubs (CTS) technologies. In this paper we present new phase shifter designs and an integrated phased array antenna system based on the use of multilayer ferroelectric materials. Simulation results show that with the appropriate selection of the materials properties and the dimensions of the multilayer dielectric system, insertion losses may be reduced by as much as a factor of 100. These results also show that while only a slight reduction (15%) in the maximum achievable tunability was observed, it was possible to achieve significant improvement in the impedance matching characteristics. A procedure to enhance the radiation efficiency from an integrated ferroelectric/CTS phased antenna array design will be described and specific array designs discussed.

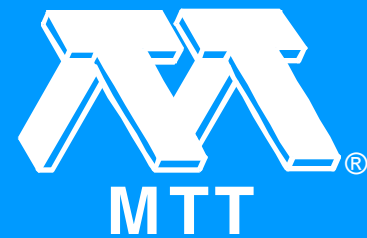
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A bi-directionally steering phased array antenna controlled by dual piezoelectric transducers

Tae-Yeoul Yun and Kai Chang. "A bi-directionally steering phased array antenna controlled by dual piezoelectric transducers." 2001 MTT-S International Microwave Symposium Digest 01.1 (2001 Vol. 1 [MWSYM]): 263-265 vol. 1.

A new bi-directionally steering phased array antenna controlled by dual piezoelectric transducers (PET) is presented. This phased array antenna operates over the frequency range from 7.6 to 26.5 GHz with a maximum beam scanning of 60/spl deg/ from -34/spl deg/ to +26/spl deg/. Both PET phase shifters are controlled by a single bias voltage that varies from 0 to 40 V. The PET controlled phase shifter is optimized with a parametric analysis, which results in a smaller control voltage and a better linearity of phase shift as a function of frequency, compared to the previously reported results. The proposed beam steering method should reduce the size and cost of phased array antenna systems.



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A novel millimeter-wave beam-steering technique using a dielectric-image-line-fed grating film

C.T. Rodenbeck, Ming-Yi Li and Kai Chang. "A novel millimeter-wave beam-steering technique using a dielectric-image-line-fed grating film." 2001 MTT-S International Microwave Symposium Digest 01.1 (2001 Vol. 1 [MWSYM]): 267-270 vol.1.

This paper introduces a novel, broadband, low-cost technique for beam steering at millimeter-wave frequencies using a moveable grating film fed by a dielectric image line. An excellent radiation pattern is maintained across the measured scanning ranges at 30, 35, and 40 GHz, with up to 53/spl deg/ scanning reported at 35 GHz. Theoretical calculations closely predict the observed scan angle across the entire range of measurement.

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A method for determining noise coupling in a phased array antenna

J.P. Weem and Z. Popovic. "A method for determining noise coupling in a phased array antenna." 2001 MTT-S International Microwave Symposium Digest 01.1 (2001 Vol. 1 [MWSYM]): 271-274 vol. 1.

A method for the calculation and accurate prediction of the noise coupling in a phased antenna array is introduced. The noise coupling is shown to be related to the scan reflection coefficient, a measurable antenna parameter. This leads to a method of calculating the noise coupling of the array using scattering parameters, which can then be used in design of a receive-mode phased array. A 49-element dipole array at 1 GHz using HPMGA-82563 LNAs is used as an example to calculate the parameters of interest for a low-noise phased array design.

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Performance of thinned antenna arrays using nonlinear processing in DBF radar applications

C. Metz, L.C. Stange, A.F. Jacob and E. Lissel. "Performance of thinned antenna arrays using nonlinear processing in DBF radar applications." 2001 MTT-S International Microwave Symposium Digest 01.1 (2001 Vol. 1 [MWSYM]): 275-278 vol.1.

Efficient thinning techniques based on nonlinear multiplicative processing of antenna arrays are evaluated for high-resolution digital beamforming (DBF) radar. Operating mechanisms of such thinned arrays are introduced briefly together with a review of the scarce literature on this subject. Measurements implemented at 77 GHz with a synthetic aperture (SA) antenna setup are consulted to compare conventional and thinned array configurations with respect to imaging performance. Nonlinear processing systems show very attractive features allowing thinning rates on the order of 80% with minor degradations in image quality.

A wide dynamic range switched-LNA in SiGe BiCMOS (2001 Vol. I [MWSYM])

T. Nakatani, J. Itoh, I. Imanishi and O. Ishikawa. "A wide dynamic range switched-LNA in SiGe BiCMOS (2001 Vol. I [MWSYM])." 2001 MTT-S International Microwave Symposium Digest 01.1 (2001 Vol. I [MWSYM]): 281-284 vol.1.

A wide dynamic range, high current efficient switched-LNA has been developed by using SiGe BiCMOS technology. The low loss RF MOSFET reduced silicon substrate effect at high frequency is used as a bypass switch for the LNA. The 800-900 MHz LNA is demonstrated in this work. In high gain/low distortion mode for transmitting and receiving simultaneously, the amplifier achieves 15.3 dB gain, 1.4 dB noise figure and +1.6 dBm IIP3 with 5.9 mA DC current. In high gain/low current mode for receiving only, 13.3 dB gain, 1.6 dB noise figure and -0.6 dBm IIP3 are achieved with 3.0 mA. In low gain mode, 1.5 dB insertion loss and +16.1 dBm IIP3 with $<10 \text{ } \mu\text{A}/\text{V}$ are realized by the bypass switch. The switched-LNA is housed in a very small and low cost SON12 plastic package with a down-mixer.

Dual bias feed SiGe HBT low noise linear amplifier (2001 Vol. I [MWSYM])

E. Taniguchi, K. Maeda, T. Ikushima, K. Sadahiro, K. Itoh, N. Suematsu and T. Takagi. "Dual bias feed SiGe HBT low noise linear amplifier (2001 Vol. I [MWSYM])." 2001 MTT-S International Microwave Symposium Digest 01.1 (2001 Vol. I [MWSYM]): 285-288 vol.1.

A 2 GHz-band SiGe HBT low noise amplifier (LNA) achieving high saturation power and low distortion performance is described. It has a novel diode/resistor dual bias feed circuit for the base of the HBT to extend its P1 dB. In the small signal region, the conventional resistor feed circuit is a dominant base current source, but in the large signal region, the diode turns on and the diode feed circuit can supply base current like a voltage source which allows higher output power and linearity. The fabricated dual feed type LNA shows the P1 dB improvement of 5 dB compared with the conventional resistor feed LNA.



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A 1.4-dB-NF variable-gain LNA with continuous control for 2-GHz-band mobile phones using InGaP emitter HBTs (2001 Vol. I [MWSYM])

Y. Aoki, M. Fujii, S. Ohkubo, S. Yoshida, T. Niwa, Y. Miyoshi, H. Dodo, N. Goto and H. Hida. "A 1.4-dB-NF variable-gain LNA with continuous control for 2-GHz-band mobile phones using InGaP emitter HBTs (2001 Vol. I [MWSYM])." 2001 MTT-S International Microwave Symposium Digest 01.1 (2001 Vol. I [MWSYM]): 289-292 vol. 1.

We designed a continuously variable-gain low-noise-amplifier (VG-LNA) circuit with a noise figure (NF) of 1.4 dB. This VG-LNA has a diode-loaded emitter follower and a variable-current source. The diode-loaded emitter follower enables gain control without NF degradation at the maximum gain; the variable-current source improves the linearity and widens the range of gain control. It was fabricated by using InGaP-emitter heterojunction bipolar transistors (HBTs) and has an NF of 1.4 dB at maximum gain, 1.95 GHz, and a 3-V supply voltage. Its maximum gain is 15 dB, its input 3rd-order-intercept-point (IIP3) at the maximum gain is 3.4 dBm, and the gain-control range is 40 dB. The obtained of NP of 1.4 dB is the lowest so far reported for a continuously controlled VG-LNA.





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A 1.7 mA low noise amplifier with integrated bypass switch for wireless 0.05-6 GHz portable applications (2001 Vol. I [MWSYM])

H. Morkner, M. Frank and S. Yajima. "A 1.7 mA low noise amplifier with integrated bypass switch for wireless 0.05-6 GHz portable applications (2001 Vol. I [MWSYM])." 2001 MTT-S International Microwave Symposium Digest 01.1 (2001 Vol. I [MWSYM]): 293-296 vol.1.

An ultra low current low noise amplifier with an integrated bypass switch has been developed using PHEMT technology. The LNA/Sw uses only 1.7 mA when powered and less than 1 A when bypassed. It is usable from 50 MHz to 6 GHz. This enables portable systems such as Bluetooth, Home RF, PDAs, wireless LANs. The LNA provides 15 dB gain, 1.8 dB noise figure with 50 Ω load at the output and Γ_{opt} at the input. Bypass mode provides 5 dB insertion loss into the same I/O match. The LNA and bypass switch with associated control circuitry are integrated into a single RFIC and housed in the miniature SOT package. This LNA/Sw provides lower current and easier usage with comparable NF, gain, and bandwidth than previously reported products.

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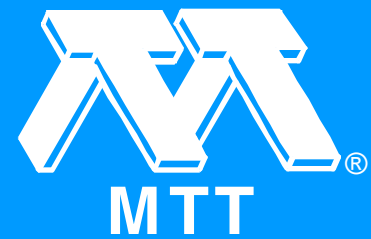


Abstracts

Passive electromagnetic compensation of permittivity changes in microwave circuits

J. Hesselbarth and R. Vahldieck. "Passive electromagnetic compensation of permittivity changes in microwave circuits." 2001 MTT-S International Microwave Symposium Digest 01.1 (2001 Vol. 1 [MWSYM]): 299-302 vol.1.

Microwave circuit elements are proposed which are inherently independent of small variations of the material permittivity. Different structures are investigated which can be used to obtain a temperature-independent resonance frequency, group velocity, or phase shift, respectively, although the permittivity of the involved materials varies.



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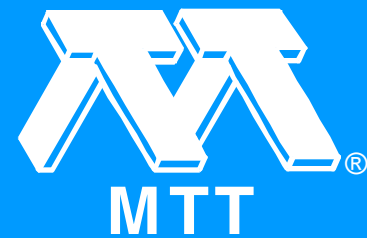


Abstracts

360-degree linear analog phase shifter design using tunable short-circuit terminated combline filters

Sanghoon Shin, R.V. Snyder and E. Niver. "360-degree linear analog phase shifter design using tunable short-circuit terminated combline filters." 2001 MTT-S International Microwave Symposium Digest 01.1 (2001 Vol. 1 [MWSYM]): 303-306 vol.1.

A new design technique is introduced for designing a 360-degree linear analog phase shifter at 5.2 GHz. Using tunable short-circuit terminated combline (STCL) filters as reactive loads, the circuit gives a very small insertion loss (less than 1.5 dB) and an almost linear phase shift over the filter bandwidth for the full 360-degree range.



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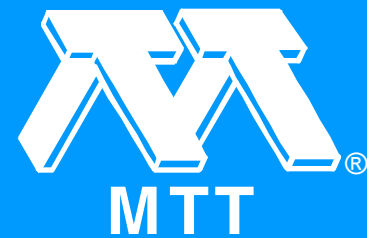


Abstracts

A novel low-loss slow-wave CPW periodic structure for filter applications

J. Sor, Yongxi Qian and T. Itoh. "A novel low-loss slow-wave CPW periodic structure for filter applications." 2001 MTT-S International Microwave Symposium Digest 01.1 (2001 Vol. 1 [MWSYM]): 307-310 vol. 1.

A novel periodic slow-wave structure for CPW is presented. This proposed structure exhibits low insertion loss in the passband, simple fabrication, and is intrinsically matched. The structure is applied to realize a miniature lowpass filter one-tenth the size of conventional filters, with spurious-free response and deep attenuation levels using only three cells.



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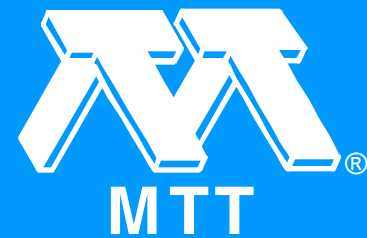
Overlapping, multiple CPW stub structures for high density MMICs

K. Hettak, C.J. Verver and M.G. Stubbs. "Overlapping, multiple CPW stub structures for high density MMICs." 2001 MTT-S International Microwave Symposium Digest 01.1 (2001 Vol. 1 [MWSYM]): 311-314 vol. 1.

This paper proposes a robust option for developing a new class of very compact matching stub configurations. It demonstrates that an overlapping technique, involving different MMIC CPW stubs built into a single line section, can provide size and cost reductions up to 60%, while also providing performance enhancements. The high flexibility of uniplanar technology allows the development of possible transmission line shapes and removes a number of limitations inherent in conventional design approaches, thus providing varying degrees of miniaturization. The experimental prototypes presented in this paper demonstrate the efficiency of the design method and the feasibility of creating multistub configurations in a single line section to get ultra compact structures. The principle of achieving such high-quality circuits is detailed and is also confirmed by experimental and theoretical results which are in good agreement up to at least 40 GHz. This good agreement validates the design procedure and shows that complex circuit functions can be implemented by means of relatively inexpensive compact structures. This study was completed by producing a very compact 90/spl deg/ CPW branchline coupler for Ka/K-band, advanced SATCOM terminal systems operating in the 20/44 GHz frequency bands, which demonstrated that the concept can be easily used.

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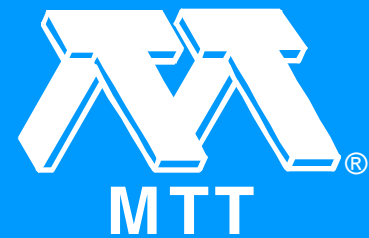
LTCC-MLC balun for WLAN/Bluetooth

Jyh-Wen Sheen and Ching-Wen Tang. "LTCC-MLC balun for WLAN/Bluetooth." 2001 MTT-S International Microwave Symposium Digest 01.1 (2001 Vol. 1 [MWSYM]): 315-318 vol. 1.

A low temperature co-fired ceramic (LTCC) multi-layer ceramic balun is presented in this paper. This balun is designed in the ISM band for WLAN or Bluetooth use. It uses multi-layer structure, meander lines, and multi-section coupled-lines with various coupling coefficients. The characteristics of phase balance and amplitude balance are extremely excellent because of its symmetric structure and a transmission line trimming section. Measured results of the LTCC-MLC balun match well with the computer simulation.

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MEMS single-pole double-throw (SPDT) X and K-band switching circuits

S.P. Pacheco, D. Peroulis and L.P.B. Katehi. "MEMS single-pole double-throw (SPDT) X and K-band switching circuits." 2001 MTT-S International Microwave Symposium Digest 01.1 (2001 Vol. 1 [MWSYM]): 321-324 vol.1.

Single-pole double-throw (SPDT) X and K-band circuit designs incorporating low-loss microelectromechanical shunt capacitive switches are reported. The switches incorporate highly inductive connecting beams which aid in further increasing the isolation at the desired operational RF frequency. Measurements show an isolation of better than 40 dB at both 7 and 20 GHz. Insertion loss was measured at -0.95 dB at 7 GHz and -0.69 dB at 20 GHz for the two respective designs.

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DC-26 GHz MEMS series-shunt absorptive switches

Guan-Leng Tan and G.M. Rebeiz. "DC-26 GHz MEMS series-shunt absorptive switches." 2001 MTT-S International Microwave Symposium Digest 01.1 (2001 Vol. 1 [MWSYM]): 325-328 vol.1.

The design and performance of a wideband coplanar waveguide (CPW) DC-26 GHz MEMS absorptive switch on silicon substrate is presented. The absorptive switch utilizes novel DC-contact series and shunt fixed-fixed beam MEMS switches with 'dimples' at the contact area for improved contact resistance. An insertion loss of 0.5 dB or better is achieved from DC-26 GHz. The isolation is -40 dB at 5 GHz, -35 dB at 10 GHz and -25 dB at 26 GHz. These switches are useful in applications where good return loss is required in the isolation state.

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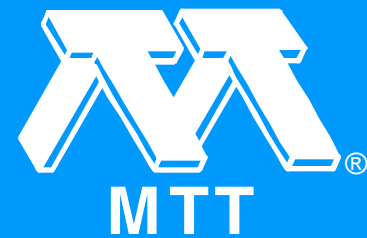


Abstracts

MEMS high Q microwave inductors using solder surface tension self-assembly

G.W. Dahlmann, E.M. Yeatman, P.R. Young, I.D. Robertson and S. Lucyszyn. "MEMS high Q microwave inductors using solder surface tension self-assembly." 2001 MTT-S International Microwave Symposium Digest 01.1 (2001 Vol. I [MWSYM]): 329-332 vol.1.

We present microwave inductors of 1.5 to 2.5 nH fabricated out-of-plane by a self-assembly process. The consequent de-coupling from the substrate allows improved Q (from 4 to 20) and frequency of maximum Q (from 0.5 GHz to 3 GHz) on low resistivity silicon substrates.



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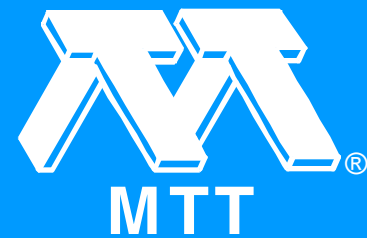
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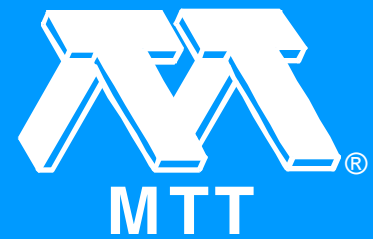
Micromachined frequency-variable impedance tuners using resonant unit cells

Sanghwa Jung, Kyungteh Kang, Jae-Hyoung Park, Ki-Woong Chung, Yong-Kweon Kim and Youngwoo Kwon. "Micromachined frequency-variable impedance tuners using resonant unit cells." 2001 MTT-S International Microwave Symposium Digest 01.1 (2001 Vol. I [MWSYM]): 333-336 vol. 1.

This paper presents a new type of micromachined impedance tuners using frequency-variable resonant unit cells. Impedance tuners using resonant unit cells realized by tunable micromachined capacitors showed a wide tuning range equivalent to almost two quadrants of the Smith chart with a high maximum VSWR of 21.2 at Ka-band. Frequency variability is also provided through the use of J-inverters with tunable capacitors. Micromachined tuners are very promising for low-loss tuning of the monolithic circuits as well as accurate noise and power characterization.

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A reconfigurable double-stub tuner using MEMS devices

K.L. Lange, J. Papapolymerou, C.L. Goldsmith, A. Malczewski and J. Kleber. "A reconfigurable double-stub tuner using MEMS devices." 2001 MTT-S International Microwave Symposium Digest 01.1 (2001 Vol. 1 [MWSYM]): 337-340 vol.1.

This paper presents a planar reconfigurable double stub tuner, that utilizes electrostatically activated MEMS switches. The tuner consists of a "4bit/spl times/4bit" digital capacitor bank and can match loads with real parts ranging from 5 to 108 /spl Omega/ and imaginary parts from -60 to 48 /spl Omega/ at 20 GHz. Simulated and measured results are presented.

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Tunable lumped components with applications to reconfigurable MEMS filters

D. Peroulis, S. Pacheco, K. Sarabandi and L.P.B. Katehi. "Tunable lumped components with applications to reconfigurable MEMS filters." 2001 MTT-S International Microwave Symposium Digest 01.1 (2001 Vol. 1 [MWSYM]): 341-344 vol.1.

This paper presents a novel design scheme for tunable coplanar waveguide components with applications to compact lumped-element MEMS reconfigurable filters. Shunt MEMS switches are employed for tuning the values of lumped components frequently encountered in microwave integrated circuits. In particular, shunt capacitors, series inductors and shunt inductive stubs are the main tunable circuit elements utilized in this work. Furthermore, accurate equivalent circuits that include the most important parasitics introduced by the tuning mechanism are provided. Finally, the proposed method is applied to the design and implementation of very compact low-pass and bandpass tunable filters. The very high tunability range, the compactness of the resulting networks and their very wideband response constitute the main advantages of this technique.

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A micromachined tunable CPW resonator

T. Ketterl, T. Weller and D. Fries. "A micromachined tunable CPW resonator." 2001 MTT-S International Microwave Symposium Digest 01.1 (2001 Vol. 1 [MWSYM]): 345-348 vol. 1.

This paper presents a novel tunable microwave resonator, consisting of a CPW spiral inductor with a cantilever interconnect structure. Tuning was achieved by applying a DC bias between the input and output of the resonator circuit. An observable resonance tuning between 3 and 7 GHz was accomplished by applying a bias from 0 to 40 V. Corresponding Q-factors between 17 and 20 were obtained in this tuning range.

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SAW filter solutions to the needs of 3G cellular phones

G. Fischerauer, T. Ebner, P. Kruck, K. Morozumi, R. Thomas and M. Pitschi. "SAW filter solutions to the needs of 3G cellular phones." 2001 MTT-S International Microwave Symposium Digest 01.1 (2001 Vol. I [MWSYM]): 351-354 vol.1.

Services based on third-generation (3G) cellular phone standards like W-CDMA or cdma-2000 will be launched in the very near future. They will bring together mobile telephony and applications such as internet communication, digital picture transmission or video conferencing that require high data rates. This objective and other provisions in the new standards lead to significantly changed requirements on the surface acoustic wave (SAW) filters employed in the IF and RF stages of 3G cell phones when compared to second-generation (2G) systems. The present contribution discusses the main issues involved in the design of SAW filters for 3G cell phones, with an emphasis on W-CDMA. The key point is that the need for miniaturization, higher operating frequencies and improved performance can only be met by a proper choice of material system, filter technique and package technology. In particular for the RF filters, it is essential to include in the simulation model a correct electrical description of the miniaturized package. State-of-the-art examples serve to illustrate these points.

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Optimized design and fabrication of a wireless pressure and temperature sensor unit based on SAW transponder technology

G. Schimetta, F. Dollinger, G. Scholl and R. Weigel. "Optimized design and fabrication of a wireless pressure and temperature sensor unit based on SAW transponder technology." 2001 MTT-S International Microwave Symposium Digest 01.1 (2001 Vol. 1 [MWSYM]): 355-358 vol.1.

The optimized design and fabrication of a passive pressure and temperature sensor unit based on SAW transponder technology fully meeting the restrictions of the European ISM RF band at 433.92 MHz is presented. The sensor unit consists of a reflective SAW delay line which is used as temperature sensor and transponder, and a capacitive pressure sensor. With a special arrangement of the impedance loaded splitfinger interdigital transducer, and the reference reflectors on the SAW substrate, a temperature corrected evaluation of the pressure signal is enabled. Due to the small dimensions and cost-effective design of the sensor unit, the utilization as a tire pressure sensor is proposed. A prototype of the SAW delay line and the micromachined pressure sensor is demonstrated.

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Spurious suppression technique for edge-trap-type SAW resonators and their application to 1-GHz wide-band SAW-VCOs for mobile communications

T. Kachi, A. Isobe, A. Sumioka, K. Asai and M. Hikita. "Spurious suppression technique for edge-trap-type SAW resonators and their application to 1-GHz wide-band SAW-VCOs for mobile communications." 2001 MTT-S International Microwave Symposium Digest 01.1 (2001 Vol. 1 [MWSYM]): 359-362 vol.1.

1-GHz wide-band VCOs using SAW resonators have been successfully developed. A control-voltage sensitivity of over 5%/V has been achieved by using new edge-trap-type SAW-resonators. Optimizing the reflectors of SAW resonators is very effective for suppressing the spurious resonance of the Rayleigh wave in the oscillation band. Two types of VCOs are compared. One uses a Si bipolar junction transistor as a feedback amplifier and the other uses a GaAs MESFET. Both VCOs achieved a control-voltage sensitivity of over 5%/V and a phase noise of less than -107 dBc/Hz at a 25 kHz offset frequency from the carrier frequency. The GaAs MESFET VCO showed better phase noise performance than the Si transistor VCO at a 30-kHz or greater offset frequency. By changing the amplifier elements, it is possible to achieve the requirements for both local VCOs and transmission VCOs for wireless communication terminals.





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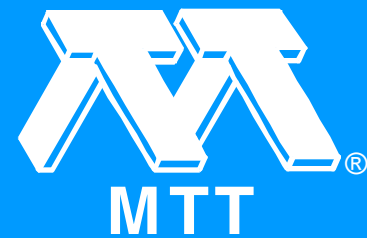
The application of dielectric thin films to enhance the properties of SAW devices

F.S. Hickernell. "The application of dielectric thin films to enhance the properties of SAW devices." 2001 MTT-S International Microwave Symposium Digest 01.1 (2001 Vol. I [MWSYM]): 363-366 vol.1.

To meet the increasing demands of personal and commercial communication systems, high performance SAW devices are required to have high frequencies, low loss, wide bandwidth, and high reliability. It was determined early in the investigation of SAWs that there were velocity, loss, coupling factor, and temperature coefficient improvements to be gained through the use of thin amorphous dielectric films on piezoelectric substrates. While this kind of film technology has been used sparingly in SAW device product development, it still represents a potential source for enhancing such products. Deposited on a bare piezoelectric wafer, amorphous films provide the functions of surface passivation, reduction of pyroelectric effects, and smoothing to reduce SAW propagation loss. Films modify the coupling factor, reduce the temperature coefficient of frequency, and permit higher order SAW modes to be propagated. As a practical manufacturing matter, thin films on electroded SAW components provide a protective coating to prevent shorting by metal particles, reduce metal migration due to electric and stress fields, protect from degradation due to chemicals and corrosive vapors, and be used very effectively for frequency trimming. For pseudo-SAW propagation on rotated substrates, the dielectric film can reduce the leaky-wave losses and enhance coupling factor and TCF. This paper considers the advantages of nitride and oxide films on piezo-substrates for the enhancement of SAW devices.

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A film bulk acoustic resonator (FBAR) duplexer for USPCS handset applications

P. Bradley, R. Ruby, J.D. Larson, III, Y. Oshmyansky and D. Figueredo. "A film bulk acoustic resonator (FBAR) duplexer for USPCS handset applications." 2001 MTT-S International Microwave Symposium Digest 01.1 (2001 Vol. I [MWSYM]): 367-370 vol.1.

We will describe the design and measured performance of a duplexer based on film bulk acoustic resonators (FBARs) for the 1900 MHz PCS cellular phone market. Typical specifications for the duplexer require the Tx filter to attenuate frequencies in the Rx band by >40 dB while maintaining a worst-case insertion loss of 3.5 dB over the Tx band. VSWR must be better than 2.2 in the pass-band (8.5 dB return loss). The Rx filter must attenuate the Tx frequencies by >50 dB while maintaining a worst-case insertion loss of 4.2 dB in the Rx band. Again, VSWR must be better than 2.2.

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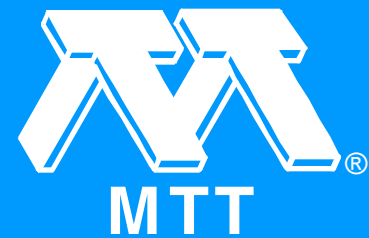


Laser measurements and simulations of FBAR dispersion relation

G.G. Fattinger and P.T. Tikka. "Laser measurements and simulations of FBAR dispersion relation." 2001 MTT-S International Microwave Symposium Digest 01.1 (2001 Vol. I [MWSYM]): 371-374 vol. 1.

In order to gain a better understanding of the behavior of thin-film bulk-acoustic-wave devices it is necessary to know the dispersion relation of an investigated layer stack. A laser interferometric measurement technique for mechanical surface vibrations is used, providing data to which numerical dispersion calculations are fitted. This method turned out to be a reliable source to determine the material parameters.

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Silicon based reconfigurable antennas

A. Fathy, A. Rosen, H. Owen, S. Kanamaluru, F. McGinty, D. McGee, G. Taylor, P.K. Swain, S. Perlow and M. ElSherbiny. "Silicon based reconfigurable antennas." 2001 MTT-S International Microwave Symposium Digest 01.1 (2001 Vol. 1 [MWSYM]): 377-380 vol.1.

Efforts are under way to revolutionize antenna technology and to increase their functionality and capabilities by implementing fast reconfiguration schemes. Sarnoff Corporation (Sarnoff) has developed a novel silicon based concept for true reconfiguration based on the creation of metallic-like conductivity plasma islands that are driven by dc current. These plasma islands can be precisely formed and controlled using today's high resolution silicon technology, and are utilized to dynamically form plasma holograms for holographic antennas, enabling frequency hopping, beam steering and shaping without the complexity of feed structures, thus providing the performance and capabilities of a phased array without their price.

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Hilbert curve fractal antennas with reconfigurable characteristics

K.J. Vinoy, K.A. Jose, V.K. Varadan and V.V. Varadan. "Hilbert curve fractal antennas with reconfigurable characteristics." 2001 MTT-S International Microwave Symposium Digest 01.1 (2001 Vol. 1 [MWSYM]): 381-384 vol.1.

Fractal Hilbert curve is one of the most recent geometries to be studied for antennas. This geometry results in an antenna with low resonant frequency compared to other configurations. The antenna consists of line segments arranged in a predictable fractal order, thus enabling easy generation and reproducible results compared to an arbitrary shrinkage of antenna size. This can be modeled using wire segments. An addition of few more interconnecting segments to the geometry is found to result in significant changes in its radiation pattern. With RF switches within these few selected additional segments and the necessary control units, radiation pattern of the antenna can be made adaptively reconfigurable. Similarly, switches connected in series along the length of the antenna result in frequency tuning characteristics.



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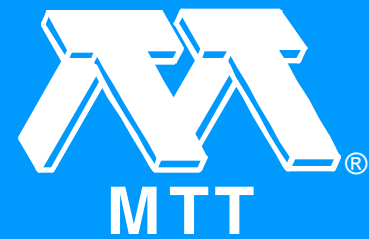
Active antenna using multi-layer ceramic-polyimide substrates for wireless communication systems

T. Seki, H. Yamamoto, T. Hori and M. Nakatsugawa. "Active antenna using multi-layer ceramic-polyimide substrates for wireless communication systems." 2001 MTT-S International Microwave Symposium Digest 01.1 (2001 Vol. 1 [MWSYM]): 385-388 vol. 1.

This paper proposes an active antenna structure for high-speed wireless communication systems that is constructed with multi-layer alumina-ceramic and polyimide substrates. This antenna structure incorporates a transmitter/receiver amplifier and time division duplex switch circuits that are mounted on a Monolithic Microwave Integrated Circuit (MMIC) chip and a low-pass filter circuit. A prototype active antenna at 25 GHz is presented and the measured total gain for both transmission and reception of more than 21 dB is achieved with the directional gain of approximately 11 dBi.

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A Ka-band high-efficiency dielectric lens antenna with a silicon micromachined microstrip patch radiator

U. Sangawa, K. Takahashi, T. Urabe, H. Ogura and H. Yabuki. "A Ka-band high-efficiency dielectric lens antenna with a silicon micromachined microstrip patch radiator." 2001 MTT-S International Microwave Symposium Digest 01.1 (2001 Vol. 1 [MWSYM]): 389-392 vol.1.

Novel antenna configurations suitable for millimeter-wave applications were proposed incorporating a dielectric lens antenna with a single microstrip patch radiator. In general high aperture efficiencies are easily obtainable with lens antennas because of flexibility in controlling the aperture-field distribution coupled with low feeder loss. The radiator was integrated with front-end circuits into a single hybrid IC using silicon micromachining and BCB (benzo-cyclobutene) multi-stacked circuit processes. The radiator was constructed on a thin suspended BCB film to suppress dielectric and conductor loss. A demonstration radiator showed good performance at 39 GHz (Ka-band). The lens was designed using geometrical optics relative to the directivity of the radiator and the aperture-field distribution. The circular polarized lens antenna assembly exhibited a gain of 15.7 dBi, 18.7 dB side-lobe level suppression and 0.17 dB axial ratio.





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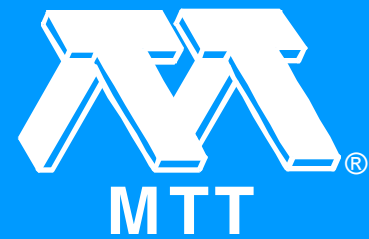
A multifunctional antenna for terrestrial and satellite radio applications

S. Lindenmeier, J.F. Luy and P. Russer. "A multifunctional antenna for terrestrial and satellite radio applications." 2001 MTT-S International Microwave Symposium Digest 01.1 (2001 Vol. 1 [MWSYM]): 393-396 vol. 1.

A multifunctional antenna is presented for the application in terrestrial radio services like GSM 900 MHz, DCS 1800 MHz as well as for satellite radio services like GPS 1575 MHz. At the terrestrial frequency bands GSM 900 MHz and DCS 1800 MHz the antenna exhibits omnidirectional radiation characteristics in horizontal plane for vertical polarized waves. At the frequency bands of the satellite radio services like GPS and Globalstar the antenna exhibits a radiation characteristic with a vertical main lobe and a circular polarized field.

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LDMOS electro-thermal model validation from large-signal time-domain measurements

R. Gaddi, J.A. Pla, J. Benedikt and P.J. Tasker. "LDMOS electro-thermal model validation from large-signal time-domain measurements." 2001 MTT-S International Microwave Symposium Digest 01.1 (2001 Vol. 1 [MWSYM]): 399-402 vol.1.

Analytical nonlinear model validation through large-signal time-domain characterization has been greatly improved, by establishing a novel link between measurement and simulation. Investigation on a silicon LDMOS device and its nonlinear electro-thermal model positively identifies links between model formulation and amplifier requirements for future telecommunication systems.

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Tunnel diode nonlinear model for microwave circuits and active antennas

M.R. Deshpande, K. Liu, S.M. El-Ghazaly, V. Nair, A. Cidronali, N. El-Zein, G. Manes and H. Goronkin. "Tunnel diode nonlinear model for microwave circuits and active antennas." 2001 MTT-S International Microwave Symposium Digest 01.1 (2001 Vol. 1 [MWSYM]): 403-406 vol.1.

Tunnel diodes have a unique property: negative differential resistance (NDR). The integration of tunnel diodes with other electronic devices creates novel, quantum functional devices and circuits. The enhanced functionality of these devices enables design of both digital and analog circuits with reduced complexity, size and better performance. In this paper we investigate the applications of a nonlinear, large signal model of the tunnel diode. This model is used to analyze tunnel diode characteristics under external conditions such as input RF signal and termination resistance. We also discuss the application of the model to simulate quantum-MMIC circuits. VCOs, and active antennas designed using tunnel diodes show power outputs in the range of -4 to -10 dBm in the 1-2 GHz band. The DC to RF conversion efficiency is about 8% in VCOs and 16% in the antennas.

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A simple bias dependant LF FET noise model for CAD

I. Angelov, R. Kozhuharov and H. Zirath. "A simple bias dependant LF FET noise model for CAD." 2001 MTT-S International Microwave Symposium Digest 01.1 (2001 Vol. 1 [MWSYM]): 407-410 vol.1.

Extensive multi-bias low frequency noise (LFN) measurements were performed on MESFET, HEMT and InP HEMT devices in order to obtain a simple bias dependent LF noise model usable in CAD tools and consistent with small and large signal models and high frequency noise models. The model was experimentally evaluated with a 10 GHz DRO and good correspondence was obtained between the modelled and measured LFN.

Temperature-dependent modeling of high power MESFET using thermal FDTD method

W. Wojtasiak and D. Gryglewski. "Temperature-dependent modeling of high power MESFET using thermal FDTD method." 2001 MTT-S International Microwave Symposium Digest 01.1 (2001 Vol. 1 [MWSYM]): 411-414 vol.1.

A temperature-dependent model of high power MESFET based on the small signal extraction methodology is presented. The temperature dependencies of the MESFET equivalent circuit elements derived from experimental results describing long-term thermal effects and short-term thermal effects have been modeled by means of FDTD method using chip dimensions. The verification of the proposed model shows an excellent agreement of the experimental results with the theoretical analysis.



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Full wave analysis of FET fingers using various semiconductor physical models

S. Goasguen, M.M. Tomeh and S.M. El-Ghazaly. "Full wave analysis of FET fingers using various semiconductor physical models." 2001 MTT-S International Microwave Symposium Digest 01.1 (2001 Vol. 1 [MWSYM]): 415-418 vol.1.

We present a full wave simulation of FET fingers based on a global modeling approach. The electromagnetic fields inside the device are computed by a standard FDTD scheme and coupled to the semiconductor equations through the current density. Four different semiconductor models are used to characterize the active device. They are derived from the hydrodynamic model obtained by integration of Boltzmann's equations. The I-V characteristics of the FET are obtained for the different models. The RF voltage gain and the S parameters can be compared. This is the first time that such an analysis is performed. The wave device interactions occurring in the FET can be modeled using various physical models. This allows us to determine which semiconductor model to use for a given gate length and a given frequency range when the electromagnetic interactions are simulated.

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Generation of multicarrier complex lowpass models of RF ICs

P. Dobrovolny, P. Wambacq, G. Vandersteen, S. Donnay, M. Engels and I. Bolsens.

"Generation of multicarrier complex lowpass models of RF ICs." 2001 MTT-S International Microwave Symposium Digest 01.1 (2001 Vol. 1 [MWSYM]): 419-422 vol.1.

The design of transceivers for wireless digital telecommunications is subject to severe requirements on cost and power consumption. This is a challenge for the design of RF front-end blocks that degrade the bit-error-rate of a telecommunication link. This paper describes a technique to generate accurate high-level models for the RF front-end blocks. The models take into account the nonlinear behavior as a function of frequency. The accuracy of the models is higher than classical complex equivalent models since out-of-band distortion is taken into account. The technique, that is verified with a low-noise amplifier design for 5 GHz WLAN, yields an important gain in simulation efficiency of RF ICs, compared to circuit-level simulations.



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A measurement based distributed low frequency noise HEMT model: application to design of millimeter wave automotive radar chip sets

A. Laloue, A. Lyoubi, M. Camiade, J.C. Nallatamby, M. Valenza, M. Prigent and J. Obregon. "A measurement based distributed low frequency noise HEMT model: application to design of millimeter wave automotive radar chip sets." 2001 MTT-S International Microwave Symposium Digest 01.1 (2001 Vol. 1 [MWSYM]): 423-426 vol. 1.

A fully measurement based extraction procedure of a distributed low-frequency nonlinear noise model of a PHEMT is proposed. This model describes accurately the distributed nature under the device gate which allows a good noise behavior prediction in nonlinear circuits. It is used to simulate successfully noise characteristics of MMICs for FMCW automotive radar at 77 GHz. The simulated and experimental results on two different source-chips: a VCO and DRO have been compared and we demonstrate the accuracy of the noise model which results in being independent of the application.

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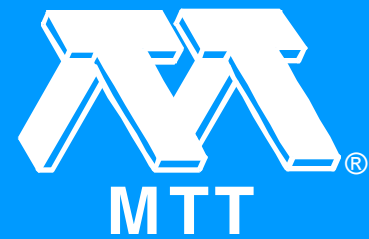
Pulse characterization of trapping and thermal effects of microwave GaN power FETs

S. Augaudy, R. Quere, J.P. Teyssier, M.A. Di Forte-Poisson, S. Cassette, B. Dessertenne and S.L. Delage. "Pulse characterization of trapping and thermal effects of microwave GaN power FETs." 2001 MTT-S International Microwave Symposium Digest 01.1 (2001 Vol. I [MWSYM]): 427-430 vol. 1.

An experimental characterization of GaN FETs is given in this paper. A pulsed I-V/pulsed S-parameters measurement set-up is used to investigate the trapping and thermal behavior of GaN MESFETs. It is shown that electrical performances are strongly affected by surface and substrate traps and that those effects are closely linked to the temperature of the device. RF measurements up to a drain voltage of 100 V and a temperature of 320/spl deg/C are presented.

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Thermal transients in microwave active devices and their influence on intermodulation distortion

S. David, W. Batty, A.J. Panks, R.G. Johnson and C.M. Snowden. "Thermal transients in microwave active devices and their influence on intermodulation distortion." 2001 MTT-S International Microwave Symposium Digest 01.1 (2001 Vol. I [MWSYM]): 431-434 vol.1.

A fully physical transient thermal model is used to investigate the effects of temperature on the intermodulation distortion performance of microwave devices. A 24 mm, 60 finger PHEMT is used to compare measurements with predictions from the model. Results are in very good agreement and are a strong indication of thermally induced intermodulation distortion.

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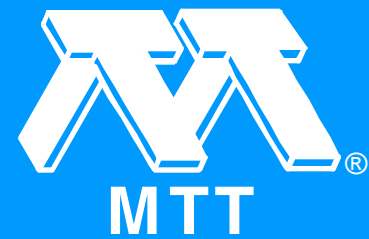
A Krylov-subspace technique for the global stability analysis of large nonlinear microwave circuits

V. Rizzoli, F. Matri, E. Furini and A. Costanzo. "A Krylov-subspace technique for the global stability analysis of large nonlinear microwave circuits." 2001 MTT-S International Microwave Symposium Digest 01.1 (2001 Vol. I [MWSYM]): 435-438 vol.1.

The paper discusses a new approach to the global stability analysis of large nonlinear microwave circuits for which Nyquist's analysis is not usable owing to the size of the characteristic equation. Making use of a Krylov method for autonomous circuits, a state lying on the bifurcated branch close enough to the bifurcation may be efficiently located. The bifurcated branch may then be found by ordinary continuation.

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Two-tone intermodulation distortion simulations in the time domain using a quasi-2D physical pHEMT model

P.J. Rudge, R.E. Miles, M.B. Steer and C.M. Snowden. "Two-tone intermodulation distortion simulations in the time domain using a quasi-2D physical pHEMT model." 2001 MTT-S International Microwave Symposium Digest 01.1 (2001 Vol. 1 [MWSYM]): 439-442 vol.1.

The need for both linear and efficient pHEMTs for modern wireless handsets necessitates a thorough understanding of the origins of intermodulation distortion at the device level. For the first time, two-tone time domain simulations of a microwave pHEMT using a quasi-two-dimensional physical device model in a CAD environment are presented. The model fully accounts for device-circuit interaction and is validated experimentally for a two-tone experiment around 5 GHz.

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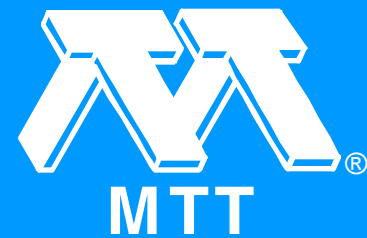
Nonlinear analysis of a microwave synthesizer based on a sampling-phase detector

S. Sancho, S. ver Hoeye, A. Suarez, J. Chuan and A. Tazon. "Nonlinear analysis of a microwave synthesizer based on a sampling-phase detector." 2001 MTT-S International Microwave Symposium Digest 01.1 (2001 Vol. I [MWSYM]): 443-446 vol.1.

A microwave synthesizer operating at 6.52 GHz and based on a sampling-phase detector has been designed and simulated. The employment of nonlinear analysis tools has enabled an in-depth study of the system dynamics. Hold-in and lock-in bands are determined in a direct and accurate way through the use of the Poincare-map technique. The nonlinear analysis has also made possible the a-priori determination of the loop-filter and VCO characteristics for a good performance in terms of phase noise and loop dynamics.

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Comparison of wavelet- and time-marching-based microwave circuit transient analyses

C.E. Christoffersen and M.B. Steer. "Comparison of wavelet- and time-marching-based microwave circuit transient analyses." 2001 MTT-S International Microwave Symposium Digest 01.1 (2001 Vol. 1 [MWSYM]): 447-450 vol.1.

In this paper we derive a transient analysis formulation that can be used in conjunction with wavelets or time-marching methods. The number of unknowns in the formulation is proportional to the number of state variables of the nonlinear devices in the circuit. The formulation was implemented in a general-purpose circuit simulator. We evaluate the numerical performance of transient analysis using wavelets and the backward Euler method by simulating a nonlinear transmission line and a quasi-optical grid amplifier. The quasi-optical example illustrates the integration of full-wave electromagnetic analysis in transient circuit simulation.

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Efficient algorithm for steady-state stability analysis of large analog/RF circuits

P. Bolcato, J.C. Nallatamby, C. Rumolo, R. Larcheveque, M. Prigent and J. Obregon. "Efficient algorithm for steady-state stability analysis of large analog/RF circuits." 2001 MTT-S International Microwave Symposium Digest 01.1 (2001 Vol. I [MWSYM]): 451-454 vol.1.

This paper presents a method for the investigation of AC and large signal steady-state stability of electrical (analog/RF) circuits. In both cases stability/instability are detected through fast calculation and analysis of circuit poles. Thanks to iterative algorithms (Krylov-subspace methods) applied to modified nodal formulation of conversion matrices, a selection of poles is computed, allowing the method to be applied to large size circuits of any type of topology.

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Novel artificial frequency mapping techniques for multi-tone simulation of mixers

N. Borges de Carvalho and J.C. Pedro. "Novel artificial frequency mapping techniques for multi-tone simulation of mixers." 2001 MTT-S International Microwave Symposium Digest 01.1 (2001 Vol. 1 [MWSYM]): 455-458 vol.1.

This paper describes two new artificial frequency mapping techniques suitable for the simulation of RF/microwave mixers when excited by a multi-tone signal. Due to the gained computational efficiency, it is for the first time possible to simultaneously analyze small and large signal behavior of nonlinear mixers subject to real multi-tone signals. Besides the theoretical study, illustrative simulation results are also given.

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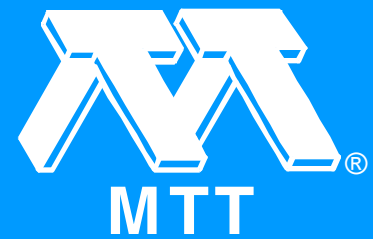
New system-level simulation of noise spectra distortion in FM-CW autonomous cruise control radar

A. Laloue, J.-C. Nallatamby, M. Camiade, M. Prigent and J. Obregon. "New system-level simulation of noise spectra distortion in FM-CW autonomous cruise control radar." 2001 MTT-S International Microwave Symposium Digest 01.1 (2001 Vol. I [MWSYM]): 459-462 vol.1.

The design of complex MMICs such as ACC car radar involves the development of efficient and fast simulation techniques to predict the characteristics of the circuits. Their noise behavior simulation is one of the main drawback due to its complexity and large computation time. We propose in this paper, a new method based on a circuit envelope to simulate the noise spectra conversion of a signal passing through a MMIC. The efficiency of the proposed method is shown with the comparison between simulation and measures of the AM/PM conversion of a millimeter wave transmitter.

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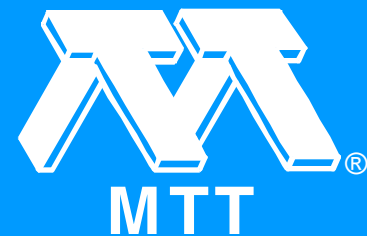
Spectrum management of pulse transmission by high-cut filter using magnetic loss

T. Miura and S. Nakagawa. "Spectrum management of pulse transmission by high-cut filter using magnetic loss." 2001 MTT-S International Microwave Symposium Digest 01.1 (2001 Vol. 1 [MWSYM]): 463-466 vol. 1.

Operation problems of a 200 MHz clock computer bus were analyzed by the time domain transmission of pulse in the bus. An absorptive high-cut filter was fabricated and installed to solve the problems. In the process of determining the operating conditions, we came upon a new concept for spectrum management.

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Null pattern synthesis of ferroelectric smart antennas

J. Modelski and Y. Yashchyshyn. "Null pattern synthesis of ferroelectric smart antennas." 2001 MTT-S International Microwave Symposium Digest 01.1 (2001 Vol. 1 [MWSYM]): 467-470 vol.1.

In this paper, new method of null pattern synthesis of antenna arrays without phase shifters and attenuators has been presented. This concept is based on utilizing a voltage-controlled ferroelectric array, where the variable pattern of each antenna element is used to synthesize the array pattern with desired nulls.

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Ferroelectric thin-film based electrically tunable Ku-band coplanar waveguide components

G. Subramanyam, N. Mohsina, A. Al Zaman, F. Miranda, F. Van Keuls, R. Romanofsky and J. Warner. "Ferroelectric thin-film based electrically tunable Ku-band coplanar waveguide components." 2001 MTT-S International Microwave Symposium Digest 01.1 (2001 Vol. 1 [MWSYM]): 471-474 vol. 1.

Barium strontium titanate Ba/sub 0.6/Sr/sub 0.4/TiO/sub 3/ thin-film based tunable coplanar waveguide (CPW) components were studied in this research. The CPW components modeled and experimentally verified include CPW transmission lines, resonators and 2-pole filters. The resonators and filters fabricated and tested exhibited a frequency tunability of approximately 3% for a bipolar bias voltage of /spl plusmn/100 V, corresponding to a peak biasing field of 40 kV/cm.



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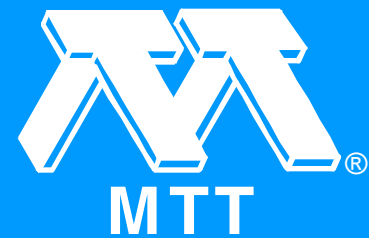
Performance and modeling of saw tooth edge mode isolators

A.H. Aly and B. Elsharawy. "Performance and modeling of saw tooth edge mode isolators." 2001 MTT-S International Microwave Symposium Digest 01.1 (2001 Vol. 1 [MWSYM]): 475-477 vol.1.

This paper presents modeling and results of a novel edge mode isolator. The new isolator can be optimized to increase isolation or to reduce insertion loss. This is achieved by introducing a saw tooth edge at the lossy periphery. Reduction of the insertion loss by about 0.3 dB is observed. In another simulation, an increase of isolation by about 3 dB is obtained compared to conventional edge mode isolator.

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Possibility of ultra fine isolator for portable phone

S. Takeda, Y. Kishimoto, H. Itoh and K. Ichikawa. "Possibility of ultra fine isolator for portable phone." 2001 MTT-S International Microwave Symposium Digest 01.1 (2001 Vol. 1 [MWSYM]): 479-482 vol. 1.

There exists a trade-off relationship between miniaturization of an isolator for portable phones and its specific bandwidth. In this paper, we introduce a new way to increase bandwidth over 13%, in spite of a reduction in garnet dimensions by one tenth, by the addition of LC impedance matching circuits. In the preliminary experiments, we obtained a 4 mm square isolator with 4.1% bandwidth at 836 MHz using LTCC technology.

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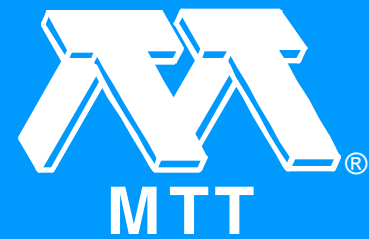
Modeling coplanar waveguide structures constructed of ferromagnetic metal

N. Cramer and D.K. Walker. "Modeling coplanar waveguide structures constructed of ferromagnetic metal." 2001 MTT-S International Microwave Symposium Digest 01.1 (2001 Vol. I [MWSYM]): 483-486 vol. 1.

We fabricate coplanar waveguide transmission lines with thin-film Fe/sub 0.2/Ni/sub 0.8/ conductors. These lines demonstrate a power attenuation of 10 dB/cm at ferromagnetic resonance frequencies of 5 to 10 GHz for applied magnetic fields less than 100 mT (1 kG). In addition, the phase of the transmitted wave can be tuned by about 20 degrees/cm by adjusting an applied magnetic field. We present a simple model for the complex reflected and transmitted waves as a function of material characteristics, geometry, and applied field. We model the skin effect influence on the transmission line circuit parameters, including the line impedance and propagation constant, by considering the full effects of the conductor permeability and conductivity.

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Planar Ka-band high temperature superconducting filters for space applications

C. Lascaux, F. Rouchaud, V. Madrangeas, M. Aubourg, P. Guillon, B. Theron and M. Maignan.
"Planar Ka-band high temperature superconducting filters for space applications." 2001 MTT-S International Microwave Symposium Digest 01.1 (2001 Vol. I [MWSYM]): 487-490 vol.1.

The impressive explosion of the satellite communication systems during the last few years has led to new constraints in regards to filtering requirements. The development of multimedia satellites and the saturation of the operational frequency bands, necessitates an increase in frequency coverage. This paper presents the design of High Temperature Superconducting (HTS) preselect receive fitters for communication satellites. Attention has been focused on obtaining low insertion loss and small dimensions, at frequencies of 4 GHz and 30 GHz.

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Multi-stage dual-mode cross-slotted superconducting filters for telecommunication application

A. Cassinese, M. Barra, G. Panariello and R. Vaglio. "Multi-stage dual-mode cross-slotted superconducting filters for telecommunication application." 2001 MTT-S International Microwave Symposium Digest 01.1 (2001 Vol. 1 [MWSYM]): 491-494 vol.1.

Dual mode high temperature superconducting (HTS) filters represent an interesting device class for telecommunication application since they combine a high power handling capability with a miniaturized size. Here we report on the design and realization of dual mode cross slotted filters presenting a more compact size if compared with the traditional dual mode patch filters. Single stage filters operating in C-band with 1% fractional bandwidth have been designed and tested at prototype level by using double sided YBa/sub 2/Cu/sub 3/O/sub 7-x/ (YBCO) and Tl/sub 2/Ba/sub 2/CaCu/sub 2/O/sub 8/ (Tl-2212) superconducting films grown on LaAlO/sub 3/ substrates. The YBCO filter presents insertion losses IL=1 dB and a power handling higher than 10 dBm at T=77 K while the Tl-2212 allows operation at higher temperatures with comparable performances. Dual stage (four poles) and four stage (eight poles) filters with 1% fractional bandwidth operating in C-band and presenting a Chebyshev or a quasi elliptical response have been analyzed. Finally, a four stage filter fitting well on a 1"/spl times/1" substrate was designed.

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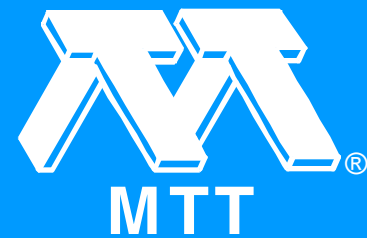
Design of an image-type dielectric resonator to measure surface resistance of a high-T/sub c/ superconductor film

Y. Kobayashi and T. Hashimoto. "Design of an image-type dielectric resonator to measure surface resistance of a high-T/sub c/ superconductor film." 2001 MTT-S International Microwave Symposium Digest 01.1 (2001 Vol. 1 [MWSYM]): 495-498 vol.1.

A new measurement method using two resonant modes, the TE/sub 021/ and TE/sub 012/ modes, in an image-type dielectric resonator is proposed to measure the surface resistance $R_{\text{sub } s/}$ of a high-T/sub c/ superconductor (HTS) film and the loss tangent $\tan/\text{spl } \delta/$ of a sapphire rod separately, precisely and nondestructively. A sapphire resonator is set in a cavity constructed from two HTS films and a copper cylinder. This resonator structure is designed from the mode charts calculated on the basis of the rigorous analysis by the mode matching method. It is verified that the mode chart also is effective to identify many resonant modes observed in measurement. The temperature dependence of $R_{\text{sub } s/}$ of a YBCO film was measured at 20 GHz by this method. The measured result agrees very well with one by the conventional two-resonator method.

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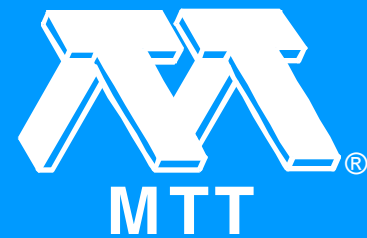
Planar superconducting lumped element bandpass filter with spiral inductors

A.E. Barinov and S.A. Zhgoon. "Planar superconducting lumped element bandpass filter with spiral inductors." 2001 MTT-S International Microwave Symposium Digest 01.1 (2001 Vol. 1 [MWSYM]): 499-501 vol. 1.

Experimental results are reported for a novel 4-pole high temperature superconducting lumped element bandpass Chebyshev filter with central frequency 1.7 GHz and 1.2% fractional bandwidth. High efficiency of the substrate area usage is reached by the application of planar coils as inductance elements. Measurements and simulation results are compared and are found to be in satisfactory agreement.

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Performance of a superconducting detector circuit using a Schottky barrier diode for bandwidth modulation

M.W. Hosking. "Performance of a superconducting detector circuit using a Schottky barrier diode for bandwidth modulation." 2001 MTT-S International Microwave Symposium Digest 01.1 (2001 Vol. 1 [MWSYM]): 503-506 vol. 1.

This paper describes some operational characteristics, at microwave frequencies, of a detector consisting of a Schottky barrier diode, integrated within a superconducting thin-film YBCO matching circuit. Emphasis is placed on the practical, operational characteristics, rather than the (better understood) transport properties of the semiconductor. The temperature dependence of key characteristics is analysed and, in particular, the change of video bandwidth with decreasing temperature. Because the bandwidth is also a function of bias current, a novel means of controlling, optimising, or modulating the bandwidth is proposed. In a system application, an unwanted variation in bandwidth could result in either a decrease in tangential sensitivity, or loss of data rate, with a consequent degradation of performance. It is proposed and demonstrated that the application of a small forward bias to the diode can be used to vary this bandwidth: a feature which could be utilised in practice to adaptively modulate, or control, the sensitivity of a detector system.

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Bias circuits for GaAs HBT power amplifiers

E. Jarvinen, S. Kalajo and M. Matilainen. "Bias circuits for GaAs HBT power amplifiers." 2001 MTT-S International Microwave Symposium Digest 01.1 (2001 Vol. 1 [MWSYM]): 507-510 vol.1.

This paper discusses the effects of process and temperature variations on the performance of GaAs HBT power amplifier bias circuits. A novel feedback bias circuit, which overcomes these problems, is presented. The measured variation from 54 to 60 mA in the bias current, over the temperature range of -25 to +85/spl deg/C, agrees well with the simulations. The circuit is insensitive to variations in the regulated voltage which is a desirable feature in a case when the amplifier is biased to a constant current. On the other hand, a smooth bias and gain control can be achieved by adding an extra resistor connected to a separate control voltage.

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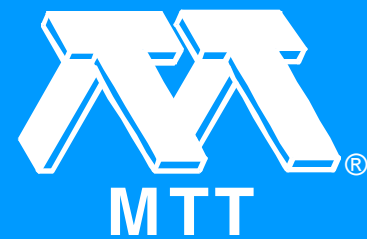
High-efficiency low-IM microwave PA design

P. Colantonio, F. Giannini, G. Leuzzi and E. Limiti. "High-efficiency low-IM microwave PA design." 2001 MTT-S International Microwave Symposium Digest 01.1 (2001 Vol. I [MWSYM]): 511-514 vol.1.

Harmonic terminations effects in microwave power amplifiers on its power and linearity performances are discussed. By a simplified theoretical approach, useful guidelines are inferred to obtain both high efficiency and low intermodulation. The concepts discussed are experimentally validated showing the performances of four hybrid amplifiers, designed using different harmonic manipulation strategies. In particular, using a proper input second harmonic output termination, an improvement both in power added efficiency and intermodulation can be obtained.

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Highly linear CMOS RF MMIC amplifier using multiple gated transistors and its Volterra series analysis

B. Kim, Jin-Su Ko and K. Lee. "Highly linear CMOS RF MMIC amplifier using multiple gated transistors and its Volterra series analysis." 2001 MTT-S International Microwave Symposium Digest 01.1 (2001 Vol. 1 [MWSYM]): 515-518 vol.1.

CMOS RF MMIC amplifiers are fabricated with linearization technique using multiple gated transistors. At 900 MHz, double and triple gated amplifiers show 2.5-4.5 dB larger figure of merit (linearity-DC power consumption), which means that only 1/2/spl sim/1/3 of DC power is needed to obtain the same OIP/sub 3/ value. Using Volterra series analysis and harmonic balance simulation, it is shown that the linearization technique with the 2nd harmonic termination can increase IIP/sub 3/ by amount of 16 dB max. without additional DC power consumption at optimal bias condition, which can reduce more than 90% of DC power consumption with the same linearity performance.

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A novel high efficiency multioctave amplifier using cascaded reactively terminated single-stage distributed amplifiers for EW system applications

A.S. Virdee and B.S. Virdee. "A novel high efficiency multioctave amplifier using cascaded reactively terminated single-stage distributed amplifiers for EW system applications." 2001 MTT-S International Microwave Symposium Digest 01.1 (2001 Vol. 1 [MWSYM]): 519-522 vol.1.

This paper demonstrates the design of a high efficiency amplifier employing a novel concept of cascaded reactively terminated single-stage distributed amplifier (CRTSSDA). In addition, CRTSSDA produces an available power gain significantly higher than conventional distributed amplifiers using the same number of active devices. Three-CRTSSDAs were designed and fabricated for EW application. The novel amplifier achieved an associated gain above 26 dB with flatness of ± 0.5 dB, an average power added efficiency in excess of 27% at an output power of 25 dBm over the 2-18 GHz band with an efficiency peak of 30% at 12 GHz.

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A 2.4 GHz integrated CMOS power amplifier with micromachined inductors

Y.C. Chen, Yong Kyu Yoon, J. Laskar and M. Allen. "A 2.4 GHz integrated CMOS power amplifier with micromachined inductors." 2001 MTT-S International Microwave Symposium Digest 01.1 (2001 Vol. 1 [MWSYM]): 523-526 vol.1.

This paper reports the development of the first 2.4 GHz monolithic-integrated CMOS power amplifier with micromachined inductors. The amplifier is implemented in a 0.24- μm CMOS technology. The high-Q (quality factor) micromachined solenoid inductors are fabricated on the surface of the CMOS chip. For 2.5-V operation, the amplifier delivers 20-dBm output power with 31% PAE (power added efficiency) to 50- Ω load.

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Monolithic 6W Ka-band high power amplifier

R. Emrick. "Monolithic 6W Ka-band high power amplifier." 2001 MTT-S International Microwave Symposium Digest 01.1 (2001 Vol. 1 [MWSYM]): 527-529 vol. 1.

The design and performance of a fully monolithic 6W Ka-band power amplifier is outlined. Excellent agreement between modeled and measured performance was demonstrated. This 3-stage power amplifier, which power combines 16 FETs on the third stage, is fully matched on chip to 50/spl Omega/ at the input and output wire bond pads. Performance achieved /spl sim/20.5 dB gain from 24-32 GHz with a peak power of >6W and PAE of /spl sim/21%. This performance was achieved using a 0.1 /spl mu/m power PHEMT process. To the authors knowledge, this is the highest output power demonstrated from a single device in this frequency band.



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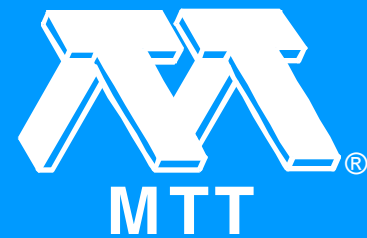
A novel method for closed-loop error correction microwave and millimeter wave QPSK modulator

A. Madjar, T. Blum, M. Namer, I. Itzkovic and B. Zusmanovic. "A novel method for closed-loop error correction microwave and millimeter wave QPSK modulator." 2001 MTT-S International Microwave Symposium Digest 01.1 (2001 Vol. 1 [MWSYM]): 531-534 vol.1.

QPSK modulators at microwave and millimeter waves can be very useful for direct modulation communication links. The main problem with such modulators is the error in phase and amplitude balance, which is quite large at MM-waves and degrades the performance of the modulator (carrier rejection, deviation from 90 degrees between states, etc.). In this paper we introduce a novel approach featuring an error correction scheme, which is simple to implement both in hybrid and MMIC forms. A very important feature of the new method is the self-generated reference signal, which enables a simple (low cost) and self contained implementation in a MMIC form of a high quality QPSK MM-wave modulator.

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Micromachined sub-millimeter and millimeter wave variable polarisation compensator

T.D. Drysdale, H.M.H. Chong, R.J. Blaikie and D.R.S. Cumming. "Micromachined sub-millimeter and millimeter wave variable polarisation compensator." 2001 MTT-S International Microwave Symposium Digest 01.1 (2001 Vol. 1 [MWSYM]): 535-538 vol.1.

A micromachined variable polarisation compensator has been designed and demonstrated experimentally at 100 GHz. The device uses two interlocking artificial dielectric gratings to produce a birefringence that varies as a function of the separation distance. The maximum phase difference was measured to be 74/spl deg/, in good agreement with computer simulations. Quarter wave dielectric antireflection coatings can be added to the exterior surfaces to reduce the insertion loss.

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Membrane-supported copper E-plane circuits

W.Y. Liu, D.P. Steenson and M.B. Steer. "Membrane-supported copper E-plane circuits." 2001 MTT-S International Microwave Symposium Digest 01.1 (2001 Vol. 1 [MWSYM]): 539-542 vol. 1.

This paper reports the realization of copper E-plane circuits on a micromachined 5 micron thick organic membrane. As the membrane is both thin and optically smooth, dielectric loss and the excitation of surface modes are virtually eliminated. Measured losses of lines are no more than 0.4 dB/cm at W-band. The relatively low-cost low-temperature process uses a photosensitive resin (SU-8) to form a self-supporting membrane on which devices can be mounted. The realization a finline resonator and an E-plane bandpass filter are presented.

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Suppression of parasitic substrate modes in flip-chip packaged coplanar W-band amplifier MMICs

A. Tessmann, W.H. Haydl, T.v. Kerssenbrock, P. Heide and S. Kudzusz. "Suppression of parasitic substrate modes in flip-chip packaged coplanar W-band amplifier MMICs." 2001 MTT-S International Microwave Symposium Digest 01.1 (2001 Vol. 1 [MWSYM]): 543-546 vol.1.

In this work, we describe the impact of different mounting configurations for flip-chip assemblies of W-band millimeter-wave integrated circuits. Coplanar 94 GHz amplifiers with high gain have been flip-chip mounted on both, semi-insulating (s.i.) GaAs and n-type doped silicon (n-Si) carriers. The influence of carrier thickness and conductivity on the isolation between the input and output port was investigated to minimize the power leakage into parasitic modes in the flip-chip substrate. The use of lossy n-Si substrates resulted in a significant reduction of feedback and crosstalk effects, and thus an unconditional stable operation of the flip-chip packaged W-band amplifier MMICs was achieved.

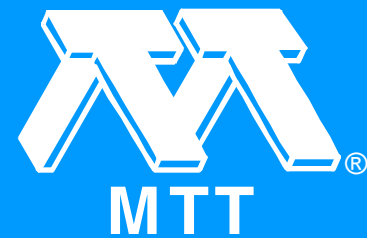
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A 60 GHz conical horn antenna excited with quasi-Yagi antenna

M. Sironen, Y. Qian and T. Itoh. "A 60 GHz conical horn antenna excited with quasi-Yagi antenna." 2001 MTT-S International Microwave Symposium Digest 01.1 (2001 Vol. 1 [MWSYM]): 547-550 vol. 1.

A conical horn antenna excited with a quasi-Yagi antenna is presented. This antenna comprises a microstrip to circular waveguide transition and a circular horn as a single unit. The transition was made non-contacting, which relaxes the mechanical tolerance requirements. The antenna is simple to fabricate and feed, and provides single mode operation with medium gain and bandwidth. A gain of 16.5 dB with cross polarization of 19 dB is measured at 60 GHz, while a 4 GHz return loss bandwidth (-11 dB) is achieved from 59 GHz to 63 GHz.



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Design of a nonradiative dielectric Rotman lens in the millimeter wave frequency

Jae-Gon Lee, Jeong-Hae Lee and Heung-Sik Tae. "Design of a nonradiative dielectric Rotman lens in the millimeter wave frequency." 2001 MTT-S International Microwave Symposium Digest 01.1 (2001 Vol. 1 [MWSYM]): 551-554 vol.1.

In this paper, a Rotman lens for a multi-beam feed that can be applied to a car collision avoidance radar in the millimeter wave frequency range was designed using nonradiative dielectric (NRD) guide. NRD guide at the output ports was designed to obtain low loss, small coupling between the output ports, and dominant mode operation. The Rotman lens is optimized so as to minimize the sidelobe of the array factor. To prevent the beam pattern from being distorted, multiple-reflection from the sidewall has been eliminated by employing a corrugated sidewall.

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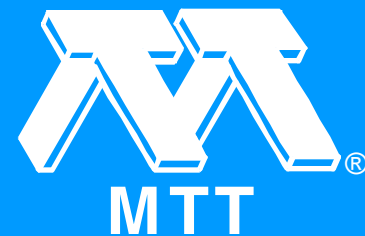


Abstracts

Nonlinear distortion suppression in directly modulated DFB lasers by sidemode optical injection

J.-H. Seo, Y.-K. Seo and W.-Y. Choi. "Nonlinear distortion suppression in directly modulated DFB lasers by sidemode optical injection." 2001 MTT-S International Microwave Symposium Digest 01.1 (2001 Vol. 1 [MWSYM]): 555-558 vol. 1.

We demonstrate a new method of suppressing nonlinear distortions in directly modulated DFB lasers. In our scheme, external laser light is injected into the sidemode of the DFB laser. Using this scheme, we achieved significant reduction in nonlinear distortions such as the second harmonic distortion (SHD), second order intermodulation distortion (IMD2), and third order intermodulation distortion (IMD3). In addition, we enhanced the external light detuning range.



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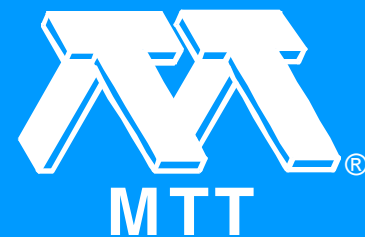


Abstracts

A new, compact model for high-speed electro-optic modulators fully integrated within a microwave CAD environment

P. Zandano, M. Pirola and G. Ghione. "A new, compact model for high-speed electro-optic modulators fully integrated within a microwave CAD environment." 2001 MTT-S International Microwave Symposium Digest 01.1 (2001 Vol. 1 [MWSYM]): 559-562 vol.1.

A compact model is presented for high-speed electro-optic modulators fully integrated within the framework of a microwave circuit design suite (MWOFFICE of AWR). Starting from geometrical and layout parameters, the model allows both simple (travelling wave) and complex (phase reversal, periodically loaded) structures to be analyzed and optimized from the standpoint of the electro-optic response both in small-signal (analog) operation and in large-signal (digital) operation exploiting standard simulator tools, including the Monte Carlo statistical analysis of device yield and sensitivity. Finally, the new model allows the designer to include, at no additional effort, parasitic and passive elements (such as optical or electrical delay paths) in the modulator model to account for the effect of tapered transitions and packaging. Comparisons with literature data and design examples are presented to validate the approach and stress its potential in the design of high-speed structure's on LiNbO/sub 3/ substrates.



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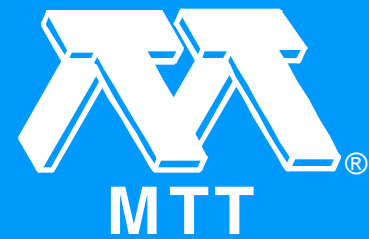
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Conformal imaging with a non-contacting microwave antenna array

Dun Li, P.M. Meaney and K.D. Paulsen. "Conformal imaging with a non-contacting microwave antenna array." 2001 MTT-S International Microwave Symposium Digest 01.1 (2001 Vol. 1 [MWSYM]): 563-566 vol. 1.

A model-based, non-contacting microwave imaging system, which allows for an arbitrarily shaped imaging domain to exist within the antenna array, has been developed using our Gauss-Newton iterative image reconstruction approach based on a hybrid of the finite element (FE) and boundary element (BE) methods. A new feature has been introduced to conform to the reconstructed field of view exactly to the coupling medium/object interface. This facilitates deployment of the reconstruction parameters solely to the zone occupied by the object, potentially improving resolution. Enhancements using this technique have been demonstrated in both simulations and phantom experiments.

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A low-power direct conversion receiver module for C-band wireless applications (2001 Vol. I [MWSYM])

B. Matinpour, A. Sutono and J. Laskar. "A low-power direct conversion receiver module for C-band wireless applications (2001 Vol. I [MWSYM])." 2001 MTT-S International Microwave Symposium Digest 01.1 (2001 Vol. I [MWSYM]): 567-570 vol.1.

In this paper, we present the first low-power direct conversion receiver module for broadband wireless applications at C-band. This module is composed of a highly-integrated receiver MMIC fabricated in a 0.6 μm commercial GaAs MESFET process mounted on a LTCC substrate with an integrated multi-layer three-dimensional front-end filter. With only 25 mW of DC power consumption, this receiver module demonstrates conversion gain of 9 dB, NF of 4.7 dB, DC offset below -70 dBm, IIP2 of +30 dBm, and IIP3 of -10 dBm at 5.8 GHz.

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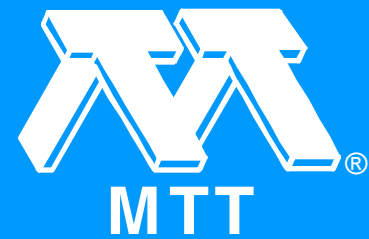
A GaAs HBT 5.8 GHz OFDM transmitter MMIC chip set (2001 Vol. I [MWSYM])

A. Raghavan, E. Gebara, C.-H. Lee, S. Chakraborty, D. Mukherjee, J. Bhattacharjee, D. Heo and J. Laskar. "A GaAs HBT 5.8 GHz OFDM transmitter MMIC chip set (2001 Vol. I [MWSYM])." 2001 MTT-S International Microwave Symposium Digest 01.1 (2001 Vol. I [MWSYM]): 571-574 vol.1.

This paper presents a GaAs-AlGaAs HBT transmitter MMIC chip set consisting of a power amplifier, a mixer and a voltage-controlled oscillator (VCO) for 5.8 GHz OFDM applications. The performance of the transmitter in an OFDM system is investigated by means of envelope co-simulation of the circuit in an OFDM transmitter simulation platform that conforms to the IEEE 802.11a wireless LAN standard. To the best of our knowledge, this research represents the first reported implementation of an OFDM transmitter in GaAs HBT technology.

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A 2.5 V CMOS differential active inductor with tunable L and Q for frequencies up to 5 GHz (2001 Vol. I [MWSYM])

M. Grozing, A. Pascht and M. Berroth. "A 2.5 V CMOS differential active inductor with tunable L and Q for frequencies up to 5 GHz (2001 Vol. I [MWSYM])." 2001 MTT-S International Microwave Symposium Digest 01.1 (2001 Vol. I [MWSYM]): 575-578 vol.1.

A differential active inductor in CMOS technology with a supply voltage of 2.5 V is presented. A self-resonant frequency of 5.6 GHz is achieved. The value of the inductance L can be controlled in the range from 10 nH up to 100 nH. The quality factor Q can be tuned independently of L to values as large as 600. The active inductor is realized with a differential gyrator. The gyrator transforms intrinsic capacitances of the MOSFETs to the emulated inductance.

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Temperature dependence of intermodulation and linearity in GaN based devices (2001 Vol. I [MWSYM])

A. Ahmed, S.S. Islam and A.F.M. Anwar. "Temperature dependence of intermodulation and linearity in GaN based devices (2001 Vol. I [MWSYM])." 2001 MTT-S International Microwave Symposium Digest 01.1 (2001 Vol. I [MWSYM]): 579-582 vol.1.

The gain and intermodulation distortion of an AlGa_N-GaN device operating at RF, have been analyzed using a general Volterra series representation. The circuit model to represent the GaN FET is obtained from a physics based analysis. Theoretical current-voltage characteristics are in excellent agreement with the experimental data. For a 1 μm /500 μm Al_{0.15}Ga_{0.85}N-GaN FET, the calculated output power, power added efficiency and gain are 25 dBm, 13% and 10.1 dB, respectively at 15 dBm input power and are in excellent agreement with the experimental data. The output referred third order intercept point IP₃ is 39.9 dBm at 350 K and 33 dBm at 650 K. These are in agreement with the simulated results from Cadence which are 39.34 dBm and 35.7 dBm, respectively. At 10 GHz, third order intermodulation distortion IM₃ for 10 dBm output power is -88 dB at 350 K and -82 dB at 650 K. At 350 K IM₃ is -97 dB at 5 GHz and -88 dB at 10 GHz. For the same frequencies IM₃ increased to -90 dB and -82 dB, respectively, at 650 K.

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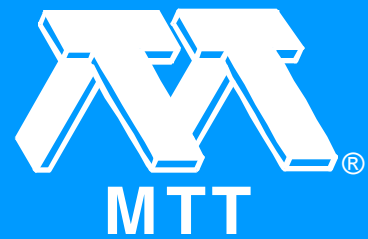


Abstracts

A new T circuit topology for the broadband modelling of symmetric inductors fabricated in CMOS technology (2001 Vol. I [MWSYM])

W. Tatinian, P. Pannier and R. Gillon. "A new T circuit topology for the broadband modelling of symmetric inductors fabricated in CMOS technology (2001 Vol. I [MWSYM])." 2001 MTT-S International Microwave Symposium Digest 01.1 (2001 Vol. I [MWSYM]): 583-586 vol.1.

This paper shows that the conventional /spl Pi/-type model is not suitable for the broadband modelling of symmetrical inductors. A T-shaped model topology is introduced and a suitable extraction procedure is proposed for its parameters. The new model allows one to reproduce the measured behaviour of symmetric inductors up to twice the self-resonance frequency.



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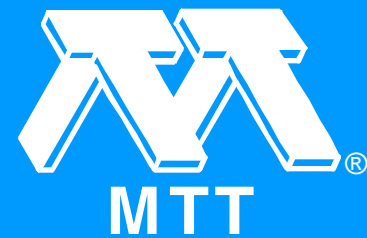


Abstracts

Modeling of inductors and transformers (2001 Vol. I [MWSYM])

S.R. Kythakypuzha and W.B. Kuhn. "Modeling of inductors and transformers (2001 Vol. I [MWSYM])." 2001 MTT-S International Microwave Symposium Digest 01.1 (2001 Vol. I [MWSYM]): 587-590 vol. 1.

This paper deals with modeling of spiral inductors and transformers. A lumped element approach is used to represent the spirals on a turn-by-turn basis. A previously reported approach for modeling of substrate eddy currents is employed and a new approach for modeling of current crowding effects is introduced. Both are modeled using inductor and resistance loops with coupling to the turn inductances. The program is written to generate a Spice sub-circuit for a wide variety of inductors and transformers. The results are validated against measured values of spirals implemented in a six-layer-copper bulk CMOS process and an SOI process.



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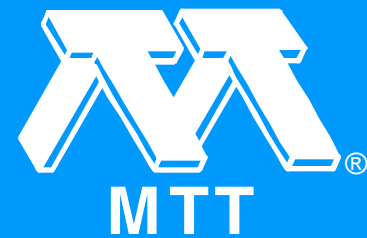


Abstracts

15 GHz wideband amplifier with 2.8 dB noise figure in SiGe bipolar technology (2001 Vol. I [MWSYM])

H. Knapp, D. Zoschg, T. Meister, K. Aufinger, S. Boguth and L. Treitinger. "15 GHz wideband amplifier with 2.8 dB noise figure in SiGe bipolar technology (2001 Vol. I [MWSYM])." 2001 MTT-S International Microwave Symposium Digest 01.1 (2001 Vol. I [MWSYM]): 591-594 vol.1.

We present a wideband amplifier with 12 dB gain and a 3-dB bandwidth of 15 GHz. The noise figure is 2.8 dB for frequencies up to 10 GHz and 4 dB at 15 GHz. The circuit is manufactured in an advanced SiGe bipolar technology and consumes 7.2 mA from a 3.3 V supply.



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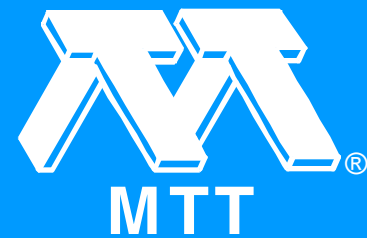
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40-Gbit/s D-type flip-flop and multiplexer circuits using InP HEMT (2001 Vol. I [MWSYM])

T. Suzuki, H. Kano, Y. Nakasha, T. Takahashi, K. Imanishi, H. Ohnishi and Y. Watanabe. "40-Gbit/s D-type flip-flop and multiplexer circuits using InP HEMT (2001 Vol. I [MWSYM])." 2001 MTT-S International Microwave Symposium Digest 01.1 (2001 Vol. I [MWSYM]): 595-598 vol.1.

We developed a novel design technique for a D-type flip-flop (D-FF) circuit that is based on a small-signal-equivalent circuit approach. This technique provides the best condition to operate the D-FF at a high frequency. Using this technique, we fabricated a master-slave D-FF using a 0.15- μm InP HEMT technology. We achieved 40-Gbit/s operation with clear-eye-waveform patterns and reduced jitter.





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A direct Ku-band linear subharmonically pumped BPSK and I/Q vector modulator in multi-layer thin-film MCM-D (2001 Vol. I [MWSYM])

G. Carchon, D. Schreurs, W. De Raedt, P. Van Loock and B. Nauwelaers. "A direct Ku-band linear subharmonically pumped BPSK and I/Q vector modulator in multi-layer thin-film MCM-D (2001 Vol. I [MWSYM])." 2001 MTT-S International Microwave Symposium Digest 01.1 (2001 Vol. I [MWSYM]): 599-602 vol. 1.

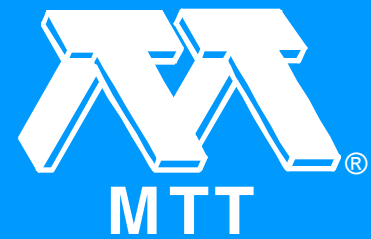
A direct Ku-band linear subharmonically pumped BPSK and I/Q vector modulator has been developed using multi-layer thin-film MCM-D technology. All passives are integrated in the low cost MCM-D substrate. The subharmonic mixing is performed using a beam-lead anti-parallel diode pair, mounted onto the MCM using thermocompression. No tuning has been performed on the circuits. The BPSK modulator has a very flat mixer conversion due to an optimal harmonic loading of the third harmonic of the LO: measurements show a +/-0.25 dB variation on the conversion loss for an LO-frequency varying between 6.8-7.6 GHz. The LO and RF return loss are below -14 dB and -12.5 dB respectively. The I/Q vector modulator consists of a Wilkinson power divider, a CPW Lange coupler and 2 BPSK modulators. The LO and RF return loss are better than -13 dB and -18 dB respectively. The QPSK-modulator has a measured image rejection better than -27 dB over the RF-range of 13.4-15.2 GHz band (corresponding to a vector phase and amplitude error lower than 2/spl deg/ and 1%). The image rejection is even better than -32 dB over the VSAT band (RF:14-14.5 GHz).



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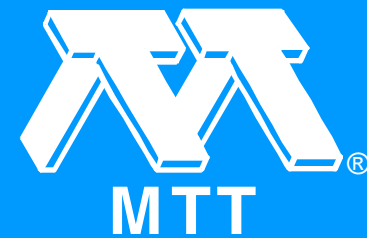
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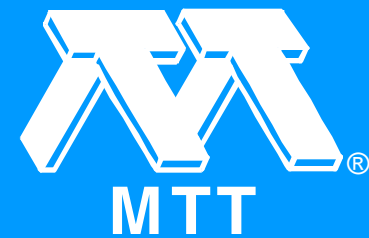
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Technical Program Schedule (2001 Vol. II [MWSYM])

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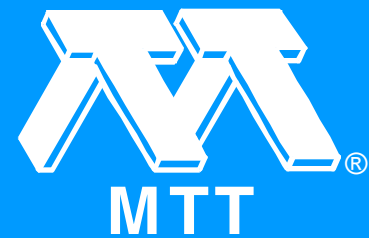
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Novel design for coplanar waveguide to microstrip transition

A.M.E. Safwata, K.A. Zaki, W. Johnson and C.H. Lee. "Novel design for coplanar waveguide to microstrip transition." 2001 MTT-S International Microwave Symposium Digest 01.2 (2001 Vol. II [MWSYM]): 607-610 vol.2.

A new design of a coplanar waveguide (CPW) to microstrip transition is presented. Simulation using the high frequency simulator software (HFSS) shows that a bandwidth of 13 GHz with less than -25 dB return loss can be achieved. The transition was fabricated and characterized. Experimentally, the S_{11} of two back to back conductor backed CPW to microstrip transitions on InP substrate is better than -12 dB up to 14 GHz. For alumina substrate the S_{11} was less than -15 dB up to 25 GHz.

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Microstrip fed coplanar stripline tee junction using coupled coplanar stripline

Young-Ho Suh and Kai Chang. "Microstrip fed coplanar stripline tee junction using coupled coplanar stripline." 2001 MTT-S International Microwave Symposium Digest 01.2 (2001 Vol. II [MWSYM]): 611-614 vol.2.

A microstrip fed coplanar stripline (CPS) tee junction was developed using a coupled coplanar stripline (CCPS) without bonding wire. The new tee junction equally splits the power to each output port with an insertion loss of 0.7 dB from 2 GHz to 4.15 GHz. The tee junction can serve as a microstrip to CPS transition to feed dipole antennas and other applications. A wideband CPS-to-microstrip transition was developed and used for conducting measurements. The two back-to-back transitions have an insertion loss of less than 3 dB and a return loss better than 10 dB for the frequency range from 1.3 GHz to 13.3 GHz (1:10.2).

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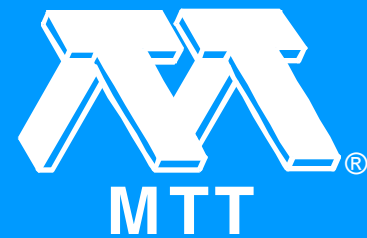
Novel lumped-element coplanar waveguide-to-coplanar stripline transitions

Yo-Shen Lin and Chun Hsiung Chen. "Novel lumped-element coplanar waveguide-to-coplanar stripline transitions." 2001 MTT-S International Microwave Symposium Digest 01.2 (2001 Vol. II [MWSYM]): 615-618 vol.2.

Novel reduced-size lumped-element coplanar waveguide-to-coplanar stripline transitions are proposed, using the planar parallel inductor-capacitor (LC) circuits to realize an effective open circuit. A simple equivalent-circuit model is also established, from which characteristics of various lumped-element transition structures are examined. Specifically, lumped-element transitions with bandwidth ranging from 1.8:1 to 3:1 and 1/12 the size of conventional ones can be achieved.

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Integrated transition of coplanar to rectangular waveguides

D. Deslandes and Ke Wu. "Integrated transition of coplanar to rectangular waveguides." 2001 MTT-S International Microwave Symposium Digest 01.2 (2001 Vol. II [MWSYM]): 619-622 vol.2.

Usual transitions between planar circuit and rectangular waveguide make use of 3-D complex mounting structures. Such an integration requires costly high precision mechanical alignment, In this paper, a new planar platform is developed in which a coplanar waveguide (CPW) and a rectangular waveguide are fully integrated on the same substrate, and they are interconnected via a simple transition. They can be built with a standard PCB process. Our experiments at 28 GHz show that an effective bandwidth of 7% at 15 dB return loss can easily be achieved. The CPW-to-waveguide transition allows for a complete integration of waveguide components on substrate with active components such as MMIC.

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A novel microstrip mode to waveguide mode transformer and its applications

N. Jain and N. Kinayman. "A novel microstrip mode to waveguide mode transformer and its applications." 2001 MTT-S International Microwave Symposium Digest 01.2 (2001 Vol. II [MWSYM]): 623-626 vol.2.

A microstrip-to-rectangular waveguide mode transformer that can be implemented using PCB technology is presented. The RT/Duroid based transformer has a wide simulated frequency response extending from 55 GHz to 140 GHz with about 0.15 dB radiation losses. Many important applications that are easy-to-manufacture are possible. Measurement results of a typical configuration are presented.

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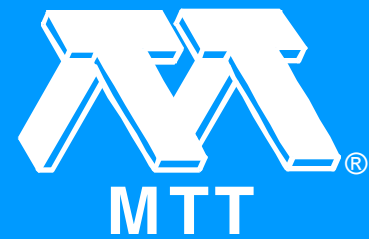
Design of HNRD guide to E-plane waveguide transitions and directional couplers by transverse resonance technique

M. Kishihara, I. Ohta and K. Yamane. "Design of HNRD guide to E-plane waveguide transitions and directional couplers by transverse resonance technique." 2001 MTT-S International Microwave Symposium Digest 01.2 (2001 Vol. II [MWSYM]): 627-630 vol.2.

The authors design two types of HNRD guide to rectangular E-plane waveguide transitions with a fractional bandwidth of 10 or more percent for -20 dB return loss and a directional coupler of HNRD-E-plane waveguide integrated structure on the basis of the transverse resonance technique (TRT). The theoretical results are in good agreement with results calculated by an EM-simulator (Ansoft HFSS).

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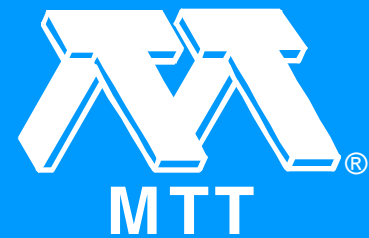
High-voltage GaAs power-HBTs for base-station amplifiers

P. Kurpas, F. Brunner, R. Doemer, B. Janke, P. Heymann, A. Maasdorf, W. Doser, P. Auxemery, H. Blanck, D. Pons, J. Wurfl and W. Heinrich. "High-voltage GaAs power-HBTs for base-station amplifiers." 2001 MTT-S International Microwave Symposium Digest 01.2 (2001 Vol. II [MWSYM]): 633-636 vol.2.

Base stations require high-power devices operating at bias voltages around 26 V. This paper reports on GaAs HBTs with increased breakdown voltage. Transistors on unthinned wafers deliver 3.2 W at 2 GHz for 27 V bias. 100 Ohms output impedance and 74% PAE make them very attractive for base-station amplifiers.

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A power PHEMT device technology for broadband wireless access

M. Miller, B. Peatman and R. Hooper. "A power PHEMT device technology for broadband wireless access." 2001 MTT-S International Microwave Symposium Digest 01.2 (2001 Vol. II [MWSYM]): 637-640 vol.2.

An unmatched power InGaAs PHEMT transistor in a ceramic package has been developed for broadband wireless access (BWA) applications. Operating at 3.5 GHz, from 12 V supplies, a typical device delivers more than 40 dBm of peak envelope power at -30 dBc IMD with drain efficiencies as high as 58% in class AB mode. Under the stringent W-CDMA spec of -40 dBc adjacent channel power (with 11.2 dB peak-to-average signal ratio), a small signal gain of 9.5 dB and linear power in excess of 31.5 dBm with 36% efficiency is obtained in class AB mode. Our paper presents the device technology, and the DC and RF performance under W-CDMA and two-tone excitation.

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Silicon carbide MESFETs performances and application in broadcast power amplifiers

*F. Temcamani, P. Pouvil, O. Noblanc, C. Brylinski, P. Bannelier, B. Darges and J.P. Prigent.
"Silicon carbide MESFETs performances and application in broadcast power amplifiers." 2001
MTT-S International Microwave Symposium Digest 01.2 (2001 Vol. II [MWSYM]): 641-644 vol.2.*

We present DC, small signal and power characterization of recent Thomson silicon carbide MESFETs. We present also performances of SiC power amplifiers designed for use in broadcast digital television. A comparison with a LDMOS amplifier showed that SiC is a very promising material for microwave and RF power amplification.

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A 240 W power heterojunction FET with high efficiency for W-CDMA base stations

I. Takenaka, K. Ishikura, K. Takahashi, K. Kishi, Y. Ogasawara, K. Hasegawa, H. Takahashi, F. Emori and N. Iwata. "A 240 W power heterojunction FET with high efficiency for W-CDMA base stations." 2001 MTT-S International Microwave Symposium Digest 01.2 (2001 Vol. II [MWSYM]): 645-648 vol.2.

An L/S-band highly efficient 240 W GaAs FET amplifier has been developed. The amplifier employed newly developed pseudomorphic heterojunction FETs (HJFETs) exhibiting large drain current and high gm characteristics. In addition, we employed the second harmonic tuning for the input and output matching circuit to obtain the high efficiency characteristics. The developed push-pull amplifier demonstrated 53.8-dBm (240 W) output power with 50% power added-efficiency and 12-dB linear gain at 2.12 GHz. It also showed low adjacent channel leakage power ratio (ACPR) of less than -35 dBc with a power-added efficiency of 28% at an output power of 45 dBm. The developed amplifier is suitable for digital cellular base station applications.

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An ultra broad band 300 W GaAs power FET for W-CDMA base stations

K. Ebihara, K. Inoue, H. Haematsu, F. Yamaki, H. Takahashi and J. Fukaya. "An ultra broad band 300 W GaAs power FET for W-CDMA base stations." 2001 MTT-S International Microwave Symposium Digest 01.2 (2001 Vol. II [MWSYM]): 649-652 vol.2.

An ultra broad band 300 W power FET for W-CDMA base stations systems has been developed. This FET consists of four newly developed 260 mm total gate width (Wgt) chips fabricated with quasi enhancement-mode (E-mode) structure. The broadband performance is obtained by means of multi-stage quarter wave length transformers, which are formed on high dielectric constant thin substrates. The developed FET demonstrated the performance of 300 W (54.8 dBm) saturated power and 11 dB linear gain at 2.15 GHz. In addition 0.2 dB power gain flatness was achieved across 180 MHz bandwidth (at output power 47 dBm). The group delay of this device was 2.14 nanosecond and the phase flatness was less than 0.35 degree between 2.11 and 2.17 GHz. This is the highest output power and widest bandwidth device ever reported.

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High power S-band solid-state amplifiers for surveillance and traffic control radars

T. Murae, K. Fujii and T. Matsuno. "High power S-band solid-state amplifiers for surveillance and traffic control radars." 2001 MTT-S International Microwave Symposium Digest 01.2 (2001 Vol. II [MWSYM]): 653-656 vol.2.

This paper describes development of a 1.8 kW solid-state amplifier operating over 2.7 to 2.9 GHz, for surveillance and traffic control radars. A 1.8 kW peak power with a pulse width of 100 /spl mu/s and 10% duty cycle is achieved by combining four 550 W solid-state power amplifiers. Modular configuration of the 1.8 kW amplifier can realize improvement of maintainability, productivity, and low cost. This paper also describes development of a 180 W output power with 40 dB gain. Linear amplifier using GaAs MMICs to realize the temperature compensation, short pulse (1 /spl mu/s) generation, high gain, and precise gain control for the 1.8 KW amplifier. The 180 W GaAs MMIC amplifier has capability of driving up to twelve 1.8 kW amplifiers, and drastically simplifies solid-state transmitter configuration.

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Ku-band Quadri-SSPA for Stentor satellite transmit active antenna

D. Rogues, H. Chane-Kee-Sheung, F. Dubos, B. Cogo and J.-L. Cazaux. "Ku-band Quadri-SSPA for Stentor satellite transmit active antenna." 2001 MTT-S International Microwave Symposium Digest 01.2 (2001 Vol. II [MWSYM]): 657-660 vol.2.

This paper presents the architecture and the performance of a Ku-band Quadri-SSPA (4 RF amplifying channels) developed in the frame of Stentor French technological satellite for transmit active antenna application. Major technical advances in terms of technological features and RF performance (output power capabilities, DC power consumption and linearity) over a 13 unit lot (52 single SSPA) are highlighted.

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Nonlinear III-V HBT compact models: do we have what we need?

J. Scott. "Nonlinear III-V HBT compact models: do we have what we need?." 2001 MTT-S International Microwave Symposium Digest 01.2 (2001 Vol. II [MWSYM]): 663-666 vol.2.

Within the large body of literature on models for III-V HBTs it now seems possible to find compact formulations with extractable parameters that model all important device characteristics. Predictions are as accurate as possible given the limitation of quasi-static host simulators. Some recommended strategies for extraction of parameters for certain formulations are given. Despite accurate formulation, some aspects may be better left out of models in the interest of expediency, with no significant reduction of final performance. Transit time remains difficult, and limitations of simulators swamp discrepancies between measurement and predictions of even apparently-precise models. It is concluded that compact models, if not simulators, are as physically precise as we should bother to make them.

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Global electrothermal CAD of complex nonlinear 3-D systems based on a fully physical time-dependent compact thermal model

W. Batty, C.E. Christoffersen, S. David, A.J. Panks, R.G. Joknson, C.M. Snowden and M.B. Steer. "Global electrothermal CAD of complex nonlinear 3-D systems based on a fully physical time-dependent compact thermal model." 2001 MTT-S International Microwave Symposium Digest 01.2 (2001 Vol. II [MWSYM]): 667-670 vol.2.

An original spectral domain decomposition approach is presented for the time-dependent thermal modelling of complex, nonlinear, 3-dimensional systems. This fully analytical approach immediately gives rise to compact models of nonlinear distributed thermal subsystems, without requiring approximation by a lumped element RC network, or nodal reduction. In combination with any thermally self-consistent models of analogue, digital, RF and microwave, microelectromechanical or photonic devices, it supplies a CAD timescale description of mutual thermal interaction between power dissipating and temperature sensitive elements. It therefore has the potential for thermal description of the whole system-in-package. In combination with microwave circuit simulator, Transim (NCSU), the thermal model is applied to the self-consistent global electrothermal harmonic balance simulation of a spatial power combining power FET array. The model is validated by comparison of electrothermal simulation of a power HEMT against experimentally obtained thermal images.





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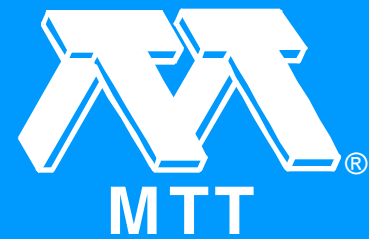
Improved large-signal model and model extraction procedure for InGaP/GaAs HBTs under high-current operations

S.V. Cherepko, M.S. Shirokov, J.C.M. Hwang and A. Brandstaedter. "Improved large-signal model and model extraction procedure for InGaP/GaAs HBTs under high-current operations." 2001 MTT-S International Microwave Symposium Digest 01.2 (2001 Vol. II [MWSYM]): 671-674 vol.2.

Improved large-signal as well as improved model extraction procedure is proposed for InGaP/GaAs HBTs under high-current operations. The model comprises physics-based differential equations that are implemented through symbolically defined devices in a commercially available circuit simulator. Other model improvements include bilateral logical correlation with small-signal characteristics, and additional series resistance with the base-emitter diffusion capacitance. The improvement in extraction procedure is mainly based on a fixed intrinsic vs. extrinsic base-collector capacitance ratio at low currents, whereas a fixed intrinsic base resistance at high currents. Experimentally it has been verified that the as-extracted model without numerical optimization closely predicts the RF power performance of the HBTs.

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Waveform characterization and modeling of dynamic charge behavior of InGaP-GaAs HBTs

C.-J. Wei, S. Sprinkle, J.T. Hu, H.-C. Chung, B. Mitchell, P. Dicarlo and D. Bartle. "Waveform characterization and modeling of dynamic charge behavior of InGaP-GaAs HBTs." 2001 MTT-S International Microwave Symposium Digest 01.2 (2001 Vol. II [MWSYM]): 675-678 vol.2.

This study presents a novel time-domain characterization method for the first time, to reveal dynamic charge behavior of HBTs. The charge model plays an important role in power InGaP-GaAs HBT amplifiers designed with self-biasing. It is shown that charge-storage and extraction from the base of the HBT at a high-power drive cannot be described by the conventional quasi-static model. A new collector-base charge model is proposed to account for the time-response of the devices.

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Scalable large-signal device model for high power-density AlGaIn/GaN HEMTs on SiC

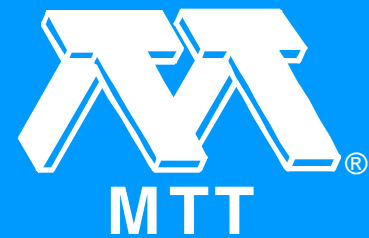
Jong-Wook Lee, Sungjae Lee and K.J. Webb. "Scalable large-signal device model for high power-density AlGaIn/GaN HEMTs on SiC." 2001 MTT-S International Microwave Symposium Digest 01.2 (2001 Vol. II [MWSYM]): 679-682 vol.2.

A scalable device model for high-power, large periphery AlGaIn-GaN HEMTs on SiC has been developed which includes device self-heating. The parameterized model coefficients were evaluated using S-parameters obtained from isothermal bias contours and pulsed I-V measurements. Model scaling with device size was examined by comparing with measurements for peripheries from 0.25 mm to 1.5 mm. The scaled model showed good agreement with measured S-parameters and power sweep data.

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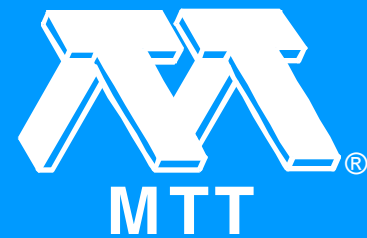
On the Gunn effect in GaAs HBTs

M. Rudolph, R. Doerner and P. Heymann. "On the Gunn effect in GaAs HBTs." 2001 MTT-S International Microwave Symposium Digest 01.2 (2001 Vol. II [MWSYM]): 683-686 vol.2.

A negative RF-resistance effect in GaAs HBTs is described. It results from the nonlinear velocity-field characteristic in GaAs, takes place in the bulk collector, and leads to $|S_{22}|$ exceeding unity. Dependence on bias point and collector doping, and consequences for modeling are discussed.

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Nonlinear effects in oscillators and synthesizers

U.L. Rohde. "Nonlinear effects in oscillators and synthesizers." 2001 MTT-S International Microwave Symposium Digest 01.2 (2001 Vol. II [MWSYM]): 689-692 vol.2.

The author shows existing problems in VCO's and synthesizers due to the nonlinearities in the active device. He proposes design guidelines to minimize such effects in oscillators by using nonlinear design tools. In synthesizers, the reference frequency and its harmonics mix with the output frequency in the phase detector and cause spurious signals. A new method is proposed to introduce a synchronized jitter in the reference, which will remove these spurious frequencies far enough outside the loop bandwidth to be suppressed by at least 90 dB.

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RF synthesizers: PLL switching speed and speed-up techniques, a short review

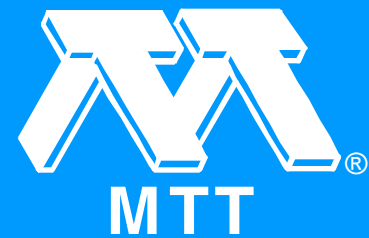
B.-G. Goldberg. "RF synthesizers: PLL switching speed and speed-up techniques, a short review." 2001 MTT-S International Microwave Symposium Digest 01.2 (2001 Vol. II [MWSYM]): 693-696 vol.2.

Traditionally, designers of frequency synthesizers, especially for high volume wireless applications, are mainly focused on the improvement of phase noise and noise floor of signals, always a fundamental property and a constant challenge in the design of radio and wireless networks. Recently, switching speed has become a critical parameter in the design of PLL synthesizers too, especially for 3G, WCDMA, WLAN and future generations of mobile, high data rate and complex wireless networks. High resolution, fast hopping, economical (size, cost, power) single loop synthesizers not compromising spectral purity, are a recent possibility. Only the combination of RF, digital and DSP (Fractional and Delta Sigma type) PLL technologies can offer this capability, as a networking and spread spectrum (combating multipath/fading) technique. The purpose of this paper is to briefly review PLL switching speed issues and speed up mechanisms. Special focus is given to CAD simulation results, optimization and view on strength, limitations, and future trends.

An agile stored $\Sigma\Delta$ sequence fractional-N synthesiser

R. Walkington and P. Brennan. "An agile stored $\Sigma\Delta$ sequence fractional-N synthesiser." 2001 MTT-S International Microwave Symposium Digest 01.2 (2001 Vol. II [MWSYM]): 697-700 vol.2.

The performance of $\Sigma\Delta$ fractional-N frequency synthesisers has a direct relation to reference frequency. The upper limit on this reference frequency is often caused by the modulator, due to the limited speed achievable in fixed point hardware. Fixed point modulator feedback coefficients with limited precision also reduce modulator cycle length leading to unavoidable periodicity in the modulator output stream. To avoid these problems, a synthesiser has been designed which is particularly suited to burst mode systems such as DCS1800. The prototype described here stores pre-generated $\Sigma\Delta$ sequences in fast memory for each required channel, allowing a 'virtual' $\Sigma\Delta$ modulator operating at 240 MHz to be implemented with a low cost FPGA and flash memory.



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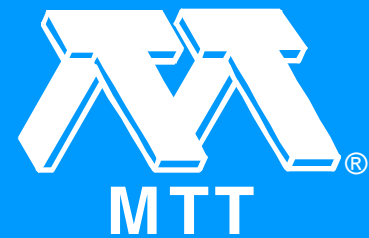
6.7 GHz frequency synthesizer in 0.8 μm /m silicon bipolar production technology

G. Ritzberger, H. Knapp, J. Bock, M. Rest, L. Treitinger and A.L. Scholtz. "6.7 GHz frequency synthesizer in 0.8 μm /m silicon bipolar production technology." 2001 MTT-S International Microwave Symposium Digest 01.2 (2001 Vol. II [MWSYM]): 701-704 vol.2.

This paper presents a 6.7 GHz phase-locked loop frequency synthesizer in a low-cost 0.8 μm /m/25 GHz-f/sub T/ silicon bipolar production technology. The total power consumption of 82 mW at 3 V includes the power consumption of the voltage-controlled oscillator, the phase-frequency detector, the charge pump, the loop filter, and the divider. The synthesizer offers a phase noise performance of -103 dBc/Hz at 1 MHz offset from the carrier. 6.7 GHz is the highest operating frequency for silicon-based synthesizers published.

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GSM 900/DCS 1800 fractional-N frequency synthesizer with very fast settling time

B. Neurauter, G. Marzinger, T. Luftner, R. Weigel, M. Scholz, V. Mutlu and J. Fenk. "GSM 900/DCS 1800 fractional-N frequency synthesizer with very fast settling time." 2001 MTT-S International Microwave Symposium Digest 01.2 (2001 Vol. II [MWSYM]): 705-708 vol.2.

This paper presents a programmable phase-locked-loop (PLL)-based fractional-N frequency synthesizer that uses a third-order $\Delta\Sigma$ -modulator. The in-band phase noise of -97 dBc/Hz in the integer-mode and -94 dBc/Hz in the fractional-mode is measured at 30 kHz offset. In addition to offering an ultra-fine frequency resolution of down to 12.4 Hz and very low in-band phase noise this frequency synthesizer offers, with a loop-bandwidth of about 100 kHz, a very fast settling time of less than 95 μ s when a 75 MHz jump is applied. This feature enables multiple RF applications, including GSM to send a signal and quickly reset to send another signal to meet high data throughput requirements.

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Phase decrement type direct frequency synthesizer driven by a DDS

K. Tajima, H. Tsuru, H. Ikematsu, K. Itoh, Y. Isota and O. Ishida. "Phase decrement type direct frequency synthesizer driven by a DDS." 2001 MTT-S International Microwave Symposium Digest 01.2 (2001 Vol. II [MWSYM]): 709-712 vol.2.

A phase decrement type direct frequency synthesizer with a quadrature mixer driven by a DDS is presented. Phase decrement of a DDS signal can increase the bandwidth of the direct synthesizer. Overflow of a DDS is employed to achieve phase decrement of the signal without adding an extra circuit. A developed 2 GHz-band synthesizer with sub Hz order frequency step achieves 240 MHz bandwidth, frequency switching time of less than 2 /spl mu/s, phase noise of -117 dBc/Hz at 100 kHz offset, and consumption current of 685 mA.



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Effect of losses on the spectral transition of modal poles between the improper and the proper Riemann sheets

A.H. Kamel and A.S. Omar. "Effect of losses on the spectral transition of modal poles between the improper and the proper Riemann sheets." 2001 MTT-S International Microwave Symposium Digest 01.2 (2001 Vol. II [MWSYM]): 715-718 vol.2.

A descriptive analysis of the spectral creation and transition of modal poles between the two Riemann surfaces of the γ -plane (γ is the propagation constant) for both lossless and lossy cases is presented. Proper poles are shown to be the spectral continuation of improper ones as a result of crossing between the corresponding Riemann sheets. In contrast to the lossless case, in which the pole transition takes place through the branch points only, poles of the lossy case can cross the branch cuts everywhere. It is also shown that the spectral band width of forward-wave and backward-wave propagation is influenced by losses. Although the presented analysis deals with the simple dielectric slab guide, the obtained results can be (at least qualitatively) generalized to other open guided-wave and leaky-wave structures. Numerical results are presented for lossless, lightly lossy and heavily lossy cases.

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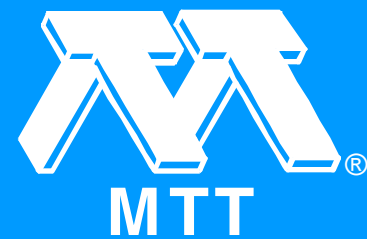
Low-frequency dispersion features of a new complex mode for a periodic strip grating on a grounded dielectric slab (2001 Vol. II [MWSYM])

P. Burghignoli, P. Baccarelli, F. Frezza, A. Galli, P. Lampariello and A.A. Oliner. "Low-frequency dispersion features of a new complex mode for a periodic strip grating on a grounded dielectric slab (2001 Vol. II [MWSYM])." 2001 MTT-S International Microwave Symposium Digest 01.2 (2001 Vol. II [MWSYM]): 719-722 vol.2.

A new leaky mode with TE polarization has been found recently on a periodic metallic strip grating placed on a grounded dielectric slab. At low frequencies the dispersion behavior of the fundamental TE mode is completely different when the grating structure is almost closed as compared to when it is almost open, that is, when the ratio of the strip width (s) to the grating period (p) is close to unity or close to zero. As is discussed here, this difference led to initially puzzling behavior as the ratio s/p was varied, and the behavior became clear only after the new complex modal solution was discovered. Results were obtained previously for only one value of dielectric constant and for only two values of s/p , leaving many open questions. This paper presents the results of a systematic parametric study which answers most of these questions, and also yields information on what ranges of the parameters can provide values of $\beta/k_{\text{sub } 0}$ and $\alpha/k_{\text{sub } 0}$ suitable for a class of practical leaky-wave antennas.

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Guided-wave properties of synthesized nonradiative dielectric waveguide for substrate integrated circuits (SICs)

Ke Wu and F. Boone. "Guided-wave properties of synthesized nonradiative dielectric waveguide for substrate integrated circuits (SICs)." 2001 MTT-S International Microwave Symposium Digest 01.2 (2001 Vol. II [MWSYM]): 723-726 vol.2.

This paper presents the very first investigation of guided-wave properties of a non-radiative dielectric (NRD) guide synthesized on a single substrate for the design of substrate integrated circuits (SICs). The synthesis of the new NRD-guide is made possible by removing part of the substrate or by punching hole or slot arrays that results in two separate lower dielectric-constant regions to which the core NRD strip is bounded. A mode-matching technique is applied to model this guided-wave problem that takes into account various parametric effects of geometry. Propagation constant, leakage loss and modal characteristics are studied for the synthesized NRD-guide structure. The results show that a synthesized NRD-guide can effectively be co-designed with planar circuits based on the same substrate to form a new class of integrated circuits called "substrate integrated circuits" (SICs). This work is useful for the development of low-cost and high-density millimeter-wave ICs.

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Slow-wave propagation of microstrip consisting of electric-magnetic-electric (EME) composite metal strips

Ching-Kuo Wu and C.-K.C. Tzuang. "Slow-wave propagation of microstrip consisting of electric-magnetic-electric (EME) composite metal strips." 2001 MTT-S International Microwave Symposium Digest 01.2 (2001 Vol. II [MWSYM]): 727-730 vol.2.

A novel integrated microstrip slow-wave line is presented. The new microstrip replaces the conventional metal strip by the composite metals paralleling the electric and magnetic surfaces. The magnetic surface is made of an array of coupled inductors that perturb the modal currents periodically. The theoretical results, validated by experiment, show more than 60% increase in the slow-wave factor while maintaining the Q-factor values which can be achieved using the proposed structure.

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TEM properties of shielded homogeneous multiconductor transmission lines with PEC and PMC walls

A. Borji, S. Safavi-Naeini and S.K. Chaudhuri. "TEM properties of shielded homogeneous multiconductor transmission lines with PEC and PMC walls." 2001 MTT-S International Microwave Symposium Digest 01.2 (2001 Vol. II [MWSYM]): 731-734 vol.2.

This paper describes a very fast computational technique for the solution of two-dimensional static boundary value problems within a homogeneous rectangular enclosure with any combination of perfect magnetic and electric conducting walls. A fast convergent series representation of the pertinent Green's function combined with a least-square MoM and point-matching technique leads to a fast and reliable numerical solution. Characteristic impedances of single and coupled shielded metallic rods are computed as an example application of the present method. The results are compared with those of the finite-element method with excellent agreement and much less CPU time.

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Explicit eigenvalue approach to the efficient determination of the hybrid spectrum of ferrite-loaded circular waveguide

L. Pierantoni, A. Camicia and T. Rozzi. "Explicit eigenvalue approach to the efficient determination of the hybrid spectrum of ferrite-loaded circular waveguide." 2001 MTT-S International Microwave Symposium Digest 01.2 (2001 Vol. II [MWSYM]): 735-738 vol.2.

Finding many higher modes in ferrite loaded waveguide becomes mandatory when dealing with discontinuities in accurate component design. It is well known, however, that this is a very difficult task in practice. In this contribution we report a novel approach to this problem based on the explicit eigenvalue formulation of the vector telegrapher's equations applied to the anisotropic uniform waveguide and discretized by using the actual modes taken at cut-off as an expanding set. Theoretical results are compared with existing ones for the case of longitudinally magnetized fully and partially loaded waveguide with very good agreement. The resulting algorithm is compact and it requires extremely low computational effort for evaluating as many modal characteristics and vector fields as required.

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Envelope-finite element (EVFE) technique - 2-D guided wave examples

Yuanxun Wang and T. Itoh. "Envelope-finite element (EVFE) technique - 2-D guided wave examples." 2001 MTT-S International Microwave Symposium Digest 01.2 (2001 Vol. II [MWSYM]): 741-744 vol.2.

A novel full-wave technique, called EVFE method, is proposed to simulate the time-domain envelopes of electromagnetic waves. Based on finite element method (FEM) solutions, EVFE method introduces the circuit envelope simulation concept into electromagnetics the first time. Compared to traditional time-domain simulation techniques such as FDTD or FETD methods, only the signal envelope needs to be sampled in EVFE simulation. Therefore it can bring magnitudes of computation savings when it is applied to the cases where signal envelope/carrier ratios are very small. In this paper, 2-D microwave guided-wave examples are presented as proof of concepts.



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Evaluation and enhancement of supraconvergence effects on nonuniform and conformal FDTD meshes

M. Celuch-Marcysiak. "Evaluation and enhancement of supraconvergence effects on nonuniform and conformal FDTD meshes." 2001 MTT-S International Microwave Symposium Digest 01.2 (2001 Vol. II [MWSYM]): 745-748 vol.2.

Numerical errors arising on nonuniform FDTD meshes have been revealed and classified. Formulae for evaluating those errors have been analytically derived and verified in simulations. Simple recipes for suppressing the errors and enhancing their order of supraconvergence with refined discretisation have been proposed. Conformal modelling based on directional and linearised cell merging is introduced and recommended for practical microwave circuit simulations.

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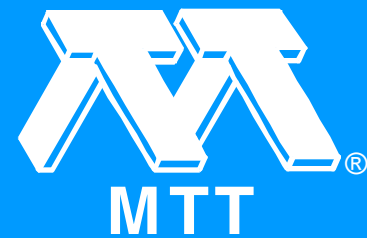
Fundamental gridding related dispersion effects in multiresolution time domain schemes (2001 Vol. II [MWSYM])

C.D. Sarris and L.P.B. Katehi. "Fundamental gridding related dispersion effects in multiresolution time domain schemes (2001 Vol. II [MWSYM])." 2001 MTT-S International Microwave Symposium Digest 01.2 (2001 Vol. II [MWSYM]): 749-752 vol.2.

The effect of electric and magnetic node arrangement on the dispersion characteristics of the multiresolution time domain technique is investigated in this paper. It is first noted that by multiresolution analysis principles, introducing one wavelet level refines the resolution of a numerical scheme based on scaling functions only, by a factor of two. However, the dispersion analysis of recently formulated MRTD schemes shows that this is not always the case. The apparent contradiction is resolved by indicating that MRTD does achieve its predicted dispersion performance under certain meshing conditions that are outlined here.

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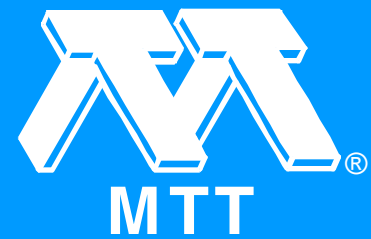
Development and application of an efficient FDTD/Haar MRTD numerical interface

C.D. Sarris and L.P.B. Katehi. "Development and application of an efficient FDTD/Haar MRTD numerical interface." 2001 MTT-S International Microwave Symposium Digest 01.2 (2001 Vol. II [MWSYM]): 753-756 vol.2.

A numerically stable interface between the Haar wavelet based MRTD technique and FDTD is presented in this paper. Such a hybridization of MRTD facilitates the application of the method to open structures and inhomogeneous circuit geometries, where the use of high order wavelets significantly complicates the formulation of a pure MRTD scheme. Furthermore, it allows for the straightforward enforcement of localized boundary conditions, bypassing the necessity to employ image theory, which typically arises in MRTD. The fact that the implementation of the proposed interface involves no spatial or temporal interpolation indicates the efficiency of the developed technique.

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A novel adaptivity for EM time domain methods: scale adaptive time steps (SATS)

A. Rennings, V. Toni, P. Waldow, Y. Qian, T. Itoh and I. Wolff. "A novel adaptivity for EM time domain methods: scale adaptive time steps (SATS)." 2001 MTT-S International Microwave Symposium Digest 01.2 (2001 Vol. II [MWSYM]): 757-760 vol.2.

We describe a space and time adaptive modified FDTD method based on wavelet transforms. The multiresolution structure of wavelet bases provides a simple way to adapt computational refinements to the local regularity of the electromagnetic field. Additionally a novel algorithm is presented that modifies the time discretization at each resolution.

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Transmission line noise from standard and proton-implanted Si

K.T. Chan, A. Chin, C.M. Kwei, D.T. Shien and J. Lin. "Transmission line noise from standard and proton-implanted Si." 2001 MTT-S International Microwave Symposium Digest 01.2 (2001 Vol. II [MWSYM]): 763-766 vol.2.

We have measured the NF/sub min/ of transmission lines on 10/sup 6/ ohm-cm proton implanted Si, Si-on-Quartz, and standard Si with top isolation oxide. Transmission lines on proton implanted Si shows the lowest NF/sub min/ of less than 0.2 dB because of the low substrate loss due to the high resistivity. The proton implantation did not contribute to excess shot noise induced by carrier trapping and de-trapping because of the very small diffusion length to metal line.

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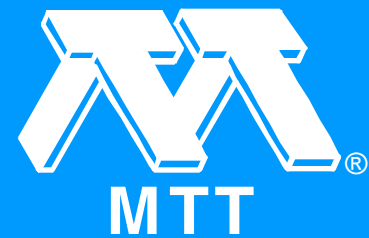
Dielectric properties of oxidized porous silicon in a low resistivity substrate

R.L. Peterson and R.F. Drayton. "Dielectric properties of oxidized porous silicon in a low resistivity substrate." 2001 MTT-S International Microwave Symposium Digest 01.2 (2001 Vol. II [MWSYM]): 767-770 vol.2.

Oxidized porous silicon (OPS) is characterized for its high frequency electrical properties up to 50 GHz. Transmission line properties are determined from measurement data and are compared with high and low resistivity silicon benchmark designs. Best OPS performance of 50 Ohm lines is observed on oxide-capped OPS, having attenuation of approximately 2.93 dB/cm at 4 GHz with an effective dielectric constant of 3.25. This technology offers promise for extending the use of CMOS circuitry to higher RF frequencies.

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A novel CPW structure for high-speed interconnects

S.-J. Yoon, S.-H. Jeong, J.-G. Yook, Y.-J. Kim, S.-G. Lee, O.-K. Seo, K.-S. Lim and D.-S. Kim.
"A novel CPW structure for high-speed interconnects." 2001 MTT-S International Microwave Symposium Digest 01.2 (2001 Vol. II [MWSYM]): 771-774 vol.2.

For high-speed digital circuits a novel elevated-CPW (ECPW) structure with low loss and low dispersion is proposed and the performances are compared with the theoretical prediction. The ECPW is designed with the aid of time domain fullwave FDTD technique and is fabricated using conventional thick-film MEMS processing. The proposed structure reveals at least 10 dB lower insertion loss compared to conventional CPW geometries and effective permittivity is 4 to 6 times smaller than that of conventional CPW. Characteristic impedances and effective permittivities are given for various geometrical parameters.

Click on title for a complete paper.



Small-size delay line based on a periodically loaded waveguide

J. Hesselbarth and R. Vahldieck. "Small-size delay line based on a periodically loaded waveguide." 2001 MTT-S International Microwave Symposium Digest 01.2 (2001 Vol. II [MWSYM]): 775-778 vol.2.

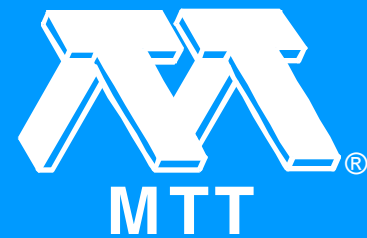
A delay line design is proposed which is based on a ceramic-strip loaded, slotted rectangular waveguide. The design combines very small size with moderate bandwidth (5%...10%) and low insertion loss (<0.50 dB/ns at 2 GHz). The delay line employs a periodic structure of coupled resonators and is rather insensitive to manufacturing insensitive to tolerances.

Frequency dependence of Bloch impedance in a periodic transmission line structure

E. Takagi. "Frequency dependence of Bloch impedance in a periodic transmission line structure." 2001 MTT-S International Microwave Symposium Digest 01.2 (2001 Vol. II [MWSYM]): 779-782 vol.2.

Frequency dependence of Bloch impedance in a periodic structure was calculated by using simple F-matrix formula. Also, relationship between band-gap on-set frequency and reactance factor was evaluated. Finally, formula was checked by the experiment.

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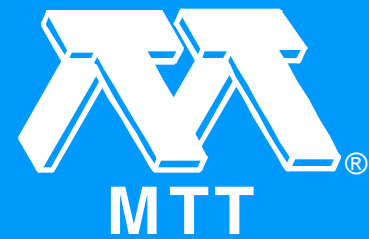
A photonic crystal joint (PCJ) for metal waveguides

J. Hesler. "A photonic crystal joint (PCJ) for metal waveguides." 2001 MTT-S International Microwave Symposium Digest 01.2 (2001 Vol. II [MWSYM]): 783-786 vol.2.

A novel method to eliminate currents in joints or interfaces in enclosed metal microwave structures is presented. By introducing a two-dimensional photonic crystal structure in the joint the conductor losses can be reduced to near that of a jointless structure. Experimental measurements at X-band of waveguide conductor loss using various joint geometries are presented, showing a drastic reduction in loss using the photonic crystal joint (PCJ). Various applications of the PCJ will be discussed, including H-plane waveguide joints, waveguide flanges and resonant cavities.

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Efficient baseband/RF feedforward linearizer through a mirror power amplifier using software-defined radio and quadrature digital up-conversion

E.G. Jeckeln, F.M. Ghannouchi, M. Sawan and F. Beaugerard. "Efficient baseband/RF feedforward linearizer through a mirror power amplifier using software-defined radio and quadrature digital up-conversion." 2001 MTT-S International Microwave Symposium Digest 01.2 (2001 Vol. II [MWSYM]): 789-792 vol.2.

This paper describes an efficient feedforward linearizer suitable for base station 3G power amplifiers based on and using both software-defined radio and quadrature digital up-conversion technologies. The linearizer accomplishes the extraction of the PA complex nonlinear behavior in real time and performs a numerical quasi-perfect carrier's cancellation that allows the reduction of the power rating of the error amplifier (EA) and eliminates the requirement for any output delay line. This enhances the overall power efficiency of the feedforward amplifier. The entire system is validated using DSP/RF co-simulation for the LDMOS model of a typical 44 dBm class AB power amplifier (PA/sub AB/) as the main amplifier.



Adaptive RF Cartesian predistorter based on the low frequency even order IM terms

Youngoo Yang, Young Yun Woo and Bumman Kim. "Adaptive RF Cartesian predistorter based on the low frequency even order IM terms." 2001 MTT-S International Microwave Symposium Digest 01.2 (2001 Vol. II [MWSYM]): 793-796 vol.2.

A new adaptive predistortion method for a high power class AB amplifier is presented. The 2nd order harmonic ($f_2 - f_1$) is generated in the properly filtered drain bias circuits of a small amplifier with proper drive level to have relatively high 2nd order and low 4th order IM components. The 4th order component ($2f_2 - 2f_1$) is generated by multiplying the 2nd order component. These low frequency even harmonics modulate the main signal in the I/Q channel form to generate the 3rd and 5th IM components. This PD is very compact and has low insertion loss and the capability to independently control the amplitudes and phases of the 3rd and 5th IM components, which are very important to achieve higher performance without having local minima in the adaptive control. A 2.15 GHz high power amplifier has been linearized for the 4.5 MHz broadband CDMA signal. The results prove that this adaptive predistorter could achieve a drastic improvement of ACP and has excellent adaptivity.



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A high efficiency feedforward amplifier with a series diode linearizer for cellular base stations

K. Horiguchi, M. Nakayama, Y. Sakai, K. Totani, H. Senda, Y. Ikeda and O. Ishida. "A high efficiency feedforward amplifier with a series diode linearizer for cellular base stations." 2001 MTT-S International Microwave Symposium Digest 01.2 (2001 Vol. II [MWSYM]): 797-800 vol.2.

A feedforward power amplifier (FFPA) with a series diode linearizer using a bias feed resistance is presented. To improve overall feedforward amplifier efficiency, a series diode linearizer is used to provide main amplifier linearization. FFPA efficiency optimization design considering FET efficiency and linearity trade-off has been demonstrated. The developed FFPA achieved the high efficiency of 10% and output power of 45.6 dBm at 10 MHz offset ACLR -50 dBc under W-CDMA 2 carriers signal.

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A gain/phase imbalance minimization technique for LINC transmitter

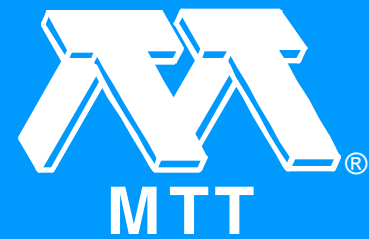
Xuejun Zhang, P. Nanawa, L.E. Larson and P.M. Asbeck. "A gain/phase imbalance minimization technique for LINC transmitter." 2001 MTT-S International Microwave Symposium Digest 01.2 (2001 Vol. II [MWSYM]): 801-804 vol.2.

A simple calibration scheme for correction of the path imbalance in a LINC transmitter has been demonstrated. In this algorithm a baseband DSP evaluates the gain and phase imbalance with a set of calibration signals through a feedback loop. Compensation of path imbalance is accomplished within the DSP by introducing a pre-distortion term. The quadrature errors of the I/Q modulators set a limit on the overall performance of this algorithm. A prototype LINC system has been tested for CDMA IS95 baseband input and -38 dBc ACI was achieved.

A novel DSP architecture of adaptive feedforward linearizer for RF amplifiers

Yuanxun Wang, J.D. Fredrick and T. Itoh. "A novel DSP architecture of adaptive feedforward linearizer for RF amplifiers." 2001 MTT-S International Microwave Symposium Digest 01.2 (2001 Vol. II [MWSYM]): 805-808 vol.2.

A novel adaptive design for feedforward amplifier linearizer with DSP control is proposed in this paper. Compared to existing adaptive architectures, this is a "blind" design which does not require pilot signal and intentional signal perturbation and phase calibration. A polar gradient adaptive algorithm is developed to support the hardware architecture, providing the unconditional convergence during the full working range of the phase control components. The stability criterion is analyzed. The linearizer performance for multi-tones and for a CDMA signal is simulated and demonstrated using EDA design tools.



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The novel programmable RF predistortion linearizer

Jia Sun and M.Y.W. Chia. "The novel programmable RF predistortion linearizer." 2001 MTT-S International Microwave Symposium Digest 01.2 (2001 Vol. II [MWSYM]): 809-812 vol.2.

A novel programmable RF predistortion linearizer is developed in this paper. The key concept of this novel circuit is the distortion compensation performance can be easily optimized at different input power and different operation frequency by controlling the BJT bias V_{b} and varactor voltage V_{vac} . There is a 9 dBc improvement in IM_3 and a 6 dBc improvement in ACPR in the prototype for the novel programmable RF predistortion linearizer for IS-95 application.

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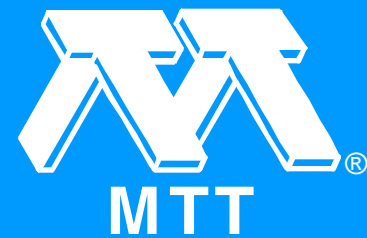


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A GaAs MESFET transient model capable of predicting trap-induced memory effects under complex digital modulation

F. Wang, W.D. Jemison and J.C.M. Hwang. "A GaAs MESFET transient model capable of predicting trap-induced memory effects under complex digital modulation." 2001 MTT-S International Microwave Symposium Digest 01.2 (2001 Vol. II [MWSYM]): 815-818 vol.2.

A transient model for GaAs MESFETs is presented that can predict distortion of digitally modulated carrier waveforms due to memory effects induced by both low-frequency dispersion and gate-lag. Experimental and simulated results are presented which demonstrate, for the first time, the successful prediction of these effects for multilevel pulse modulated waveforms.



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Intermodulation distortion simulation using physical GaAs FET model

W. Contrata, Y. Ando, Y. Hori and M. Kuzuhara. "Intermodulation distortion simulation using physical GaAs FET model." 2001 MTT-S International Microwave Symposium Digest 01.2 (2001 Vol. II [MWSYM]): 819-822 vol.2.

Intermodulation distortion is simulated using a physical GaAs FET model for the first time, to our knowledge. A GaAs FET power amplifier, including input and output circuits, is examined. For the FET, a fully 2-dimensional Monte Carlo simulator is used. The simulated P/sub IN/-P/sub OUT/ performance is in fair agreement with measured data. Gain and phase compression (AM-PM) characteristics are simulated, and correlated to features in the RF I-V characteristics. Finally, third order intermodulation distortion is estimated from the AM-PM characteristics and compared to measurement, with qualitative agreement. This technique advances the art of computer aided design of nonlinear devices because it allows the prediction of distortion characteristics before undertaking an expensive and time-consuming device fabrication.

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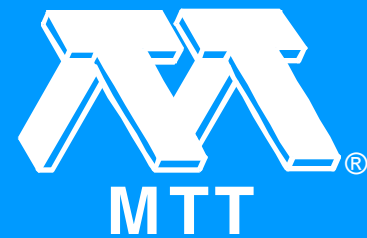
Full extraction of PHEMT state functions using time domain measurements

D.G. Morgan, G.D. Edwards, A. Phillips and P.J. Tasker. "Full extraction of PHEMT state functions using time domain measurements." 2001 MTT-S International Microwave Symposium Digest 01.2 (2001 Vol. II [MWSYM]): 823-826 vol.2.

The large signal state functions of the PHEMT, (Pseudomorphic High Electron Mobility Transistor) are fully extracted for the first time using dynamic measurements only. A novel reverse waveform measurement technique combined with forward waveform measurements yield the intrinsic current and charge surfaces, state functions. The new reverse extraction results have been verified to be bias and power level independent and the resultant state functions obtained are confirmed to be unique. The technique provides a direct high frequency curve-tracing tool, and allows for the generation of the parameter surfaces required for dynamic table-based models.

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Large-signal look-up table model for InP HEMTs including non-quasi-static and impact ionisation effects

D. Schreurs, A. Orzati, L. Pergola, H. Benedickter, O. Homan and W. Bachtold. "Large-signal look-up table model for InP HEMTs including non-quasi-static and impact ionisation effects." 2001 MTT-S International Microwave Symposium Digest 01.2 (2001 Vol. II [MWSYM]): 827-830 vol.2.

We developed an efficient method to determine a large-signal look-up table model for InP HEMTs. By performing the measurements on a logarithmic frequency scale, we have a high resolution at lower frequencies to accurately characterise impact ionisation, and sufficient data points at millimetre wave frequencies to extract the non-quasi-static parameters.

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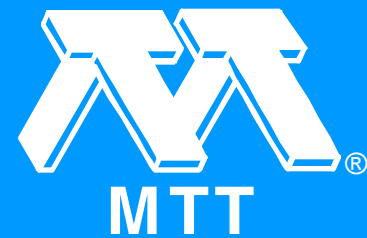
Nonlinear noise modeling of a PHEMT device through residual phase noise and low frequency noise measurements

O. Llopis, J.B. Juraver, B. Tamen, F. Danneville, M. Chaubet, A. Cappy and J. Graffeuil.
"Nonlinear noise modeling of a PHEMT device through residual phase noise and low frequency noise measurements." 2001 MTT-S International Microwave Symposium Digest 01.2 (2001 Vol. II [MWSYM]): 831-834 vol.2.

The phase noise generated by a FET device is investigated using transmission and reflection residual phase noise measurements. This approach helps in locating, in the intrinsic device, the low frequency noise sources which are responsible for these phase fluctuations. On the basis of these experiments, a new nonlinear noise model of the FET is proposed. This model is able to describe a phenomenon that has been observed, but never modeled in the past: the dependence of the baseband noise on the microwave input power.

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Intrinsic noise currents in deep submicron MOSFETs

Chih-Hung Chen, M.J. Deen, Yuhua Cheng and M. Matloubian. "Intrinsic noise currents in deep submicron MOSFETs." 2001 MTT-S International Microwave Symposium Digest 01.2 (2001 Vol. II [MWSYM]): 835-839 vol.2.

A systemic extraction method to obtain the induced gate noise ($i_{g/i}/i_{g/*}$), channel thermal noise ($i_{d/i}/i_{d/*}$) and their cross-correlation term ($i_{g/i}/i_{d/*}$) in submicron MOSFETs directly from scattering and RF noise measurements is presented and verified with measurements. The extracted noise currents versus frequency, bias condition and channel length for MOSFETs from a 0.18 μm CMOS process are presented and discussed.

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NIST: responding to basic needs, responding to special needs

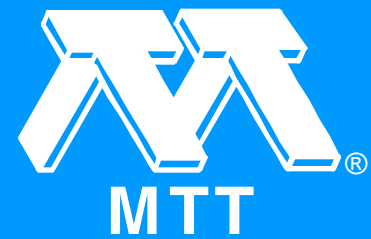
L. Greenhouse. "NIST: responding to basic needs, responding to special needs." 2001 MTT-S International Microwave Symposium Digest 01.2 (2001 Vol. II [MWSYM]): 841-844 vol.2.

The National Institute of Standards and Technology (NIST) was established by an Act of Congress in 1901 as the National Bureau of Standards (NBS). It was charged with serving the Nation's science and industry by establishing and maintaining the fundamental standards of science and related instrumentation and measurement methods and by providing calibration services and determinations of the properties and physical constants of materials. Work done by NBS in radio, aircraft, optical glass manufacture, and to facilitate industrial standardization established a pattern for NBS/NIST of mobilizing its scientific talent in response to national needs in times of crisis or challenge.

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Radio-frequency metrology from NBS to NIST: the legacy

D.S. Friday. "Radio-frequency metrology from NBS to NIST: the legacy." 2001 MTT-S International Microwave Symposium Digest 01.2 (2001 Vol. II [MWSYM]): 845-848 vol.2.

Reviews a century of radio metrology research and development in the US that paralleled the birth and evolution of radio/wireless and other electromagnetic technologies. The interplay between the scientific and technological advances and the research, measurement and standards development programs at the National Institute of Standards and Technology (formerly the National Bureau of Standards (NBS)) was a factor that facilitated both commercialization of products and implementation of systems for the public benefit.

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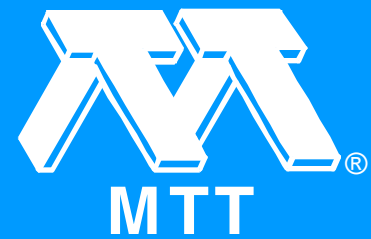
Primary frequency standards at NIST

D.B. Sullivan. "Primary frequency standards at NIST." 2001 MTT-S International Microwave Symposium Digest 01.2 (2001 Vol. II [MWSYM]): 849-852 vol.2.

The development of primary frequency standards at the National Institute of Standards Technology (NIST) is traced, and generations of atomic frequency standards described: cesium-beam standards, cesium-fountain standards, and stored-ion standards. The uncertainty of the present NIST frequency standard is 1.7 parts in 10^{15} , but the prospects for substantial improvement are high. Finally, the uncertainties of the most recent NIST standards are displayed relative to the uncertainties of standards of several other countries.

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Broadband Josephson voltage standards

C.A. Hamilton and S.P. Benz. "Broadband Josephson voltage standards." 2001 MTT-S International Microwave Symposium Digest 01.2 (2001 Vol. II [MWSYM]): 853-856 vol.2.

A Josephson junction is a perfect frequency-to-voltage converter, that is, $V=f/K_{\text{J-90}}$ where $K_{\text{J-90}}=483597.9 \text{ GHz/V}$. This unique property has been used to convert a narrow band (1 Hz) 75 GHz reference frequency to a DC voltage standard. Josephson standards use arrays of thousands of junctions to raise the voltage to 10 V. More recently, the broadband capability of Josephson devices is being exploited at NIST to create a new AC voltage standard. In this case, the Josephson junction is a pulse generator that can be triggered at frequencies from DC to 20 GHz, and that produces short ($\sim 50 \text{ ps}$) voltage pulses with a time integral of exactly $1/K_{\text{J-90}}$. A delta-sigma algorithm with a high oversampling ratio is used to define a digital pulse sequence for any desired output waveform. The sequence is programmed into a digital code generator that triggers the Josephson device. The result is a replication of the desired waveform with a time-dependent amplitude that is exactly calculable from a knowledge of the pulse code, the sampling frequency, and the number of Josephson junctions in the array.

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The electronic kilogram

M.H. Kelley. "The electronic kilogram." 2001 MTT-S International Microwave Symposium Digest 01.2 (2001 Vol. II [MWSYM]): 857-860 vol.2.

The kilogram is the only remaining base unit in the International System of Units (SI) whose definition is based on a single physical artifact rather than on fundamental properties of nature. Effects such as environmental contamination or material loss from surface cleaning are causing the "true" mass of the International Prototype Kilogram to drift (by about 0.5 μ g per year), relative to sister prototypes. The equivalence of electrical and mechanical power provides a possible alternate measurement of mass in terms of other units that are based on fundamental quantum mechanical principles, such as the speed of light, the Josephson voltage, and the quantum Hall resistance. This provides a possible time-invariant definition of mass.

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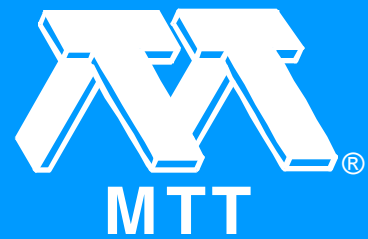


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Behavioral feature of fast-wave modes on printed-circuit transmission lines of open and packaged types

M. Tsuji and H. Shigesawa. "Behavioral feature of fast-wave modes on printed-circuit transmission lines of open and packaged types." 2001 MTT-S International Microwave Symposium Digest 01.2 (2001 Vol. II [MWSYM]): 863-866 vol.2.

Dispersion characteristics of fast-wave modes are deeply investigated for both open and packaged printed circuit transmission lines. The numerical results conclude that in the packaged guide, the fast-wave mode is mutually connected to the bound mode in the wavenumber behavior, while that for the open guide is completely separated from the bound mode.



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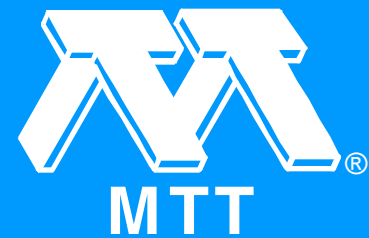
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Structural conditions for offering high-performance printed-circuit devices in millimeter-wave range

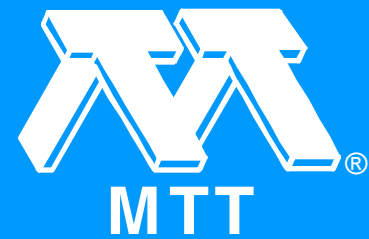
H. Shigesawa and M. Tsuji. "Structural conditions for offering high-performance printed-circuit devices in millimeter-wave range." 2001 MTT-S International Microwave Symposium Digest 01.2 (2001 Vol. II [MWSYM]): 867-870 vol.2.

The power leakage effect on printed-circuit transmission lines often produces serious performance difficulties in millimeter-wave integrated circuits. One of difficulties is that the critical frequency only for the fundamental bound mode propagation becomes lower in millimeter-wave range. Such a critical frequency for single-mode operation changes significantly depending on the structural dimensions of a line cross section. In this paper, therefore, we discuss for the first time this important issue systematically and deeply for transmission lines frequently used, and present several useful results that offer us the preferable structural dimensions of a transmission line suitable for developing high-performance millimeter-wave devices.

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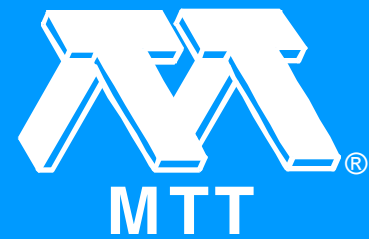
High frequency leaky-mode excitation on microstrip line

F. Mesa, D.R. Jackson and M. Freire. "High frequency leaky-mode excitation on microstrip line." 2001 MTT-S International Microwave Symposium Digest 01.2 (2001 Vol. II [MWSYM]): 871-874 vol.2.

The excitation of leaky modes and the continuous spectrum on microstrip line at high frequencies is studied. It is shown that the current excited from a practical source or discontinuity exhibits spurious effects at high frequencies due to the excitation of the continuous spectrum (radiation spectrum), which may or may not be dominated by a leaky mode, depending on the frequency range and the substrate permittivity. In some cases the spurious effects are due to a leaky mode, while in other cases the effects are due to the excitation of one or more "residual-wave" currents, which have not been previously studied for open microstrip line.

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Spurious radiation from a practical source on a leaky covered microstrip line

W.L. Langston, J.T. Williams, D.R. Jackson and F. Mesa. "Spurious radiation from a practical source on a leaky covered microstrip line." 2001 MTT-S International Microwave Symposium Digest 01.2 (2001 Vol. II [MWSYM]): 875-878 vol.2.

The radiated fields from the currents induced on a covered microstrip transmission line by a finite-gap voltage source are presented. The behavior of the bound-mode and continuous-spectrum fields is studied. It is determined that leaky-mode fields can contribute to cross-talk and other interference effects near the source and within an angular leakage region, while bound-mode radiation fields are the predominant mechanism for these effects further away from the gap source outside the leakage region.

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Proper definition of voltage for a leaky two-layer stripline consistent with its characteristic impedance

N.K. Das. "Proper definition of voltage for a leaky two-layer stripline consistent with its characteristic impedance." 2001 MTT-S International Microwave Symposium Digest 01.2 (2001 Vol. II [MWSYM]): 879-882 vol.2.

Under suitable conditions, a non-uniform stripline having two different dielectric substrates on the two sides of its center conductor (referred to as a two-layer stripline), leaks power to its surrounding parallel-plate medium. The transverse fields of such a leaky line becomes strongly non-TEM in nature, with a non-conventional field behavior. This situation makes it impossible or ambiguous to define some of the basic, useful transmission-line parameters, such as voltage, transverse propagation power or a characteristic impedance. In this paper we investigate a suitable definition of the voltage of a two-layer leaky line, using which the characteristic impedance can be correctly computed. The practical validity of the definition, and its basic consistency with independent results are evaluated.

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A generalized approach to wide-band S-parameter extraction from FD-TD simulations applicable to evanescent modes in inhomogeneous guides

W.K. Gwarek and M. Celuch-Marcysiak. "A generalized approach to wide-band S-parameter extraction from FD-TD simulations applicable to evanescent modes in inhomogeneous guides." 2001 MTT-S International Microwave Symposium Digest 01.2 (2001 Vol. II [MWSYM]): 885-888 vol.2.

In this paper we introduce a new method of S-parameter extraction from time domain electromagnetic simulations. The method can be effectively applied to wideband analyses in a multi-mode environment including evanescent modes. We show that the new method must be based on a proper choice of the definition of the S-matrix, and we discuss somewhat unusual properties of such matrices for evanescent modes.



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Modified Yee's cell for finite-difference time-domain modeling of periodic boundary guiding structure

Heeseok Lee and Joung-ho Kim. "Modified Yee's cell for finite-difference time-domain modeling of periodic boundary guiding structure." 2001 MTT-S International Microwave Symposium Digest 01.2 (2001 Vol. II [MWSYM]): 889-892 vol.2.

A modified Yee's cell is proposed for the finite-difference time-domain (FDTD) modeling of a waveguide structure with the longitudinally periodic boundary condition. For the presented FDTD scheme based on Floquet's theorem, an arrow representing a complex field component in the original Yee's cell is divided into two real- and imaginary-arrows separated by a half of the longitudinal spatial-increment, $\Delta z/2$. By the proposed mesh scheme and the periodicity of the computational domain, the handling of the complex field function and the periodic boundary condition is streamlined, resulting in the reduction of the computation time and memory. To verify the proposed scheme, the dispersion diagram of a corrugated parallel-plate waveguide is obtained and compared with the transmission line analysis. Also, the numerical stability condition and the numerical dispersion relation are given.





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A new multiresolution near-field to near-field transform suitable for multi-region FDTD schemes

A. Laisne, R. Gillard and G. Piton. "A new multiresolution near-field to near-field transform suitable for multi-region FDTD schemes." 2001 MTT-S International Microwave Symposium Digest 01.2 (2001 Vol. II [MWSYM]): 893-896 vol.2.

In this paper, new Discrete Wavelet Transform (DWT)-based compression techniques are applied to the computation of the near-field to near-field transform in a Multi-Region FDTD (MR/FDTD) scheme. The compression is applied to both radiating fields on the source surface and incident fields on the excitation surface, which significantly decreases the computation cost of the interactions between the volumes.

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A global modeling approach using interpolating wavelets

S. Goasguen, M.M. Tomeh and S.M. El-Ghazaly. "A global modeling approach using interpolating wavelets." 2001 MTT-S International Microwave Symposium Digest 01.2 (2001 Vol. II [MWSYM]): 897-900 vol.2.

A MESFET and a two-dimensional cavity enclosing a cylinder are simulated using a nonuniform mesh generated by an interpolating wavelet scheme. A self-adaptive mesh is implemented and controlled by the wavelet coefficient threshold. A fine mesh can therefore be used in domains where the unknown quantities are varying rapidly and a coarse mesh can be used where the unknowns are varying slowly. It is shown that good accuracy can be achieved while compressing the number of unknowns by 50 to 80% during the whole simulation. This represents the on going effort toward a numerical technique that uses wavelets to solve both Maxwell's equations and the semiconductor equations. Such a method is of great interest to deal with the multi-scale problem that is the full wave simulation of active microwave circuits.

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Performance of three-dimensional graded ADI-FDTD algorithm

E. Hu and W.J.R. Hoefer. "Performance of three-dimensional graded ADI-FDTD algorithm." 2001 MTT-S International Microwave Symposium Digest 01.2 (2001 Vol. II [MWSYM]): 901-904 vol.2.

In this paper, a 3D unconditionally stable ADI-FDTD algorithm without the CFL stability constraint is described. We have investigated the computational accuracy and the CPU time of this method and compared it with conventional FDTD for both uniform and graded meshes. Since the ADI-FDTD algorithm is unconditionally stable, the selection of the time step is not restricted by stability considerations, but the relative error of the ADI-FDTD algorithm increases with increasing time step. The numerical results show that the saving in CPU time of the ADI-FDTD is not dramatic in comparison with the conventional FDTD algorithm when the mesh size and computational accuracy of both methods are the same. The reduction in the number of time steps and hence, CPU time, is offset by reduced accuracy. Therefore, the choice of the ADI-FDTD method is governed by the acceptable error.

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Reconstruction of microwave structures using two-dimensional inverse TLM (Transmission Line Matrix) method

W.A. de Souza and R.A.X. de Menezes. "Reconstruction of microwave structures using two-dimensional inverse TLM (Transmission Line Matrix) method." 2001 MTT-S International Microwave Symposium Digest 01.2 (2001 Vol. II [MWSYM]): 905-908 vol.2.

This work proposes a new reconstruction procedure of two-dimensional microwave structures based on the inversion of the two-dimensional TLM (Transmission Line Matrix) method. The technique is based on the solution of the inverse scattering problem using a TLM based algorithm. The procedure consists of determining the geometry of the obstacle that generates the desired scattered field. In the case of TLM this field is the time-domain input reflection coefficient at all input terminals and the geometry is the impedance at all nodes of the TLM mesh. The procedure can be used to reconstruct objects with arbitrary characteristics in small TLM meshes.

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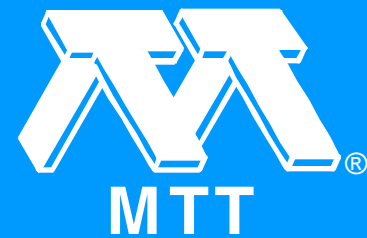


Abstracts

A 1 W CMOS power amplifier for GSM-1800 with 55% PAE

C. Fallesen and P. Asbeck. "A 1 W CMOS power amplifier for GSM-1800 with 55% PAE." 2001 MTT-S International Microwave Symposium Digest 01.2 (2001 Vol. II [MWSYM]): 911-914 vol.2.

Until recently it was the common opinion that CMOS RF power amplifiers were not feasible for mobile handsets. This paper presents a CMOS power amplifier for the GSM-1800 standard, with only two external matching components and a few decoupling capacitors. The performance of the power amplifier is better than any other CMOS power amplifier reported and comparable to commercially available power amplifiers in other technologies.



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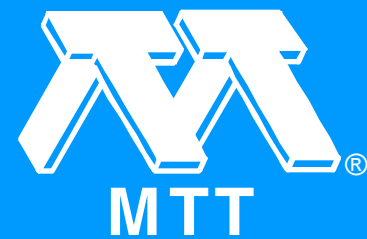
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A high efficiency 0.25 /spl mu/m CMOS PA with LTCC multi-layer high-Q integrated passives for 2.4 GHz ISM band

D. Heo, A. Sutono, E. Chen, E. Gebara, S. Yoo, Y. Suh, J. Laskar, E. Dalton and E.M. Tentzeris. "A high efficiency 0.25 /spl mu/m CMOS PA with LTCC multi-layer high-Q integrated passives for 2.4 GHz ISM band." 2001 MTT-S International Microwave Symposium Digest 01.2 (2001 Vol. II [MWSYM]): 915-918 vol.2.

We present the first high efficiency CMOS power amplifier utilizing fully integrated multi-layer Low Temperature Co-fired Ceramic (LTCC) high-Q passives for 2.4 GHz ISM band applications. The inductor and capacitor library was built in a multi-layer LTCC board using a compact topology. An inductor Q-factor as high as 110 with a self-resonant-frequency (SRF) as high as 12 GHz was demonstrated. Measured results of the CMOS-LTCC PA show 45% power added efficiency, 23 dBm output power and 18 dB gain at 2.4 GHz with a low 2.5 V drain supply voltage. This result is the first significant step toward a compact transceiver module development utilizing fully integrated multi-layer LTCC high-Q passives and a deep submicron (0.25 /spl mu/m) CMOS technology.

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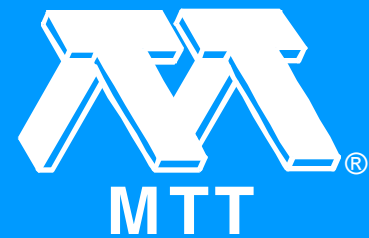


Variable gain power amplifier for mobile WCDMA applications (2001 Vol. II [MWSYM])

V. Vintola, M. Matilainen, S. Kalajo and E. Jarvinen. "Variable gain power amplifier for mobile WCDMA applications (2001 Vol. II [MWSYM])." 2001 MTT-S International Microwave Symposium Digest 01.2 (2001 Vol. II [MWSYM]): 919-922 vol.2.

A single chip linear power amplifier (PA) with >48 dB gain control range and >24 dBm output power with adjacent channel leakage power (ACP) figures below -36 dBc is presented. The chip is realized using an AlGaAs-GaAs HBT process and is aimed at 1.95 GHz mobile WCDMA applications. The amplifier consists of two blocks, the variable gain amplifier and the power amplifier; The chip size is 1.3/spl times/1.1 mm/sup 2/ and it is mounted on a 8/spl times/8 mm FR-4 type laminate with 26 pieces of 0402 SMD components composing a complete 50 /spl Omega/ input-output amplifier module. This paper presents the design of the two blocks, discusses issues related to the combining and finally presents the complete amplifier realization and measurement results.

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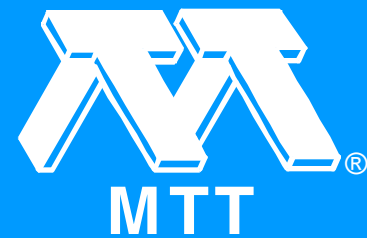
A single supply high performance PA MMIC for GSM handsets using quasi-enhancement mode PHEMT

W. Abey, T. Moriuchi, R. Hajji, T. Nakamura, Y. Nonaka, E. Mitani, W. Kennan and H. Dang. "A single supply high performance PA MMIC for GSM handsets using quasi-enhancement mode PHEMT." 2001 MTT-S International Microwave Symposium Digest 01.2 (2001 Vol. II [MWSYM]): 923-926 vol.2.

A 3-stage GaAs FET power amplifier MMIC utilizing a quasi-enhancement mode PHEMT process has been developed for single supply GSM applications. The MMIC operates from a 3.2 V power supply and at 900 MHz, provides 35.5 dBm output power and 63.0% power added efficiency. Another 3 stage MMIC designed for DCS-1800, which at 1750 MHz provides 33.2 dBm output power with 61.1% PAE, is also presented.

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E-PHEMT, single supply, high efficient power amplifiers for GSM and DCS applications

Shuyun Zhang, Jiang Cao and R. Mcmorrow. "E-PHEMT, single supply, high efficient power amplifiers for GSM and DCS applications." 2001 MTT-S International Microwave Symposium Digest 01.2 (2001 Vol. II [MWSYM]): 927-930 vol.2.

This paper presents power amplifier MMICs for GSM and DCS applications using a newly developed 0.5 μm enhancement mode power PHEMT process. An Automatic Bias Control (ABC) circuit is implemented on-chip to achieve high PAE. A Voltage Variable Attenuator (VVA) is also designed and fabricated on-chip to adjust the input power level and the overall gain. Under a low single supply voltage of 3.2 V the GSM PA provides 35 dBm output power with 55% PAE, and the DCS PA delivers 33 dBm with 40% PAE. Both chips are housed in 20-pin 4 mm/spl times/4 mm Miniature Leadless Packages (MLP).

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An extended Doherty amplifier with high efficiency over a wide power range (2001 Vol. II [MWSYM])

M. Iwamoto, A. Williams, Pin-Fan Chen, A. Metzger, Chengzhou Wang, L.E. Larson and P.M. Asbeck. "An extended Doherty amplifier with high efficiency over a wide power range (2001 Vol. II [MWSYM])." 2001 MTT-S International Microwave Symposium Digest 01.2 (2001 Vol. II [MWSYM]): 931-934 vol.2.

An extension of the Doherty amplifier architecture which maintains high efficiency over a wide range of output power (>6 dB) is presented. This extended Doherty amplifier is demonstrated experimentally with InGaP-GaAs HBTs at a frequency of 950 MHz. $P_{\text{sub 1 dB}}$ is measured at 27.5 dBm with PAE of 46%. PAE of at least 39% is maintained for over an output power range of 12 dB backed-off from $P_{\text{sub 1 dB}}$. This is an improvement over the classical Doherty amplifier, where high efficiency is typically obtained up to 5-6 dB backed-off from $P_{\text{sub 1 dB}}$. Generalized design equations for the Doherty amplifier are derived to show a careful choice of the output matching circuit and device scaling parameters can improve efficiencies at lower output power.

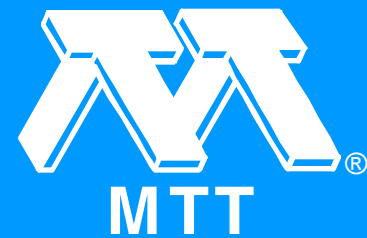
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Analysis and experimental study of an L-band new topology Doherty amplifier

S. Bousnina and F.M. Ghannouchi. "Analysis and experimental study of an L-band new topology Doherty amplifier." 2001 MTT-S International Microwave Symposium Digest 01.2 (2001 Vol. II [MWSYM]): 935-938 vol.2.

This paper describes the first design of an L-band unbalanced-topology Doherty amplifier fabricated with FET devices. In the proposed topology and unlike the standard one, the carrier amplifier operates (at low input drive levels) into a load impedance three times larger than its optimum. Thus, theoretically the Doherty amplifier achieves 78.5% of efficiency at 7.24 dB back-off. At 11 dB back-off from the maximum output power of 26.7 dBm, the measured Doherty amplifier power added efficiency achieves 35.2% at 1.9 GHz that is 18.5% higher than that of a class-B amplifier. Optimum values of Doherty amplifier load and quarter-wave transformer characteristic-impedance were determined. The theory and design of this amplifier with its new topology are discussed.



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Current mode class-D power amplifiers for high efficiency RF applications (2001 Vol. II [MWSYM])

H. Kobayashi, J. Hinrichs and P.M. Asbeck. "Current mode class-D power amplifiers for high efficiency RF applications (2001 Vol. II [MWSYM])." 2001 MTT-S International Microwave Symposium Digest 01.2 (2001 Vol. II [MWSYM]): 939-942 vol.2.

We show that current mode class-D (CMCD) power amplifiers can achieve high efficiency at RF frequencies. In contrast with conventional voltage-mode class D amplifiers, the CMCD features "zero voltage switching" which eliminates the output capacitance discharge loss. Experimental CMCD amplifiers with 76.3% PAE at 290 mW output and 71.3% PAE at 870 mW output are demonstrated, using GaAs FETs at 900 MHz.

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A compact LTCC Ku-band transmitter module with integrated filter for satellite communication applications

C.-H. Lee, A. Sutono, S. Han and J. Laskar. "A compact LTCC Ku-band transmitter module with integrated filter for satellite communication applications." 2001 MTT-S International Microwave Symposium Digest 01.2 (2001 Vol. II [MWSYM]): 945-948 vol.2.

We present the first demonstration of an ultra compact low temperature co-fired ceramic (LTCC) based transmitter module using commercial GaAs MESFET MMICs for Ku-band satellite communication applications. The upconverter MMIC integrated with a VCO exhibits a measured up-conversion gain of 9 dB and an IIP3 of 17 dBm, while the power amplifier (PA) MMIC shows a measured total gain of 31 dB and a 1 dB compression output power of 26.5 dBm at 14 GHz. Both MMICs were integrated on a compact LTCC module where an integrated front-end band pass filter (BPF) with a measured insertion loss of 1.8 dB at 14.5 GHz was integrated. This transmitter module has a compact size of 400/spl times/310/spl times/35.2 mil/sup 3/.

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A microwave frequency generation unit for space applications

L. Dayaratna, L.G. Ramos and M. Hirokawa. "A microwave frequency generation unit for space applications." 2001 MTT-S International Microwave Symposium Digest 01.2 (2001 Vol. II [MWSYM]): 949-952 vol.2.

Spacecraft systems designed to provide communications require the necessity to generate multiple, redundant local oscillator frequencies for various up/down converters in the payload. The design requirements are low noise, low power, small size and mass. They are also required to be SEU hard and total dose tolerant and reliable. The reliability is increased by having a design with built in redundancy. The FGU is powered from the spacecraft bus with dedicated EPCs, which are redundant. The FGU is phase locked to a stable reference, which is also redundant. Several test points in the form of telemetry are provided for checking unit functionality and operational characteristics.



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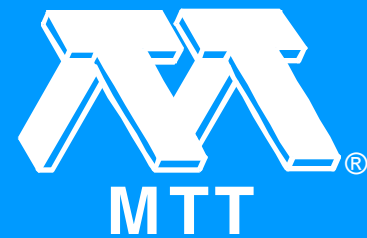
Low cost Ka band transmitter modules for LMDS equipment mass production

G. Torregrosa-Penalva, A. Asensio-Lopez, F.J. Ortega-Gonzalez and J. Lluch-Ladron-de-Guevara. "Low cost Ka band transmitter modules for LMDS equipment mass production." 2001 MTT-S International Microwave Symposium Digest 01.2 (2001 Vol. II [MWSYM]): 953-956 vol.2.

Two different Ka band medium power transmitters for LMDS (Local Multipoint Distribution System) applications have been designed proving successful performance while introducing low cost components and simple mounting techniques for industrial purposes. Commercially available BGA and LM packaged components are attached with epoxy dispensing procedures to a 0.254 mm height cost effective plastic substrate. The output power stages are die form MMIC amplifiers which are first mounted on separate carriers. A novel epoxy-on-bonding die attaching technique is used in order to prevent undesired bonding to plastic quality and performance. New active biasing networks are employed so that no later adjustment is necessary to control the overall transmitter behaviour. Active biasing also allows higher PAE than usual resistor dividers for gate biasing while preserving linearity and P1 dB output power. The transmitter modules work at 31.15 GHz and 25.7 GHz respectively. The measured P1 dB was 26.5 dBm and PAE at P1 dB was 16%.

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A complete integrated TX/RX front-end combining 3D topologies and global synthesis

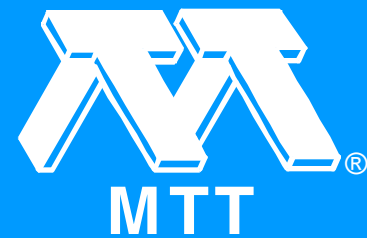
T. Le Nadan, C. Person and J.P. Coupez. "A complete integrated TX/RX front-end combining 3D topologies and global synthesis." 2001 MTT-S International Microwave Symposium Digest 01.2 (2001 Vol. II [MWSYM]): 957-960 vol.2.

We propose an original procedure for integrating a RX/TX front-end. A dual operating mode function (mixer/modulator), based upon a CPW magic-Te, is developed. A global synthesis technique is then considered in combination with 3D integration techniques for achieving bandwidth requirements and design flexibility. The complete RX/TX module is presented.

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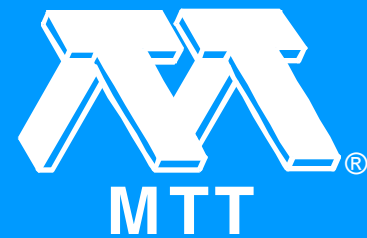
Design and characterization of a low cost ISM-band sub carrier multiplexed broadband digital microwave radio link

N. Toledo, C.G. Santos, A. Manlapat, B. Galang, Jr., A.A. Chio, I. Wong, R. Guevarra, D.J. Sabido and IX. "Design and characterization of a low cost ISM-band sub carrier multiplexed broadband digital microwave radio link." 2001 MTT-S International Microwave Symposium Digest 01.2 (2001 Vol. II [MWSYM]): 961-964 vol.2.

This paper describes the design, construction and characterization of a subcarrier multiplexed broadband digital microwave radio link with Viterbi error control coding. The design and construction of the RF and microwave devices are described and analyzed. A key point of the research is that low cost materials could be used to implement a broadband wireless link. The effect of error control coding on the system is analyzed and bit error rate measurements were performed. Adjacent channel interference (ACI) measurements were also performed to assess the performance of the link in the presence of an adjacent carrier.

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RF LDMOS characterization and its compact modeling

Jaejune Jang, O. Tornblad, T. Arnborg, Qiang Chen, K. Banerjee, Zhiping Yu and R.W. Dutton. "RF LDMOS characterization and its compact modeling." 2001 MTT-S International Microwave Symposium Digest 01.2 (2001 Vol. II [MWSYM]): 967-970 vol.2.

This paper presents characterization of power LDMOS using device simulation and analytical modeling. Features of the LDMOS such as graded channel and quasi-saturation effect which result in a peculiar behavior on capacitance and nonlinear LDD resistance are analyzed and modeled using device simulation. A compact model for LDMOS is implemented in HSPICE based on additional lumped elements, combined with the BSIM3 MOSFET model.

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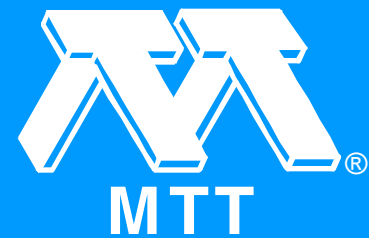
Direct extraction and modeling method for temperature dependent large signal CAD model of Si-BJT

Y. Suh, D. Heo, A. Raghavan, E. Gebara, S. Nuttnick, K. Lim and J. Laskar. "Direct extraction and modeling method for temperature dependent large signal CAD model of Si-BJT." 2001 MTT-S International Microwave Symposium Digest 01.2 (2001 Vol. II [MWSYM]): 971-974 vol.2.

A new Si-BJT CAD model and the corresponding direct extraction method are presented. An exact analytical expression for the total distributed base resistance is developed. Several exact analytical solutions for the thermal resistance and the current source models are derived. The model based on the new analytical expressions can predict the measured data minimizing the least square errors between measured and modeled data. This current source modeling method requires no optimization or trimming process. The parameters are extracted self consistently to minimize the error in modeling. We applied this method to a 5 finger 0.4/spl times/20 /spl mu/m/sup 2/ Si-BJT and verified the model over the temperature range 273-333/spl deg/K and up to 15 GHz. The model shows good correlation with the measured data.

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An accurate large-signal model for a high-efficient Si bipolar GSM power transistor

R.M. Heeres, H.A. Visser and M.P.J.G. Versleijen. "An accurate large-signal model for a high-efficient Si bipolar GSM power transistor." 2001 MTT-S International Microwave Symposium Digest 01.2 (2001 Vol. II [MWSYM]): 975-978 vol.2.

We present an accurate large-signal modelling approach for Si bipolar RF power transistors. An equivalent circuit model of a state of the art GSM power transistor (900 MHz, 3.5 V, 4 W, 70%) is constructed. The model is verified with accurate load pull measurements. Large-signal parameters (P_{out} , G_T , PAE) are predicted accurately.

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Analysis of low frequency memory and influence on solid state HPA intermodulation characteristics

N. Le Gallou, J.M. Nebus, E. Ngoya and H. Buret. "Analysis of low frequency memory and influence on solid state HPA intermodulation characteristics." 2001 MTT-S International Microwave Symposium Digest 01.2 (2001 Vol. II [MWSYM]): 979-982 vol.2.

A theoretical analysis using two-tone simulations and practical measurements of low frequency memory impact on third order intermodulation (IM3) on HBT as well as HFET power amplifiers is carried out. A particular emphasis is placed on the thermal origin for the HBT case and electrical origin for the HFET case of these low frequency nonlinear phenomena.

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An improved behavioral modeling technique for high power amplifiers with memory

N. Le Gallou, E. Ngoya, H. Buret, D. Barataud and J.M. Nebus. "An improved behavioral modeling technique for high power amplifiers with memory." 2001 MTT-S International Microwave Symposium Digest 01.2 (2001 Vol. II [MWSYM]): 983-986 vol.2.

The introduction of frequency dependence in system level nonlinear behavioral models is of prime importance as wideband signals are going to be massively used with nonlinear SSPA. This paper describes an improved technique to model envelope memory effects for amplifiers exhibiting both high and low frequency memory.



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Broadband access networks: evolution and convergence implications for equipment providers

T.J. Brophy. "Broadband access networks: evolution and convergence implications for equipment providers." 2001 MTT-S International Microwave Symposium Digest 01.2 (2001 Vol. II [MWSYM]): 989-992 vol.2.

In this paper, the broadband access market is reviewed from the point of view of an equipment provider traditionally operating in the CATV marketplace. The network providers in this market include the range of Multiple System Operators (MSO) of the CATV distribution networks, the Broadband Service Providers who are currently overbuilding in many markets, and the traditional telephone company providers (ILEC) and their competitors (CLEC). An overview of the segments and the pressures which are driving common infrastructure solutions are considered. The several architectures employed will be required to work together for the delivery of essentially common information types. Consideration will be given to the end-customer desired information stream, the competitors and their goals to be achieved, some critical issues which will drive choices among the solutions, and ultimately the technological underpinnings of an eventual solution. Overlap examples of Metro Access, Hybrid-Fiber-Coax, and traditional telephony solutions will be given. The push to get the fiber closer to the home is leading to definition of enabling technologies, and the definition and limitations of some of these will be identified. The coaxial portion of the network will change, and some consideration for what these changes will mean will be considered.

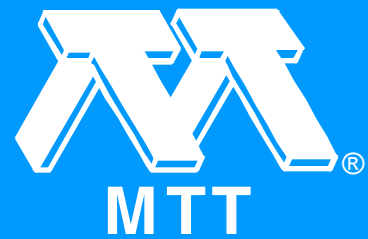


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Wireless aspects of broadband access

K. Warble, J. Locke and B. Bishop. "Wireless aspects of broadband access." 2001 MTT-S International Microwave Symposium Digest 01.2 (2001 Vol. II [MWSYM]): 993-996 vol.2.

Access to data is no longer a luxury. The demand for access to large volumes of data is driving industry to find ways to assure real-time, high quality delivery at affordable cost. In this paper we examine some of the aspects of wireless broadband data access.



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A combined optical-wireless broadband Internet access: transmission challenges

T. Marozsak, E. Udvary and T. Berceli. "A combined optical-wireless broadband Internet access: transmission challenges." 2001 MTT-S International Microwave Symposium Digest 01.2 (2001 Vol. II [MWSYM]): 997-1000 vol.2.

The demand for high bit rate Internet access with portable computers is rapidly growing and needs an easily configurable, fast local area network in a combined system optical transmission can provide high bit rate and radio connection to the personal computers ensures the flexibility and comfort in establishing network connection. In this paper the transmission challenges of both the wireless and optical sections are investigated based partly on the results obtained in the FRANS project of the European Union.

In-band optical crosstalk in fiber-radio WDM networks

D. Castleford, A. Nirmalathas, D. Novak and R. Tucker. "In-band optical crosstalk in fiber-radio WDM networks." 2001 MTT-S International Microwave Symposium Digest 01.2 (2001 Vol. II [MWSYM]): 1001-1004 vol.2.

We present the first experimental investigation of the impact of in-band optical crosstalk in fiber-radio networks incorporating wavelength division multiplexing. We show that crosstalk-induced power penalties are reduced when the crosstalk signal carries a different wireless frequency band, however, penalties are still observed even for perfect RF filtering of the crosstalk signal.



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Neural inverse space mapping EM-optimization

J.W. Bandler, M.A. Ismail, J.E. Rayas-Sanchez and Q.J. Zhang. "Neural inverse space mapping EM-optimization." 2001 MTT-S International Microwave Symposium Digest 01.2 (2001 Vol. II [MWSYM]): 1007-1010 vol.2.

For the first time, we present Neural Inverse Space Mapping (NISM) optimization for EM-based design of microwave structures. The inverse of the mapping from the fine to the coarse model parameter spaces is exploited for the first time in a Space Mapping algorithm. NISM optimization does not require: up-front EM simulations, multipoint parameter extraction or frequency mapping. The inverse of the mapping is approximated by a neural network whose generalization performance is controlled through a network growing strategy. We contrast our new algorithm with Neural Space Mapping (NSM) optimization.

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An approach for knowledge-aided-design (KAD) of microwave circuits using artificial neural networks

R. Zingg and K.C. Gupta. "An approach for knowledge-aided-design (KAD) of microwave circuits using artificial neural networks." 2001 MTT-S International Microwave Symposium Digest 01.2 (2001 Vol. II [MWSYM]): 1011-1014 vol.2.

This paper points out that appropriately trained artificial neural networks can be used to develop knowledge-aided-design (KAD) modules for RF and microwave design. The approach is illustrated by examples of the reflection type and the loaded line type phase shifters. It also is applicable to other types of circuits and subsystems. KAD modules were developed and verified by using available microwave CAD software.

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Exact adjoint sensitivity analysis for neural based microwave modeling and design

Jianjun Xu, M.C.E. Yagoub, Runtao Ding and Qi-Jun Zhang. "Exact adjoint sensitivity analysis for neural based microwave modeling and design." 2001 MTT-S International Microwave Symposium Digest 01.2 (2001 Vol. II [MWSYM]): 1015-1018 vol.2.

For the first time, an adjoint neural network method is introduced for sensitivity analysis in neural-based microwave modeling and design. Exact first and second order sensitivities are systematically calculated for generic microwave neural models including variety of knowledge based neural models embedding microwave empirical information. A new formulation allows the models to learn both the input/output behavior of the modeling problem and its derivative data simultaneously. Examples for passive and active microwave modeling and simulation are presented.

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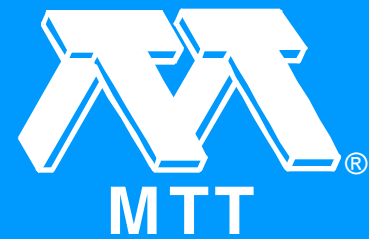
New technique using poles and modes derivatives for frequency and geometry parameterization of microwave structures

A. Gati, M.F. Wong and V.F. Hanna. "New technique using poles and modes derivatives for frequency and geometry parameterization of microwave structures." 2001 MTT-S International Microwave Symposium Digest 01.2 (2001 Vol. II [MWSYM]): 1019-1022 vol.2.

The present work describes a novel technique of parameterization for microwave circuit design and modeling in view of a full-wave 3D electromagnetic (EM) optimization. The proposed technique is based on the poles and modes computation using the finite element method and the use of the determined poles and modes for obtaining the transfer function characterizing the studied microwave structure frequency response over a large frequency band. The technique is then extended to geometry parameterization by computing the geometric derivatives of the determined poles and their corresponding modes. The computation of the derivatives allows the establishment of a very accurate parametric model describing the variation of the poles and the modes as a function of the circuit geometry deformation. Therefore, no more simulations or additional meshing are needed to evaluate the response of the circuit when its dimensions are changed.

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Extending Spice-like analog simulator with a time-domain full-wave field solver

Tong Li and Wenquan Sui. "Extending Spice-like analog simulator with a time-domain full-wave field solver." 2001 MTT-S International Microwave Symposium Digest 01.2 (2001 Vol. II [MWSYM]): 1023-1026 vol.2.

In this paper an analog circuit simulator is integrated with a versatile full-wave finite-difference time-domain (FDTD) electromagnetic (EM) solution module. The circuit-field co-simulation method is introduced to connect a Spice-like circuit simulator with an FDTD solver for simulating hybrid high-speed systems. The interface that links both simulators is derived directly from the Maxwell's equations and is simple to implement. Results from example circuits show that the proposed technique is highly accurate and stable and is suitable for integrating with any existing analog simulators, enhancing their capabilities in high-frequency circuit and packaging analysis where field effects cannot be ignored.

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Efficient FDTD modeling of irises/slots in microwave structures

Ao Sheng Rong, Heng Yang and A. Cnagellaris. "Efficient FDTD modeling of irises/slots in microwave structures." 2001 MTT-S International Microwave Symposium Digest 01.2 (2001 Vol. II [MWSYM]): 1029-1032 vol.2.

A new methodology is proposed for the computationally efficient, numerically stable, and accurate FDTD simulation of microwave structures with electrically thin irises and slots. The proposed method is based on the hybridization of Yee's standard FDTD scheme with Pade approximations of the electromagnetic properties of the irises/slots. Using rigorous modal expansions for the description of the fields in the waveguide sections formed by the irises/slots, highly accurate rational function approximations of their transmission and reflection properties are obtained. These transfer functions are then incorporated directly in the FDTD algorithm through their corresponding z-transform expressions. Results from the analysis of typical building blocks in combine filters and multiplexes for the satellite and wireless communications are used to demonstrate the validity and accuracy of the proposed methodology.

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Time domain characterization of multichip module elements

W. Dressel, T. Mangold, L. Vietzorreck and P. Russer. "Time domain characterization of multichip module elements." 2001 MTT-S International Microwave Symposium Digest 01.2 (2001 Vol. II [MWSYM]): 1033-1036 vol.2.

The development of multichip modules (MCM) or multichip packages (MCP) is an important step towards the miniaturization of integrated circuits. In this technique two or more chips without housing are mounted on a single substrate and connected by each other, resulting in very small and compact elements. An important role for the quality of this modular concept is the performance of the connecting structures and external devices like DC-blocks or line crossings between the ICs. In this contribution various elements are analysed by the TLM method. A deembedding technique for the S-parameter calculation is presented and windowing functions for the time-domain signals are investigated in order to decrease the computation time. Results are demonstrated for the S-parameters of interdigital capacitors and a balun transformer and compared to measurements.

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Full-wave analysis and model-based parameter estimation approaches for Y-matrix computation of microwave distributed RF circuits

V. Chtchekatourov, F. Coccetti and P. Russer. "Full-wave analysis and model-based parameter estimation approaches for Y-matrix computation of microwave distributed RF circuits." 2001 MTT-S International Microwave Symposium Digest 01.2 (2001 Vol. II [MWSYM]): 1037-1040 vol.2.

Distributed microwave circuits are analyzed in time domain using the Transmission Line Matrix (TLM) method. System Identification (SI) and Spectral Analysis (SA) methods are used to compute S- and Y-parameters. Model-based approaches to calculate the Y-parameters from truncated signals are presented. The extracted models are compared with running TLM analysis in real-time. In this way a stop criterion for the TLM computation is obtained. Compared with ordinary time-domain simulation the presented method of admittance parameter computation yields a reduction of computation time. The behavior of a microswitch realized via micromachining technique was investigated by using the TLM and the SA (SI) methods.

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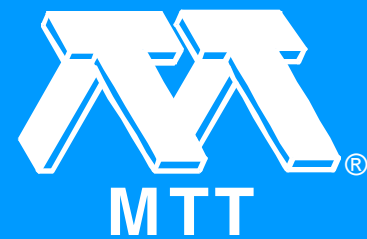


Abstracts

Analysis of signal integrity in high-speed digital ICs, by combining MOSFET modeling and the LE-FDTD method

F. Alimenti, G. Stopponi, P. Placidi, P. Ciampolini, L. Roselli and R. Sorrentino. "Analysis of signal integrity in high-speed digital ICs, by combining MOSFET modeling and the LE-FDTD method." 2001 MTT-S International Microwave Symposium Digest 01.2 (2001 Vol. II [MWSYM]): 1041-1044 vol.2.

For the reliable design of high-speed digital integrated circuits, signal integrity analysis of the critical interconnection lines needs to be performed. Such an analysis should account for electromagnetic effects (propagation, impedance mismatch, cross-talk and substrate losses) as well as for the nonlinear behavior of the active circuitry. This work proposes a comprehensive approach to carry-out the above analysis. In particular, an accurate MOSFET analytical model, suitable for advanced submicrometric microelectronic technologies, has been incorporated in a full-wave simulator based on the Lumped Element Finite Difference Time Domain (LE-FDTD) method. In this abstract, discretization and implementation procedures are discussed, and some preliminary simulations, aimed at validating the approach, are presented.



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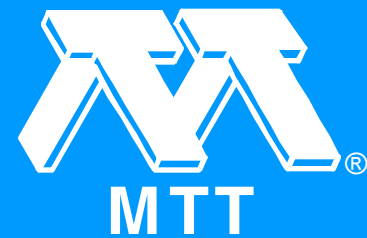


Abstracts

Interpolating wavelet Galerkin model of time dependent inhomogeneous electrically-large optical waveguide problems

M. Fujii and W.J.R. Hoefer. "Interpolating wavelet Galerkin model of time dependent inhomogeneous electrically-large optical waveguide problems." 2001 MTT-S International Microwave Symposium Digest 01.2 (2001 Vol. II [MWSYM]): 1045-1048 vol.2.

Biorthogonal interpolating wavelets have been applied to inhomogeneous electromagnetic field modeling through the wavelet-Galerkin scheme, yielding a simple and versatile algorithm for the time dependent Maxwell's equations. The resulting scheme significantly reduces the computational expenditure particularly in the modeling of electrically large optical waveguides while maintaining high accuracy.



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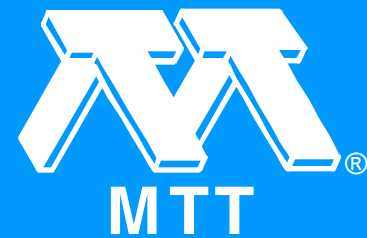
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Time domain optical response of electro-optic modulator using FDTD (2001 Vol. II [MWSYM])

M.M. Tomeh, S. Goasguen and S.M. El-Ghazaly. "Time domain optical response of electro-optic modulator using FDTD (2001 Vol. II [MWSYM])." 2001 MTT-S International Microwave Symposium Digest 01.2 (2001 Vol. II [MWSYM]): 1049-1052 vol.2.

We perform a time domain analysis of a LiNbO₃/sub 3/ electro-optic modulator using the finite difference time domain (FDTD) technique. This allows us to obtain the optical modulation and the time domain optical response of an electro-optic modulator. The electromagnetic fields computed by FDTD are coupled to standard electro-optic relations that characterize electro-optic interactions inside the embedded Ti diffused LiNbO₃/sub 3/ optical waveguides. The change in index of refraction inside these optical waveguides is determined in time, allowing for the simulation of optical intensity modulation. This novel approach to LiNbO₃/sub 3/ electrooptic modulators using a coupled FDTD technique allows for previously unattainable investigations into device operating bandwidth and data transmission speed.

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A 6 GHz, 50 watt low distortion push-pull GaAs power FET optimized for 12 V class A-B operation

T. Yamamoto, S. Sano, K. Naito, T. Igarashi and J. Fukaya. "A 6 GHz, 50 watt low distortion push-pull GaAs power FET optimized for 12 V class A-B operation." 2001 MTT-S International Microwave Symposium Digest 01.2 (2001 Vol. II [MWSYM]): 1055-1058 vol.2.

A low distortion 50 Watt push-pull quasi E-mode GaAs FET for 6 GHz terrestrial and satellite communication applications has been developed. The push-pull FET, which operates at drain voltage (V_{ds}) of 12 V, class A-B, has a saturated output power (P_{sat}) of 47 dBm (50 W) and a linear gain (G_L) of 10 dB in the frequency range of 5.8 to 6.5 GHz. A third order intermodulation distortion (IM_3) and an associated power-added efficiency (PAE) at 41 dBm output power of -35 dBc and 18% respectively. As compared with conventional single-ended D-mode FET, it has an IM_3 and PAE improvement of 5 dB and 5% respectively.

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High-power broadband AlGaIn/GaN HEMT MMICs on SiC substrates (2001 Vol. II [MWSYM])

B.M. Green, V. Tilak, Sungjae Lee, Hyungtak Kim, J.A. Smart, K.J. Webb, J.R. Shealy and L.F. Eastman. "High-power broadband AlGaIn/GaN HEMT MMICs on SiC substrates (2001 Vol. II [MWSYM])." 2001 MTT-S International Microwave Symposium Digest 01.2 (2001 Vol. II [MWSYM]): 1059-1062 vol.2.

Broadband, high power cascode AlGaIn/GaN HEMT MMIC amplifiers with high gain and power-added efficiency (PAE) have been fabricated on high-thermal conductivity SiC substrates. A cascode gain cell exhibiting 5 W of power at 8 GHz with a small signal gain of 19 dB was realized. A broadband amplifier MMIC using these cascode cells in conjunction with a lossy-match input matching network was designed, fabricated, and evaluated, showing a useful operating range of DC-8 GHz with an output power of 5-7.5 W and a PAE of 20-33% respectively. A nonuniform distributed amplifier (NDA) based on this same process yielded an output power of 3-6 W over a DC-8 GHz bandwidth with an associated PAE of 13-31%.

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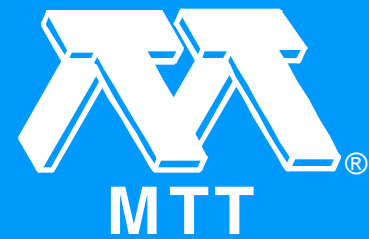
New design method of non-uniform distributed power amplifiers. Application to a single stage 1 W PHEMT MMIC

C. Duperrier, M. Campovecchio, L. Roussel, M. Lajugie and R. Quere. "New design method of non-uniform distributed power amplifiers. Application to a single stage 1 W PHEMT MMIC." 2001 MTT-S International Microwave Symposium Digest 01.2 (2001 Vol. II [MWSYM]): 1063-1066 vol.2.

A new design methodology of non-uniform distributed power amplifiers is reported in this paper. This method is based on analytical expressions of the optimum input and output artificial lines making up the non-uniform distributed power amplifier. These relationships are based on the optimum load line requirement for power operation. To validate the proposed design methodology, a non-uniform distributed power amplifier has been manufactured at the TriQuint Semiconductor foundry using a 0.25 μm power PHEMT process. This single stage MMIC amplifier is made of six non-uniform cells and demonstrates 1 W output power with 7 dB associated gain and 20% PAE over multi-octave bandwidth.

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20-30 GHz broadband MMIC power amplifiers with compact flat gain PHEMT cells

Y. Sasaki, H. Kurusu, H. Hoshi, T. Hisaka and Y. Mitsui. "20-30 GHz broadband MMIC power amplifiers with compact flat gain PHEMT cells." 2001 MTT-S International Microwave Symposium Digest 01.2 (2001 Vol. II [MWSYM]): 1067-1070 vol.2.

20-30 GHz band MMICs have been successfully developed using two types of novel compact size flat gain PHEMT cells that have flat maximum available gain and sufficient stabilities over a wide frequency range of 20-30 GHz. One type is a feedback type. The other has an equalizer circuit at the gate of a PHEMT. The MMIC delivers gains of over 18 dB and P1dB of over 22 dBm. These results show this method is very effective in designing broadband MMICs.

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X-band MMIC power amplifier with an on-chip temperature compensation circuit (2001 Vol. II [MWSYM])

K. Yamauchi, Y. Iyama, M. Yamaguchi, Y. Ikeda and T. Takagi. "X-band MMIC power amplifier with an on-chip temperature compensation circuit (2001 Vol. II [MWSYM])." 2001 MTT-S International Microwave Symposium Digest 01.2 (2001 Vol. II [MWSYM]): 1071-1074 vol.2.

An X-band MMIC power amplifier with an on-chip temperature compensation circuit has been presented. The temperature compensation circuit is composed of a diode and a resistor. The compensation circuit is applied to a 4 stage X-band MMIC power amplifier. The gain variation is improved from 5.5 dB to 1.3 dB in the temperature range between -10 degC and +80 degC.

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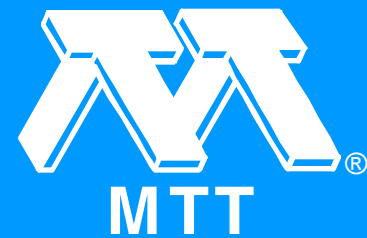
A novel base feed design for high power, high frequency heterojunction bipolar transistors

M. Salib, Hyo-Kun Hahn, J. Kositz, J. Zingaro, A. Ezis and A. Gupta. "A novel base feed design for high power, high frequency heterojunction bipolar transistors." 2001 MTT-S International Microwave Symposium Digest 01.2 (2001 Vol. II [MWSYM]): 1075-1078 vol.2.

HBTs for power amplifiers are typically designed to provide high power per unit cell to minimize chip area and losses in the on-chip combiner circuitry. A high power unit cell is obtained by combining the power of several emitter fingers ("subcells"). A problem arises when the magnitude and phase of signals driving each sub-cell differ significantly from one to the other. The imbalance results in reduced total power and efficiency and the problem gets worse with increasing frequency. Our experience is that at X-band the performance of the unit cell is compromised when more than four to six subcells ($40 \text{ /spl mu/m/sup 2/}$ each) are combined in one device using the conventional "fishbone" method. This paper describes a new method of feeding signal to the sub-cells for overcoming this problem. An example is provided where the powers of the sixteen $40 \text{ /spl mu/m/sup 2/}$ subcells are combined such that the output scales as expected and there is minimal loss in the efficiency. The unit cell produced 29.6 dBm power with a 10 dB gain and PAE of 58% at 10.5 GHz. A two-stage X-Band power MMIC using this cell yielded 5 W with a gain of 13 dB and 43% PAE.

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High efficiency S-band class AB push-pull power amplifier with wideband harmonic suppression

C.Y. Hang, Y. Qian and T. Itoh. "High efficiency S-band class AB push-pull power amplifier with wideband harmonic suppression." 2001 MTT-S International Microwave Symposium Digest 01.2 (2001 Vol. II [MWSYM]): 1079-1082 vol.2.

A high-efficiency class-AB push-pull power amplifier is designed utilizing a novel photonic band-gap (PBG) ground plane. This design allows simultaneous tuning of both the second and the third harmonics, thus resulting in a high efficiency power amplifier design. The measured PAE is 63.8% at an output power of 28.2 dBm. In addition, the measured IP3 is 45 dBm, about 17 dB above the P/sub 1dB/ point.

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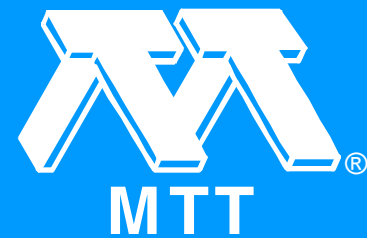
A flexible multiband frontend for software radios using high IF and active interference cancellation

W. Schacherbauer, A. Springer, T. Ostertag, C.C.W. Ruppel and R. Weigel. "A flexible multiband frontend for software radios using high IF and active interference cancellation." 2001 MTT-S International Microwave Symposium Digest 01.2 (2001 Vol. II [MWSYM]): 1085-1088 vol.2.

A flexible analog frontend for multiband mobile communications equipment is presented. The circumvention of tight RF band filtering as applied in current single-band designs is fundamental to attain this goal. A successful application of wideband RF filtering, covering all frequency bands of interest, combined with a high intermediate frequency stage and active interferer cancellation is demonstrated. The high intermediate frequency following the RF stage allows for respectively image and sideband rejection. Direct feedthrough of the TX signal into the RX path is suppressed by active cancellation. A demonstrator capable of operating within an RF range from 800 to 2200 MHz with variable channel bandwidths up to 5 MHz has been realized and measurement results are presented and discussed.

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A highly-integrated low-power direct conversion receiver MMIC for broadband wireless applications

B. Matinpour, S. Yoo and J. Laskar. "A highly-integrated low-power direct conversion receiver MMIC for broadband wireless applications." 2001 MTT-S International Microwave Symposium Digest 01.2 (2001 Vol. II [MWSYM]): 1089-1091 vol.2.

In this paper, we present a highly integrated low-power direct conversion receiver MMIC for broadband wireless applications at C-band. This receiver chip is fabricated in a 0.6 μm commercial GaAs MESFET process and operates on only 90 mW of dc power consumption. Using an integrated switched LNA and direct-coupled baseband amplifiers, this receiver demonstrates a conversion gain of 25 dB, NF of 6.7 dB, dc offset below -70 dBm, IIP2 of +20 dBm, and IIP3 of -15 dBm in the high-gain mode and +15 dBm in the low-gain mode at 5.8 GHz.

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High-speed low-cost direct conversion digital receiver

J.-F. Gagne, J. Gauthier, Ke Wu and R.G. Bosisio. "High-speed low-cost direct conversion digital receiver." 2001 MTT-S International Microwave Symposium Digest 01.2 (2001 Vol. II [MWSYM]): 1093-1096 vol.2.

In this paper, an analog carrier recovery loop is proposed and developed to provide a complete direct conversion digital six-port receiver operating at microwave ISM frequency of 2.45 GHz. Results on data rate limitation are shown for QPSK signals up to data rates of 52 Mb/s. Parametric measurements in connection with CW, adjacent channel and co-channel interferences are presented for a data rate of 40 Mb/s. Finally, phase offset between the carrier and the reference signal, along with carrier frequency deviation performance are also presented for a rate of 40 Mb/s.



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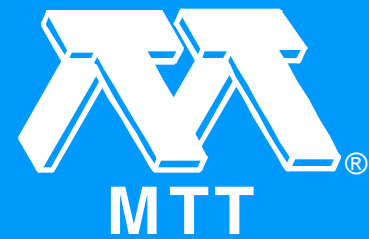
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A 156 Mbps compact FSK modulator module for 38 GHz wireless LANs

Zhongmin Wen, M. Akiyama and Y. Hase. "A 156 Mbps compact FSK modulator module for 38 GHz wireless LANs." 2001 MTT-S International Microwave Symposium Digest 01.2 (2001 Vol. II [MWSYM]): 1097-1100 vol.2.

The results on the development of a 156 Mbps modulator module for 38 GHz wireless LANs are presented. The modulator module employing a dielectric resonator and MMICs has a compact structure. The frequency stability is less than 5.7 ppm/degree and suitable to a direct modulation of FSK. The spectrum of 38 GHz RF signals shows a wide frequency deviation of 75 MHz for 156 Mbps modulation. The 2/sup 11/-1 random data of 156 Mbps demodulated in a testing system exhibits a clear eye pattern. Error free operation in the data transmission process between the modulation and the demodulation is also confirmed.





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An electromagnetic characterization of indoor radio environment in microwave WLAN systems

P. Bernardi, R. Cicchetti and O. Testa. "An electromagnetic characterization of indoor radio environment in microwave WLAN systems." 2001 MTT-S International Microwave Symposium Digest 01.2 (2001 Vol. II [MWSYM]): 1101-1104 vol.2.

An accurate electromagnetic characterization of a typical indoor environment in which a microwave WLAN system operates is presented. The characterization has been performed by means of a heuristic UTD diffraction coefficient suitable to take into account not only the effects of building walls, floors, and corners, but also the presence of penetrable furniture. The numerical results show that the electromagnetic field distribution and the channel performances are significantly influenced by the diffraction processes arising from the presence of furniture.

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A low profile 77 GHz three beam antenna for automotive radar

F. Kolak and C. Eswarappa. "A low profile 77 GHz three beam antenna for automotive radar." 2001 MTT-S International Microwave Symposium Digest 01.2 (2001 Vol. II [MWSYM]): 1107-1110 vol.2.

The design and fabrication of a 76.5 GHz, planar, three beam antenna is presented. This antenna has greater than 31 dB of gain and sidelobes that are less than -29 dB below the main beam. This antenna demonstrates the ability to achieve very low sidelobes in a simple, compact, and planar structure. This is accomplished uniquely by feeding waveguide slots that are coupled to microstrip radiating elements. This illumination technique allows for a very low loss and highly efficient structure. Also, a novel beam-scanning concept is introduced. To orient a beam from bore sight it requires phase differences between the excitations of the successive elements. This is achieved by varying the width of the W-band waveguide. This simple, beam steering two-dimensional structure offers the advantage of easy manufacturing compared to present lens and alternative technologies.

Proposal of millimeter-wave holographic radar with antenna switching

Y. Asano, S. Ohshima, T. Harada, M. Ogawa and K. Nishikawa. "Proposal of millimeter-wave holographic radar with antenna switching." 2001 MTT-S International Microwave Symposium Digest 01.2 (2001 Vol. II [MWSYM]): 1111-1114 vol.2.

This paper proposes a millimeter-wave holographic radar with a simple structure for automotive applications. The simplicity can be realized by switching both transmitting antennas and receiving antennas. Also, a super resolution technique is introduced for the detection of angular positions in the proposed radar. The radar developed experimentally has accomplished an azimuthal angular resolution of less than 2 degrees and an azimuthal field of view (FoV) of more than 20 degrees simultaneously.



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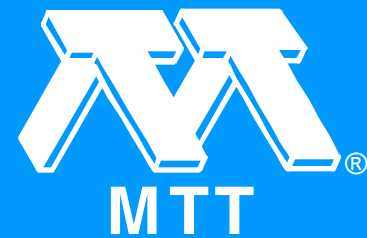
Fully integrated automotive radar sensor with versatile resolution (2001 Vol. II [MWSYM])

C. Metz, J. Grubert, J. Heyen, A.F. Jacob, S. Janot, E. Lissel, G. Oberschmidt and L.C. Stange. "Fully integrated automotive radar sensor with versatile resolution (2001 Vol. II [MWSYM])." 2001 MTT-S International Microwave Symposium Digest 01.2 (2001 Vol. II [MWSYM]): 1115-1118 vol.2.

A planar radar sensor for automotive application is presented. The design comprises a fully integrated transceiver multi-chip module (MCM) and an electronically steerable microstrip patch array. The antenna feed network is based on a modified Rotman-lens. An extended angular coverage together with an adapted resolution allows for the integration of automatic cruise control (ACC), precrash sensing and cut-in detection within a single 77 GHz frontend. For ease of manufacturing the interconnects between antenna and MCM rely on a mixed wire bond and flip-chip approach. The concept is validated by laboratory radar measurements.

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A reconfigurable active retrodirective/direct conversion receiver array for wireless sensor systems

R.Y. Miyamoto, Yongxi Qian and T. Itoh. "A reconfigurable active retrodirective/direct conversion receiver array for wireless sensor systems." 2001 MTT-S International Microwave Symposium Digest 01.2 (2001 Vol. II [MWSYM]): 1119-1122 vol.2.

A reconfigurable active retrodirective/direct conversion receiver array is presented. The system can serve as both a retrodirective array transponder and a direct conversion receiver simply by changing the frequency of the LO applied to the mixers. In the retrodirective array mode, the circuit provides 20 dB gain and 20 dB RF-IF isolation. The mixers perform phase-conjugation and modulation simultaneously. When operating as a direct conversion receiver, both I and Q channels are successfully recovered.

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A novel card-type transponder designed using retrodirective antenna array

Shyh-Jong Chung, Ten-Chi Chou and Yung-Nein Chin. "A novel card-type transponder designed using retrodirective antenna array." 2001 MTT-S International Microwave Symposium Digest 01.2 (2001 Vol. II [MWSYM]): 1123-1126 vol.2.

A novel card-type 5.8 GHz passive transponder is designed for possible use in the Dedicated Short-Range Communication (DSRC) systems and/or the RF/ID systems. Four LHCP microstrip antennas are arranged in the transponder by using the Van Atta retrodirective design so that the transponder possesses the advantages of both a high responding signal level and a wide range of responding angles. Measurement results show that the present transponder produces a signal level 12 dB higher than a transponder with single-antenna design, while maintaining the same range of the responding angles as the single-antenna one. Finally, by incorporating 8-bit test codes in the beacon (or interrogator) and in the transponder, the downlink and uplink performances of the transponder are demonstrated.

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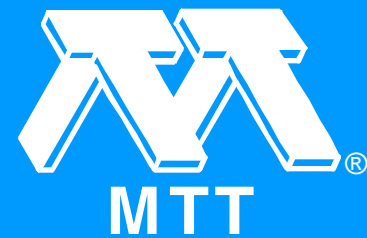


Abstracts

Satellite systems for multimedia and Internet traffic

P. Chitre and R. Gupta. "Satellite systems for multimedia and Internet traffic." 2001 MTT-S International Microwave Symposium Digest 01.2 (2001 Vol. II [MWSYM]): 1129-1132 vol.2.

Satellite networks handle Internet and multimedia traffic at C- and Ku-bands today, while a new generation of systems is being developed at Ka-band. Present satellite systems provide high-speed ISP backbone connectivity and two-way Internet accesses. Future Ka-band systems are primarily targeted for business and home users with low-cost fixed user terminals. Satellite links are also used for interconnecting remote networks as well as some semi-fixed and mobile networks applications. This paper provides an overview of the present and planned satellite systems/services, and addresses the key related RF and antenna technology issues.



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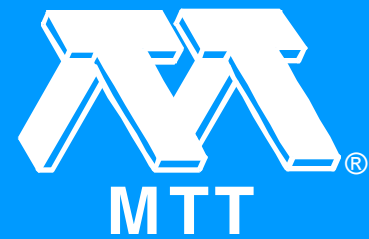
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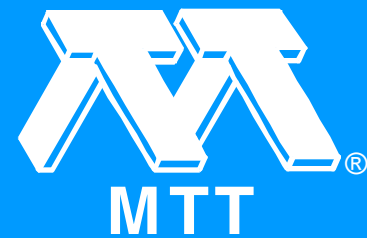
Ka band satellite system architecture for local loop Internet access

A.E. Atia. "Ka band satellite system architecture for local loop Internet access." 2001 MTT-S International Microwave Symposium Digest 01.2 (2001 Vol. II [MWSYM]): 1133-1136 vol.2.

A Ka-band satellite system architecture that provides wide-band local loop access to consumers and small businesses is described. It is based on the phased deployment of simple, low cost bent-pipe GEO satellites providing highly directive spot beam coverage over the continental United States. Each spot beam covers a desired service area, usually not well served by terrestrial communications systems. Internet Service Providers (ISP) use hub antennas within the spot beams to provide two-way Internet connections to the end users. The end users access the ISP hub via the GEO satellite using USATs (Ultra-Small Antenna Terminals). The downstream data rate can be as high as 90 Mbps, and the upstream rates vary from 64 kbps to as high as 2.048 Mbps.

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User equipment antennas for broadband NGSO satellite communications systems

R.W. Kreutel. "User equipment antennas for broadband NGSO satellite communications systems." 2001 MTT-S International Microwave Symposium Digest 01.2 (2001 Vol. II [MWSYM]): 1137-1139 vol.2.

The demand for high speed information delivery direct to the home has led to proposal(s) to construct a constellation of Ka band satellites operating in nongeostationary orbit. This type of constellation can provide high elevation angle (>40 degrees) service to the user, low time delay and high spectrum efficiency, i.e. a large number of frequency reuses. The NGSO system, however, imposes the requirement that the User Equipment (UE) terminal must be capable of tracking the satellite and performing handover from one satellite to another. In addition, the UE terminal must have a low profile, preferably have no moving parts, have an aesthetically pleasing appearance and be affordable. In this presentation, the Ka band NGSO UE terminal design is addressed in the light of these requirements. The discussion focuses on the antenna portion of the terminal since the antenna is the critical element of the UE.





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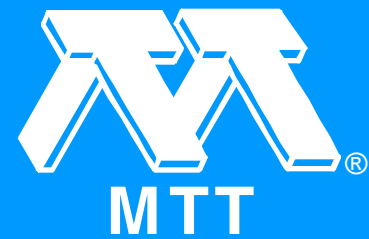
Outdoor units for Ka/Ku-band satellite interactive terminals

J.L. Fikart. "Outdoor units for Ka/Ku-band satellite interactive terminals." 2001 MTT-S International Microwave Symposium Digest 01.2 (2001 Vol. II [MWSYM]): 1141-1144 vol.2.

This paper describes the main features and components of a class of OutDoor Units (ODUs) for user terminals for interactive data communications as well as for TV reception via the new 12/30 GHz ASTRA satellite launched last year, and future satellites with similar parameters. The first prototypes of these units were first reported at the 5/sup th/ Ka-band Utilisation Conference in Taormina, Italy (1999). Since then, the units underwent further redesign and are now in regular production. The ODU's use block conversion from S-band (2.5-3 GHz) for the transmitter and to standard L-band (0.95-2.15 GHz) for the receiver, and interface with an Indoor Unit (IDU) with the the corresponding S/L modem. Their EIRP, G/T and purity allow transmitting at data rates from 144 kb/s to about 2 Mb/s using the above satellites, with sufficient margin, and reception of signals with high data rates (such as 40 Mb/s or even higher). Three ODU's with different Tx power levels and antenna sizes have been designed to cover the above range of data rates. The configuration, main characteristics and technology of the ODU's are described and their performance data reported in this paper.

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Multi-carrier 16QAM over a linearized TWTAs

A. Katz. "Multi-carrier 16QAM over a linearized TWTAs." 2001 MTT-S International Microwave Symposium Digest 01.2 (2001 Vol. II [MWSYM]): 1145-1148 vol.2.

A major concern relating to the transmission of Internet services by means of satellite has been the linearity of available high power amplifiers (HPAs). Traveling wave tube amplifiers (TWTAs) offer the greatest efficiency and power capacity, but are somewhat limited in linearity. This paper investigates the use of linearized TWTAs for the transmission of high data rate bandwidth efficient traffic.

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Expanded space mapping design framework exploiting preassigned parameters

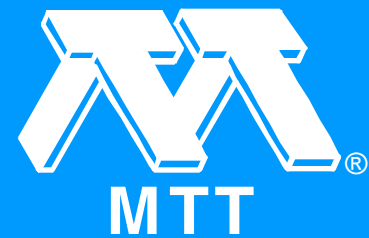
J.W. Bandler, M.A. Ismail and J.E. Rayas-Sanchez. "Expanded space mapping design framework exploiting preassigned parameters." 2001 MTT-S International Microwave Symposium Digest 01.2 (2001 Vol. II [MWSYM]): 1151-1154 vol.2.

We present a novel design framework for microwave circuits. We expand the original space mapping technique by allowing preassigned parameters (which are not used in optimization) to change in some components of the coarse model. We refer to those components as "relevant" components and we present a method based on sensitivity analysis to identify them. As a result, the coarse model can be calibrated to align with the fine model. Our algorithm establishes a mapping from some of the optimizable parameters to the preassigned parameters of the relevant components. This mapping is updated iteratively until we reach the optimal solution. We illustrate our approach through a microstrip design example.

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Abstracts



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Multi-level passive order reduction of interconnect networks

R. Khazaka and M. Nakhla. "Multi-level passive order reduction of interconnect networks." 2001 MTT-S International Microwave Symposium Digest 01.2 (2001 Vol. II [MWSYM]): 1155-1158 vol.2.

This paper presents an efficient algorithm for transient simulation of multi-port interconnect networks in the presence of nonlinear terminations. Krylov-subspace order reduction techniques have been shown to provide a significant speed-up in the simulation of interconnect networks. These methods however are far from optimal, and the resulting macromodel contains many redundant poles. In this paper, a passive multi-level reduction technique is presented. The proposed method eliminates the redundant poles, thus resulting in significant CPU cost reduction.

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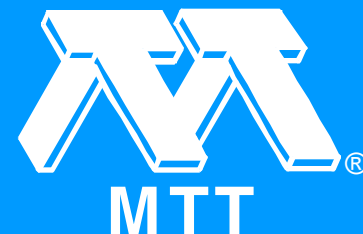


Abstracts

Fast analysis and optimization of combine filters using FEM

D.G. Swanson, Jr. and R.J. Wenzel. "Fast analysis and optimization of combine filters using FEM." 2001 MTT-S International Microwave Symposium Digest 01.2 (2001 Vol. II [MWSYM]): 1159-1162 vol.2.

We analyze a combine filter using the Finite Element Method (FEM) with ports where the tuning screws would normally be. The filter is tuned with a circuit simulator using the multiport S-parameter data and lumped capacitors at the ports. We can then optimize the combine filter very rapidly by mapping the "coarse" circuit model to the "fine" FEM model. This optimization is shown to converge in one iteration, with a good starting point.



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Integrated CAD procedure for iris design in a multi-mode waveguide environment

W. Steyn, R. Lehmensiek and P. Meyer. "Integrated CAD procedure for iris design in a multi-mode waveguide environment." 2001 MTT-S International Microwave Symposium Digest 01.2 (2001 Vol. II [MWSYM]): 1163-1166 vol.2.

A fast integrated CAD procedure for designing irises in multi-mode coupled cavity filters is presented. A reduced generalized scattering matrix (GSM), obtained by using adaptive frequency sampling for analysis, is combined with aggressive space mapping for coupling structures. The technique reduces the number of computational electromagnetic (CEM) analysis points needed for the design of an iris, achieving a reduction factor of up to 50 for a design coupling 3 modes across one iris.

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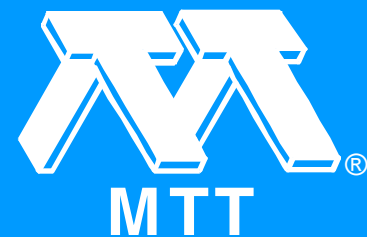
Decomposition synthesis approach to design of RF and microwave active circuits

L.I. Babak. "Decomposition synthesis approach to design of RF and microwave active circuits." 2001 MTT-S International Microwave Symposium Digest 01.2 (2001 Vol. II [MWSYM]): 1167-1170 vol.2.

The paper presents a new decomposition synthesis method for designing linear and nonlinear active high-frequency circuits. This method allows the synthesis of passive correction (matching, compensation, feedback, etc.) networks from circuit performance specifications, with a circuit block diagram given. The method forms the basis of unified synthesis procedure for a wide range of RF and microwave active semiconductor circuits. Statements of problems at the synthesis stages are formulated and methods and algorithms for solving these problems are discussed. Also, we overview our research results with application to designing RF/microwave transistor amplifiers. CAD tools for transistor amplifiers and passive matching/compensation networks were implemented; they were used to design amplifiers of various types and structures.

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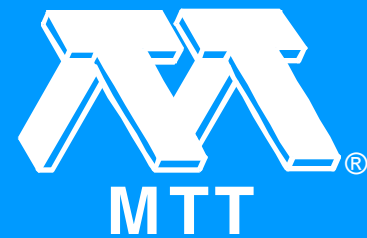
UHF frequency selective limiters

J.D. Adam, S.N. Stitzer and R.M. Young. "UHF frequency selective limiters." 2001 MTT-S International Microwave Symposium Digest 01.2 (2001 Vol. II [MWSYM]): 1173-1174 vol.2.

A frequency selective limiter, based on magnetostatic surface wave propagation in a GaScYIG film, is described. Small signal insertion loss was 10 dB and the threshold power level was -25 dBm over the 400 MHz to 800 MHz frequency range. Small signal attenuation and intermodulation products, resulting from the interaction between two signals, are only significant if the signals are less than 10 MHz apart. Similar devices are expected to be used to extend the dynamic range of broadband receivers.

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Very low loss wideband isolators for mm-wavelengths

N.R. Erickson. "Very low loss wideband isolators for mm-wavelengths." 2001 MTT-S International Microwave Symposium Digest 01.2 (2001 Vol. II [MWSYM]): 1175-1178 vol.2.

Isolators based on Faraday rotation in a cylindrical dielectric waveguide have long been used for full waveguide band coverage, but the typical loss has been significantly higher than for Y junction designs. A modification of the Faraday rotation design using better mode conversion and a greatly reduced ferrite length has resulted in much lower loss and better VSWR while maintaining high isolation. The performance is now comparable to the best narrow band Y junction designs but with nearly full waveguide bandwidth, and with even smaller size. The best WR10 units have a loss of 0.5-0.8 dB across the 75-110 GHz band, and a WR5 design has 1.0-1.2 dB loss from 160-180 GHz, increasing to 2 dB at 220 GHz. A further modification to the design using a diamond heat sink to dissipate high power has also been developed. These isolators work at cryogenic temperatures with somewhat lower loss.

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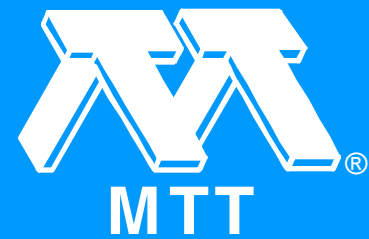
A novel nonreciprocal ferrite image guide

A.S. Akyol and L.E. Davis. "A novel nonreciprocal ferrite image guide." 2001 MTT-S International Microwave Symposium Digest 01.2 (2001 Vol. II [MWSYM]): 1179-1182 vol.2.

A single ferrite/dielectric image line is analyzed using the effective permittivity method, adapted for ferrites. E_{pq}/x modes are used in association with a transverse bias direction to obtain nonreciprocal behavior. It is shown that the required conditions can be obtained that enables the composite image line to guide in one direction and leak in the other. Thus, the structure behaves as a "leaky-wave isolator". Dispersion diagrams showing this behavior in the frequency range 14-30 GHz are obtained for a 2×2 mm ferrite rod with adjacent dielectric loading with $\epsilon_r = 11$.

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An ultra miniature isolator with broadband isolation using ferrite gyrator

T. Okada, T. Makino, S. Shinmura, S. Hino, T. Nakada and H. Asai. "An ultra miniature isolator with broadband isolation using ferrite gyrator." 2001 MTT-S International Microwave Symposium Digest 01.2 (2001 Vol. II [MWSYM]): 1183-1186 vol.2.

An ultra miniature isolator, which we call a "buffer device", characterized in broadband isolation and with no battery power consumption, is developed. It consists of a ferrite plate and two wire windings. It provides an insertion loss of 1.5 dB at 2.52 GHz and an isolation of 20 dB or more over a frequency range of DC through 3.0 GHz. The size of the buffer devices is only 3.2/spl times/2.5/spl times/1.7 mm/sup 3/. It is designed to replace power consuming buffer amplifiers in CDMA, TDMA, and W-CDMA mobile phone handsets.

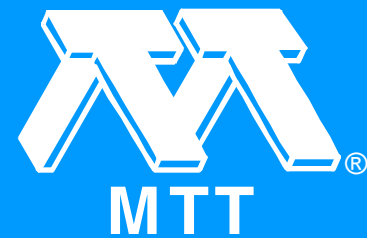
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A method of effective use of ferrite for microwave absorber

Y. Kotsuka and M. Amano. "A method of effective use of ferrite for microwave absorber." 2001 MTT-S International Microwave Symposium Digest 01.2 (2001 Vol. II [MWSYM]): 1187-1190 vol.2.

To meet the demands of various types of EM-wave absorber, a method of effective use of conventional ferrites for microwave absorber applications is investigated both by FDTD analysis and experiments. The effects of various kinds of parameters are clarified, particularly for permeability. A new matching characteristic is realized simply by punching out small holes in the conventional rubber ferrite without producing a new ferrite material in the region of the microwaves.



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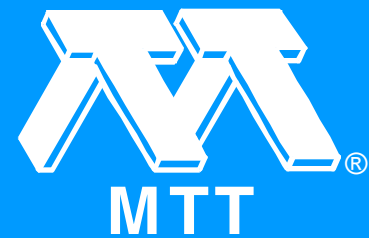
Phase shifters using (Ba,Sr)TiO/sub 3/ thin films on sapphire and glass substrates

B. Acikel, Yu Liu, A.S. Nagra, T.R. Taylor, P.J. Hansen, J.S. Speck and R.A. York. "Phase shifters using (Ba,Sr)TiO/sub 3/ thin films on sapphire and glass substrates." 2001 MTT-S International Microwave Symposium Digest 01.2 (2001 Vol. II [MWSYM]): 1191-1194 vol.2.

In this paper, we present results from distributed phase shifter circuits that were fabricated on sapphire and glass substrates. The circuits employ voltage tunable (Ba,Sr)TiO/sub 3/ (BST) thin films deposited by rf magnetron sputtering. Both parallel-plate and interdigital capacitor structures are investigated. K/Ka-band phase shifters demonstrated a phase shift of 265/spl deg/ with an insertion loss of 5.8 dB at 20 GHz and 180/spl deg/ phase shift with an insertion loss of 4 dB at 30 GHz. Both circuits demonstrated a promising figure of merit /spl sim/60/spl deg//dB at 10 GHz. A C/X-band phase shifter demonstrated a phase shift of >460 degrees with an insertion loss of 8.8 dB at 8 GHz.

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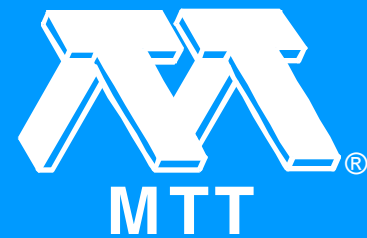
MOS varactors with ferroelectric films

S. Gevorgian, S. Abadei, H. Berg and H. Jacobsson. "MOS varactors with ferroelectric films." 2001 MTT-S International Microwave Symposium Digest 01.2 (2001 Vol. II [MWSYM]): 1195-1198 vol.2.

The microwave performance of MOS varactors with additional ferroelectric film (MFOS) is presented. The tunability of MFOS varactors above 20 GHz is more than 10% higher than that of simple MOS varactors, with sufficiently high Q factor. The proposed MFOS varactor has a simple design and is compatible with standard CMOS processes. It may have symmetric C-V curves at rather high tuning voltages and superior performance at millimetre wave frequencies. In experiments varactors are based on $\text{NaNbO}_3/\text{sub 3/}$ films grown on high resistivity silicon substrates.

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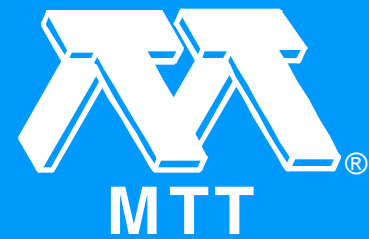
Waveguiding properties of a line of periodically arranged passive dipole scatterers

S.A. Tretyakov and A.J. Viitanen. "Waveguiding properties of a line of periodically arranged passive dipole scatterers." 2001 MTT-S International Microwave Symposium Digest 01.2 (2001 Vol. II [MWSYM]): 1201-1204 vol.2.

Electromagnetic properties of line-periodical arrangements of passive loaded dipole scatterers are studied. An analytical solution for eigenwaves propagating along infinite lines of dipoles is presented. Conditions of existence of guided-wave solutions are established. It is shown that in arrays of capacitively-loaded antennas very rapid phase variations along the line are possible, which can possibly be used to realize wide-band superdirective reflectors.

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New type of millimeter wave antenna by using the high permittivity LSE NRD guide

F. Kuroki, M. Yamaguchi, Y. Minamitani and T. Yoneyama. "New type of millimeter wave antenna by using the high permittivity LSE NRD guide." 2001 MTT-S International Microwave Symposium Digest 01.2 (2001 Vol. II [MWSYM]): 1205-1208 vol.2.

A technique for construction of a millimeter-wave antenna has been developed based on high permittivity LSE-NRD guide technology. The novelty of the present technique lies in the use of a simple radiator, which consists of tapered dielectric strip with the length of about a guided wavelength and a broad radiation pattern. A new type of fan beam antenna for marine radar use has been fabricated by locating the radiator in the focal point of the cylindrical parabolic reflector. A good fan beam pattern with half-power beam widths of 4 in the horizontal plane and 38 in the vertical plane can be obtained.

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An efficient method for solving 3D dielectric planar circuit with parabolic equation

T. Anada, R. Sawada, T. Hiraoka, Hsu Jui-Pang, T.M. Benson and P. Sewell. "An efficient method for solving 3D dielectric planar circuit with parabolic equation." 2001 MTT-S International Microwave Symposium Digest 01.2 (2001 Vol. II [MWSYM]): 1209-1212 vol.2.

In this paper, a 3D wide-angle parabolic equation algorithm combining the Douglas scheme and the Pade series expansion is given for photonic integrated circuits and devices. The present method is easy to solve numerically by using the operator splitting method in allowing wider propagation angles, and the truncation error of the Douglas operator scheme is fourth-order $O(\Delta x^4)$ for finite differences in the transverse direction. Therefore, it is expected that this technique can improve the accuracy and efficiency of computation for optical field propagation. Finally, numerical examples are presented for a ridge-type 3D waveguide, a curved 3D waveguide model and a primitive MMI device.

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Design of surface-wave band-gaps for planar integrated circuits using multiple periodic metallic patch arrays

R. Leone and H.Y.D. Yang. "Design of surface-wave band-gaps for planar integrated circuits using multiple periodic metallic patch arrays." 2001 MTT-S International Microwave Symposium Digest 01.2 (2001 Vol. II [MWSYM]): 1213-1216 vol.2.

In recent years, there has been significant interest in complete surface-wave elimination (meaning in all-possible directions) with the use of periodic elements in integrated circuit structures. This paper presents the theory for guided surface-wave and leaky-waves of a multi-layer dielectric substrate with multiple planar periodic metallic patch arrays. This paper demonstrates that the use of multiple planar periodic patch arrays enlarges the surface-wave band-gap in all directions and provide more design flexibility as compared to a single planar periodic array. Several design examples are given. Design rules to obtain modeless (omnidirectional band-gap) substrates for integrated circuits are outlined.

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Space leakage of power from the slotline

J. Zehentner, J. Machac and P. Lorenz. "Space leakage of power from the slotline." 2001 MTT-S International Microwave Symposium Digest 01.2 (2001 Vol. II [MWSYM]): 1217-1220 vol.2.

In this paper we present the comprehensive dispersion characteristics of the slotline on thin and low permittivity substrate with a wide slotwidth comprising the bound and space leaky waves with even and odd electric field symmetry. The final design and measurement of the slotline antenna radiation are based on our analysis of this slotline. The antenna and its feeding circuit are designed assuming only the first odd space leaky wave radiation. Measured and calculated return losses and radiation patterns of the antenna are shown. Remarks are made on the applicability of the antenna.

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Derivation of analytical dyadic Green's function modifications for microstrip attenuation in transmission layered structures

C.M. Krowne. "Derivation of analytical dyadic Green's function modifications for microstrip attenuation in transmission layered structures." 2001 MTT-S International Microwave Symposium Digest 01.2 (2001 Vol. II [MWSYM]): 1221-1224 vol.2.

Rigorous derivation of the correction to the dyadic Green's function for a microstrip structure containing complex layered media is carried out for imperfect metallization. A hierarchy of formulas is found consistent with a full-wave electromagnetic code employing zero thickness extent conductors for the guiding structure metal. At the bottom of the hierarchy are formulas which are only dependent on the conductor geometry and material properties. Numerical examples show the sensitivity of the attenuation constant to these formulas.

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On the penetration of the longitudinal component of EM fields into metals

R.I. Tzontchev, A.E. Chubykalo, J.M. Rivera-Juarez and V. Onoochin. "On the penetration of the longitudinal component of EM fields into metals." 2001 MTT-S International Microwave Symposium Digest 01.2 (2001 Vol. II [MWSYM]): 1225-1228 vol.2.

The penetration of an EM wave with the frequency of 14 MHz through metallic shields of different design has been investigated. Despite for a normally incident wave the theory predicts the decay of the signal $E_{\text{out}}/E_{\text{in}} < 0.01$ (i.e. less -40 dBWt) for the shields used in the experiments, the decay of the measured signal was no less than -1.2 dB, i.e. anomalously large penetration of the signal through the metallic layer was detected. This effect can be caused by suppressing the magnetic component in the incident EM wave.



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Modal cutoff in coaxial transmission lines of conical and cylindrical geometries

C.M. Weil, B.F. Riddle, D.R. Novotny and R.T. Johnk. "Modal cutoff in coaxial transmission lines of conical and cylindrical geometries." 2001 MTT-S International Microwave Symposium Digest 01.2 (2001 Vol. II [MWSYM]): 1229-1232 vol.2.

We present numerical data on normalized cutoff wavelength versus cone half-angle for the first three higher-order TE/sub m1/ modes, as well as four other modes of interest, in conical coaxial transmission lines (the "co-conical" line). These are given as a function of the ratio of outer-to-inner cone half-angles (proportional to line impedance) for outer cone half-angles of 10 and 22.5 degrees. Results were compared to those for the coaxial transmission line of cylindrical geometry and found to be qualitatively similar.

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Fullwave analysis of transverse and longitudinal couplings in silicon RFIC. Effect of buried diffusions

S. Wane, D. Bajan, H. Baudrand and P. Gamand. "Fullwave analysis of transverse and longitudinal couplings in silicon RFIC. Effect of buried diffusions." 2001 MTT-S International Microwave Symposium Digest 01.2 (2001 Vol. II [MWSYM]): 1233-1236 vol.2.

Couplings in Si based RFICs result from the combination of the effects of the substrate resistivity, homogenous and localized buried diffusions as well as metallic losses. A fullwave analysis is performed and longitudinal and transverse coupling coefficients are defined from a generalized equivalent circuit. Concurrently, considerable improvement of isolation performances are demonstrated by inserting localized buried diffusions.

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Frequency/time-domain modeling of microstrip circuits by a modified spectral domain approach

P. Arcioni, M. Bressan and G. Conciauro. "Frequency/time-domain modeling of microstrip circuits by a modified spectral domain approach." 2001 MTT-S International Microwave Symposium Digest 01.2 (2001 Vol. II [MWSYM]): 1237-1240 vol.2.

This paper shortly describes a novel full-wave approach to the analysis of boxed planar passive MMICs. The analysis takes into account both the losses in the substrate and in the metallization. Like in the standard SDA the analysis is performed by applying the Method of Moments (MoM) in the spectral domain, but the standard algorithm is modified according to the philosophy of the Boundary-Integral Resonant-Mode-Expansion (BIRME) method. Like in frequency-time domain modeling based on finite difference or finite element methods, this modification lends itself to obtaining the pole expansion of the admittance matrix in the s-plane by solving a linear matrix eigenvalue problem. With respect to finite methods, the implementation of the integral approach described in this paper results in much shorter computer times and requires much smaller memory resources. An example demonstrates the advantage of the method.

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Efficient analysis of waveguide-to-microstrip and waveguide-to-coplanar line transitions

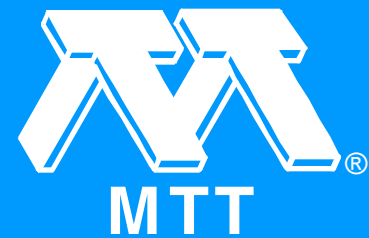
L. Greda and R. Pregla. "Efficient analysis of waveguide-to-microstrip and waveguide-to-coplanar line transitions." 2001 MTT-S International Microwave Symposium Digest 01.2 (2001 Vol. II [MWSYM]): 1241-1244 vol.2.

A general procedure using the Method of Lines (MoL) for the analysis of waveguide-to-microstrip and waveguide-to-coplanar line transitions is described. Using two crossed two-dimensional discretization line systems instead of a full three-dimensional discretization allows to reduce the numerical effort. This concept is combined with the concept of impedance/admittance transformation. The described relations are also useful for other applications. The proposed algorithm is validated by comparison to measured and theoretical results.

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A 3-D method of moments for the analysis of real life MMICs

M. Farina and T. Rozzi. "A 3-D method of moments for the analysis of real life MMICs." 2001 MTT-S International Microwave Symposium Digest 01.2 (2001 Vol. II [MWSYM]): 1245-1248 vol.2.

In this paper we introduce a 3-D Method of Moments (MoM) approach, suitable for the analysis of real life monolithic circuits for microwaves/millimeter waves (MMIC). It shares the flexibility and the efficiency of the currently available spectral domain commercial simulators, while considering all metallizations to have finite thickness and finite conductivity. The method is successfully applied to a microelectromechanical system (MEMS) capacitive switch in the 1-50 GHz frequency range.

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Generalized polygonal basis functions for the electromagnetic simulation of complex geometrical planar structures

L. Knockaert, J. Sercu and D. De Zutter. "Generalized polygonal basis functions for the electromagnetic simulation of complex geometrical planar structures." 2001 MTT-S International Microwave Symposium Digest 01.2 (2001 Vol. II [MWSYM]): 1249-1252 vol.2.

This paper describes the generalization of the well known rectangular and triangular rooftop functions to polygonal subdomains. The rooftop functions are commonly used for the discretization of planar currents in electromagnetic simulators. The new generalized polygonal functions allow for a more efficient meshing of complex geometrical structures in terms of polygonal shaped cells. They naturally model the current flow in the polygonal cells, satisfy the current continuity relation and their usage significantly enhances the electromagnetic simulation performance for complex geometrical structures. The increased simulation performance is demonstrated for a complex RF board interconnection layout.

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FD-FD GSM technique for the CAD and optimization of combline filters

R. Lotz and F. Arndt. "FD-FD GSM technique for the CAD and optimization of combline filters." 2001 MTT-S International Microwave Symposium Digest 01.2 (2001 Vol. II [MWSYM]): 1253-1256 vol.2.

A combined frequency domain finite difference (FD-FD) generalized scattering matrix (GSM) technique is presented for the design and optimization of filters including 3D resonator structures, such as circular posts of partial waveguide height. This combination unites advantageously the flexibility of the FD method with the efficiency of the GSM technique. The formulation for the FD algorithm is based on the advanced combination of a direct subgrid technique with a locally conformal grid for modeling curved metallic boundaries. The flexibility and efficiency of the method is demonstrated at the example of the CAD of combline filters that are optimized using a genetic algorithm. The theory is verified by measurements.

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Electromagnetic modeling of multi-layer microwave circuits by the longitudinal decomposition approach

A. Kirilenko, D. Kulik, L. Rud, V. Tkachenko and P. Pramanick. "Electromagnetic modeling of multi-layer microwave circuits by the longitudinal decomposition approach." 2001 MTT-S International Microwave Symposium Digest 01.2 (2001 Vol. II [MWSYM]): 1257-1260 vol.2.

A system approach based on the transverse-resonance technique and well-equipped modeling system is used to calculate the eigen-mode spectrum of multiconductor lines with piece-wise continuous coordinate boundaries of their cross-section. The exact models of the multi-layer circuits are built with the mode-matching and generalized S-matrix techniques. Viability of the created program tools is demonstrated with the examples of a multi-turn loop inductor and a third-order low-pass filter.

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A novel cold-FET method for determining extrinsic capacitances using a capacitive transmission line model

Yeong-Lin Lai and Cheng-Tsung Chen. "A novel cold-FET method for determining extrinsic capacitances using a capacitive transmission line model." 2001 MTT-S International Microwave Symposium Digest 01.2 (2001 Vol. II [MWSYM]): 1261-1264 vol.2.

A novel cold-FET method using a capacitive transmission line (CTL) model to extract extrinsic capacitances for the small-signal equivalent circuit of field-effect transistors (FET's) is proposed. The extrinsic gate capacitance (C_{pg}) and drain capacitance (C_{pd}) of the FET's are extracted on the basis of the distributed CTL model and ABCD matrix representation for the depletion region beneath gate under the pinched-off cold-FET condition. The extraction method proposed is applied to obtain the small-signal equivalent circuit model for the FET's. The simulated S parameters using the CTL model exhibit great agreement with the measured S parameters.

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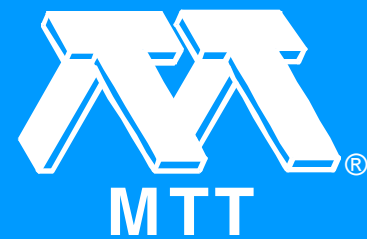
Modeling of 3-D planar conducting structures on lossy silicon substrate in high frequency integrated circuits

J. Zheng, J.-P. Li and A. Weisshaar. "Modeling of 3-D planar conducting structures on lossy silicon substrate in high frequency integrated circuits." 2001 MTT-S International Microwave Symposium Digest 01.2 (2001 Vol. II [MWSYM]): 1265-1268 vol.2.

This paper describes simple yet accurate models for 3-D planar conducting structures such as substrate contacts and bond pads in high frequency and mixed-signal integrated circuits on lossy silicon substrate. The modeling approach is based on a rigorous 3-D EM characterization followed by equivalent circuit model extraction. The simple equivalent circuit models for coupled conducting structures are based on the physical structure. The frequency response of the models shows good agreement with the EM solution.

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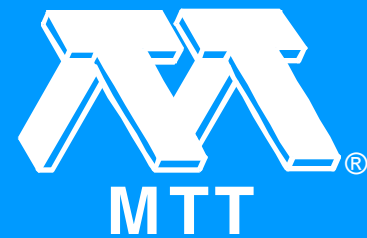
Modeling and investigation of instabilities in heterojunction interband tunnel diodes for microwave applications

A. Cidronali, G. Collodi, M. Deshpande, C. Toccafondi, N. El-Zein, G. Manes, V. Nair and H. Goronkin. "Modeling and investigation of instabilities in heterojunction interband tunnel diodes for microwave applications." 2001 MTT-S International Microwave Symposium Digest 01.2 (2001 Vol. II [MWSYM]): 1269-1272 vol.2.

The existence of Negative Differential Resistance (NDR) in tunneling diode has led to novel, quantum functional devices and circuits. The enhanced functionality of these devices enables design of both digital and analog circuits with reduced complexity, size and better performance. For many of these applications, the study of the stability criteria and the development of comprehensive CAD model is of great importance for both the design and the development of new devices. In this paper we present the results of the modeling and investigation of instability for InGaAs/InAlAs/InGaAs tunnel diodes having different dimensions. Experimental results, which confirm the conclusions, are presented.

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MOSFET bulk effect behaviour and estimation for microwave-frequency modeling

R.V. Reynisson, T.E. Kolding and T. Larsen. "MOSFET bulk effect behaviour and estimation for microwave-frequency modeling." 2001 MTT-S International Microwave Symposium Digest 01.2 (2001 Vol. II [MWSYM]): 1273-1276 vol.2.

This paper describes MOSFET bulk effect behaviour as a function of width and gate/drain bias. The conductance from the intrinsic bulk to the bulk straps is measured directly using a modified MOSFET device. Measurements confirm that the bulk conductance follows a linear relation with respect to device width and is dependent of both gate and drain bias. By extracting the bulk conductance using low frequency S-parameter measurements, the paper presents a method to identify which MOSFET layout gives the lowest bias dependency on bulk effects. Due to active area edge effects, fairly small finger widths appear to greatly simplify bulk effect modeling for RF applications. The validity of extracted bulk effects are investigated at microwave frequencies by comparing device simulations with measurements.

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A new analytical small-signal model of dual-gate GaAs MESFET

M. Ibrahim, B. Syrett and J. Bennett. "A new analytical small-signal model of dual-gate GaAs MESFET." 2001 MTT-S International Microwave Symposium Digest 01.2 (2001 Vol. II [MWSYM]): 1277-1280 vol.2.

The development of an analytical small-signal model for the intrinsic elements of a dual gate GaAs MESFET (DGMESFET) is described. The model is based on splitting the Z-parameters of each FET part analytically without any simplifications or assumptions. The model is extracted directly from the measured three-port S-parameters. No extra measurements are required, thus reducing the lengthy procedures needed to characterize the DGMESFET. Experimental verification of the new model is presented.



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Measurement-based extrinsic modeling of RF components

K. Naishadham. "Measurement-based extrinsic modeling of RF components." 2001 MTT-S International Microwave Symposium Digest 01.2 (2001 Vol. II [MWSYM]): 1281-1284 vol.2.

An understanding of the high-frequency parasitic and packaging effects of passive surface-mounted devices (SMDs) is required for robust equivalent circuit modeling of the device. In this paper, we develop a CAD model for SMD inductors on a CPW layout, which incorporates the non-ideal behavior associated with frequency dispersion, board layout, component parasitics, and the device packaging. The equivalent circuit parameters are extracted in closed-form from an accurate measurement of the S-parameters of the board-mounted SMD inductor, without the necessity for cumbersome optimization procedures normally followed in RF circuit synthesis.

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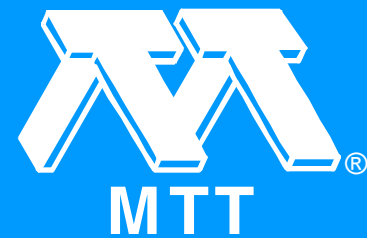
Design and implementation of micromachined lumped quadrature (90/spl deg/) hybrids

L.-H. Lu, S. Mohammadi, G.E. Ponchak, P. Bhattacharya and L.P.B. Katehi. "Design and implementation of micromachined lumped quadrature (90/spl deg/) hybrids." 2001 MTT-S International Microwave Symposium Digest 01.2 (2001 Vol. II [MWSYM]): 1285-1288 vol.2.

To reduce the chip size of a quadrature hybrid at frequencies below K-band, lumped components have been employed to replace the transmission line segments. Systematic analysis and design technique has been developed. For the first time, X-band lumped quadrature hybrids with low insertion loss and wide bandwidth have been fabricated using a micromachined process technology. Approximately, two order of magnitude area reduction has been achieved by this approach compared with distributed designs.

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Q-enhancement of spiral inductor with N/sup +/-diffusion patterned ground shields

Y.E. Chen, D. Bien, D. Heo and J. Laskar. "Q-enhancement of spiral inductor with N/sup +/-diffusion patterned ground shields." 2001 MTT-S International Microwave Symposium Digest 01.2 (2001 Vol. II [MWSYM]): 1289-1292 vol.2.

This paper discusses the quality factor enhancement by employing different patterned ground shields underneath the simple spiral inductor in a commercial BiCMOS technology. The effectiveness of the patterned ground shield technique depends heavily on the counter-effects between the reduction of substrate loss and the increase of parasitic capacitance. With proper choice of the shielding layer, the quality factor can achieve 21% enhancement for a 5-nH spiral inductor. The n/sup +/-diffusion layer is found to be the most effective layer for the patterned ground shield technique due to less associated parasitic capacitance.

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A design mapping formula of asymmetrical multi-element coupled line directional couplers

Joon-Bum Kil, Chul-Soo Kim, Kwan Sun Choi, Jun-Seok Park and Dal Ahn. "A design mapping formula of asymmetrical multi-element coupled line directional couplers." 2001 MTT-S International Microwave Symposium Digest 01.2 (2001 Vol. II [MWSYM]): 1293-1296 vol.2.

This paper presents a design mapping formula, which is the relation between performance specification and design parameters, for asymmetrical multi-section coupled transmission line directional coupler. The presented mapping function can provide convenience in its use and accurate design parameters for a given design specification. Simulations and experiments on designed three-, five-, and seven-element coupled line directional couplers with 16 dB/spl plusmn0.2 dB coupling show the validity of the presented design mapping formula.

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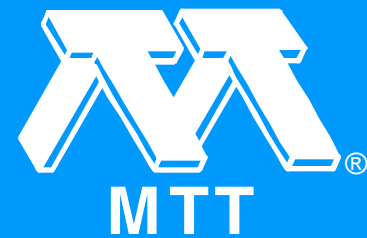


Abstracts

A general design formula of multi-section power divider based on singly terminated filter design theory

Sung-Won Lee, Chul-Soo Kim, Kwan Sun Choi, Jun-Seok Park and Dal Ahn. "A general design formula of multi-section power divider based on singly terminated filter design theory." 2001 MTT-S International Microwave Symposium Digest 01.2 (2001 Vol. II [MWSYM]): 1297-1300 vol.2.

A novel design formula of multi-section power divider is derived to obtain wide isolation performance. The derived design formula is based on the singly terminated filter design theory. This paper presents several simulation and experimental results of multi section power divider to show validity of the proposed design formula. Experiments show excellent performance of multi section power divider with multi-octave isolation characteristic.



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A new balanced amplifier using 6-port power divider

Jong-Sik Lim, Soon-Young Eom, Jae-Hee Han, Seong-Hun Kim, Deok-Hee Lee and Sangwook Nam. "A new balanced amplifier using 6-port power divider." 2001 MTT-S International Microwave Symposium Digest 01.2 (2001 Vol. II [MWSYM]): 1301-1304 vol.2.

A new balanced amplifier using the 6-port power divider is proposed. The power divider used in this balanced amplifier has a totally planar structure, and needs no internal resistor and termination. The measured insertion loss of the 2-port back-to-back power divider/combiner for the balanced amplifier is around 0.7 dB, which is a reasonable value at 10 GHz. In power measurement, the 1 dB output power compression point of the proposed balanced amplifier is twice that of the single-ended amplifier as predicted. The measured performances show that the proposed amplifier can be applied as a new balanced amplifier.



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60 GHz coplanar waveguide couplers and slotline transition on polished beryllium oxide

B. Lakshminarayanan, T. Weller and M. Oldenburg. "60 GHz coplanar waveguide couplers and slotline transition on polished beryllium oxide." 2001 MTT-S International Microwave Symposium Digest 01.2 (2001 Vol. II [MWSYM]): 1305-1308 vol.2.

This paper presents results for mm-wave coplanar waveguide couplers and a low loss slotline transition that are printed on polished beryllium oxide (BeO). BeO offers excellent microwave properties including a low loss tangent (0.0003) and high thermal conductivity. Included is the design of an optimized quadrature coupler with insertion loss around 3.7 dB at 60 GHz.

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Integration of optimized low-pass filters in band-pass filters for out-of-band improvement (2001 Vol. II [MWSYM])

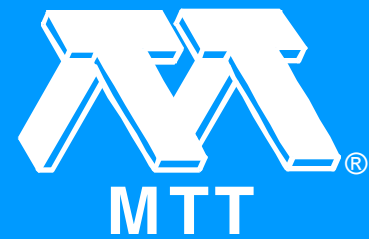
C. Quendo, C. Person, E. Rius and M. Ney. "Integration of optimized low-pass filters in band-pass filters for out-of-band improvement (2001 Vol. II [MWSYM])." 2001 MTT-S International Microwave Symposium Digest 01.2 (2001 Vol. II [MWSYM]): 1309-1312 vol.2.

We propose an original structure for the design of high performance filters with simultaneously controlled band-pass and band-reject responses. The band-reject response is controlled due to the integration of low-pass structure. Thus, the spurious resonances of the band-pass filter are rejected up to the low-pass filter ones. In this way, we have to optimize the response of the low-pass structure in order to control the out-of-band response of the band-pass filters.

Non adjacent resonators effects on coupling and resonant frequency in combline filters

M. El Sabbagh, K. Zaki and M. Yu. "Non adjacent resonators effects on coupling and resonant frequency in combline filters." 2001 MTT-S International Microwave Symposium Digest 01.2 (2001 Vol. II [MWSYM]): 1313-1316 vol.2.

Resonant frequencies and coupling coefficient between two combline cavities, in the presence of other cavities, are obtained accurately using mode matching technique. The effect of iris dimensions and position on the electric and magnetic coupling is rigorously investigated. The corresponding data for two isolated cavities are included for comparison.



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Evanescent-mode bandpass filters based on ridged waveguide sections and inductive strips

A. Kirilenko, L. Rud, V. Tkachenko and D. Kulik. "Evanescent-mode bandpass filters based on ridged waveguide sections and inductive strips." 2001 MTT-S International Microwave Symposium Digest 01.2 (2001 Vol. II [MWSYM]): 1317-1320 vol.2.

A new type of evanescent-mode filter based on ridged waveguide sections is proposed. Insertion of additional inductive strips between ridge sections allows reducing the longitudinal filter size and achieving a sufficient improvement of its stopband characteristics. The features of the developed software and results of its application for filter synthesis and optimization are discussed.

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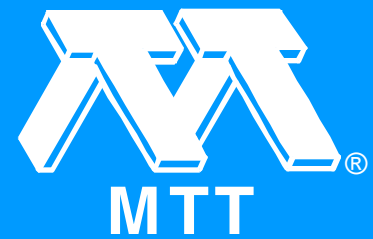
A compact elliptic-function BPF using triple-mode cavities for terrestrial digital television transmitters

K. Konno, M. Kubota and Y. Iwamoto. "A compact elliptic-function BPF using triple-mode cavities for terrestrial digital television transmitters." 2001 MTT-S International Microwave Symposium Digest 01.2 (2001 Vol. II [MWSYM]): 1321-1324 vol.2.

A compact six-pole elliptic-function BPF for terrestrial digital television transmitters is developed using two triple-mode cavities. The BPF needs a very sharp cut-off response to reject neighboring channels. Therefore, it needs to achieve exact coupling parameters without parasitic couplings. A new coupling method is presented to achieve these couplings independently of each other through one wall between two triple-mode cavities. A compact BPF test model which uses this method has resulted in good performance for digital television transmitters.

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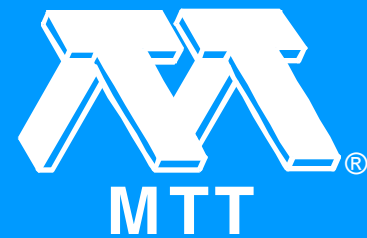
Circular-to-rectangular waveguide diplexers

T. Shen, K.A. Zaki and T.G. Dolan. "Circular-to-rectangular waveguide diplexers." 2001 MTT-S International Microwave Symposium Digest 01.2 (2001 Vol. II [MWSYM]): 1325-1328 vol.2.

Design of circular-to-rectangular waveguide diplexers with circular waveguide as common port is presented. A ridged circular-to-rectangular waveguide T-junction is proposed as diplexing manifold. Full-wave optimization is used in the diplexer design. A Ka-band H-plane circular-to-rectangular waveguide diplexer is designed. Measured results are in good agreement with computed results.

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K-band monolithic double-balanced resistive mixer with integrated balanced oscillator

K.S. Ang, I.D. Robertson, Dong-sik Kim, Moon-Cheul Ju and Hwa-Chang Seo. "K-band monolithic double-balanced resistive mixer with integrated balanced oscillator." 2001 MTT-S International Microwave Symposium Digest 01.2 (2001 Vol. II [MWSYM]): 1329-1332 vol.2.

A balanced oscillator has been used to provide the balanced LO signals for a double-balanced resistive mixer, in an integrated monolithic circuit. This first reported balanced oscillator/resistive mixer chip operates at 25.5 GHz with low levels of LO leakage and spurious intermodulation products.

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Fundamental limitations of conversion loss and output power on an even harmonic mixer with junction capacitance

K. Itoh and M. Shimosawa. "Fundamental limitations of conversion loss and output power on an even harmonic mixer with junction capacitance." 2001 MTT-S International Microwave Symposium Digest 01.2 (2001 Vol. II [MWSYM]): 1333-1336 vol.2.

An even harmonic mixer with an anti-parallel diode pair is an effective technique for low spurious transmitters and direct conversion receivers. This paper describes general representation of conversion loss and output power on the even harmonic mixer with junction capacitance. For the anti-parallel diode pair, the switch model with resistance and non-linear capacitance is employed for the analytical approach. The analyses clarify fundamental limitation of the characteristics on the even harmonic mixer with the optimized junction dimension. This paper contributes to the design methodology for the even harmonic mixer used in millimeter wave systems.

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A K-band subharmonic down-converter in a GaAs metamorphic HEMT process

B. Matinpour, N. Lal, J. Laskar, R.E. Leoni, III and C.S. Whelan. "A K-band subharmonic down-converter in a GaAs metamorphic HEMT process." 2001 MTT-S International Microwave Symposium Digest 01.2 (2001 Vol. II [MWSYM]): 1337-1339 vol.2.

In this paper, we present the first implementation of a K-band subharmonic down-converter fabricated in a 0.18- μm GaAs Metamorphic High Electron Mobility Transistor (MHEMT) process. The low noise and high gain characteristics of the MHEMTs at K-band allow for the integration of a single-stage amplifier with a subharmonic mixer resulting in low-power broadband performance. The subharmonic mixer exhibits conversion loss of 13 dB and IIP3 of +8 dBm from 23 to 30 GHz. With the addition of the amplifier, the down-converter exhibits a conversion loss of 3 dB, noise figure of 5 dB, and IIP3 of -5 dBm from 26 to 30 GHz. The single-stage amplifier exhibits InP-like performance with gain of 11 dB, NF of 1.5 dB, and dc power consumption of 15 mW.

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Performance comparison of single and dual stage MMIC limiters

J.M. Carroll. "Performance comparison of single and dual stage MMIC limiters." 2001 MTT-S International Microwave Symposium Digest 01.2 (2001 Vol. II [MWSYM]): 1341-1344 vol.2.

This paper details a performance comparison between single and dual stage MMIC PIN Limiters. The two limiters were designed for the best 3 to 28 GHz small signal performance with minimum die size possible. The dual stage limiter was 32% larger than the single stage but provided many performance benefits. Simulations and measurements of the fabricated devices give insight into critical performance trade-offs valuable for future limiter design efforts.

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Novel frequency doubler using feedforward for fundamental frequency component suppression

N. Siripon, M. Chongcheawchamnan and I.D. Robertson. "Novel frequency doubler using feedforward for fundamental frequency component suppression." 2001 MTT-S International Microwave Symposium Digest 01.2 (2001 Vol. II [MWSYM]): 1345-1348 vol.2.

Feedforward techniques are applied to a microwave frequency doubler for the first time. The feedforward branch is composed of 2 couplers and 1 phase shifter to adjust the phase and cancel the fundamental signal at the output of a single-ended doubler. This technique is experimentally demonstrated in the 1-to-2 GHz frequency. Compared to the single-ended doubler, the experimental results show more than 50 dBc fundamental signal suppression with only a small drop in conversion gain.

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A compact T/R switching circuit using quadrature couplers and drain-driven HPAs

H. Uchida, M. Nii, Y. Tsukahara, M. Miyazaki and Y. Itoh. "A compact T/R switching circuit using quadrature couplers and drain-driven HPAs." 2001 MTT-S International Microwave Symposium Digest 01.2 (2001 Vol. II [MWSYM]): 1349-1352 vol.2.

A novel T/R switching circuit is proposed for microwave T/R modules. It consists of balanced high-power amplifiers with quadrature couplers, and a low-noise amplifier which is connected to the isolation port of the coupler. In RX-mode, the HPAs are switched off by controlling drain voltage of FETs. A prototype C- to Ku-band T/R switching circuit has been fabricated, and the validity of the switching method has been confirmed experimentally.



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Comparison of different adaptation algorithms for adaptive digital predistortion based on EDGE standard

K.C. Lee and P. Gardner. "Comparison of different adaptation algorithms for adaptive digital predistortion based on EDGE standard." 2001 MTT-S International Microwave Symposium Digest 01.2 (2001 Vol. II [MWSYM]): 1353-1356 vol.2.

Radio Frequency (RF) power amplifiers require linearization in order to reduce adjacent channel intermodulation (IM) distortion. Adaptive digital predistortion is one promising linearization technique that can be employed. There are, however, a lot of adaptation algorithms involved with this technique, namely polynomial and look-up table. This paper assesses four methods, which are the combination of least square curve fitting and least mean square (polynomial) and also polar, secant and linear (look-up table). Their convergence time and mean magnitude of error improvement achieved by using the standard set by EDGE system are compared.

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An internally matched LTCC 3G W-CDMA 180 watt LDMOS power amplifier

J. Estes, P. Piel, G. Shapiro, A. Pavio, M. Hurst, J. Call and G. Funk. "An internally matched LTCC 3G W-CDMA 180 watt LDMOS power amplifier." 2001 MTT-S International Microwave Symposium Digest 01.2 (2001 Vol. II [MWSYM]): 1357-1358 vol.2.

A wide band CDMA LDMOS power transistor, with internal RF matching and bias networks, fabricated on LTCC (Low Temperature Cofired Ceramic) substrates, has been developed. The internally matched packaged device can be configured to deliver output power of 180 watts, while providing third order inter-modulation distortion products less than -40 dBc, 20% efficiency, and 12 dB of gain. The terminal impedances of the packaged LDMOS transistor, at the gate and drain leads respectively, are greater than 5 Ω . The LTCC elements each contain embedded passive L-C circuitry, forming the input and output matching networks. These networks are designed to transform to a high level of impedance, to the source and load impedance targets required by the devices in order to achieve optimal wide band CDMA performance.

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Effect of efficiency optimization on linearity of LINC amplifiers with CDMA signal

Jaehyok Yi, Youngoo Yang and Bumman Kim. "Effect of efficiency optimization on linearity of LINC amplifiers with CDMA signal." 2001 MTT-S International Microwave Symposium Digest 01.2 (2001 Vol. II [MWSYM]): 1359-1362 vol.2.

The linear and efficient power amplification can be achieved with LINC (linear amplification with nonlinear components) amplifiers because RF power amplifiers deal with constant envelope signals in LINC systems. To increase the average efficiency in some modulation schemes with high peak to average ratio, reactance termination in combining circuit is used. However, the shunt reactance termination degrades the linearity performance of LINC. This work shows the effect of efficiency optimization with reactance termination on ACLR (Adjacent Channel Leakage Ratio) of LINC amplifiers with WCDMA modulation systems using envelope simulation.

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Ultra-linear distributed class-AB LDMOS RF power amplifier for base stations

M.P. van der Heijden, H.C. de Graaff, L.C.N. de Vreede, J.R. Gajadharsing and J.N. Burghartz.
"Ultra-linear distributed class-AB LDMOS RF power amplifier for base stations." 2001 MTT-S International Microwave Symposium Digest 01.2 (2001 Vol. II [MWSYM]): 1363-1366 vol.2.

This paper describes a distributed amplifier, employing multiple parallel-connected LDMOS devices with optimized overall transconductance for class-AB operation. In comparison to a conventional amplifier under class-A and class-AB conditions the design method results in a significant linearity improvement over a large dynamic range. Measurements demonstrate a linearity improvement of 20 dB in 3/sup rd/-order intermodulation distortion (IM3) and 10 dB in adjacent channel power ratio (ACPR) for a wideband CDMA signal. Consequently, a reduction in the required back-off level has been achieved.

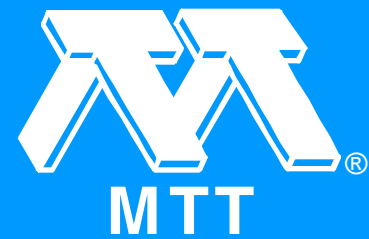
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Experimental investigation on efficiency and linearity of microwave Doherty amplifier

Youngoo Yang, Jaehyok Yi, Young Yun Woo and Bumman Kim. "Experimental investigation on efficiency and linearity of microwave Doherty amplifier." 2001 MTT-S International Microwave Symposium Digest 01.2 (2001 Vol. II [MWSYM]): 1367-1370 vol.2.

We have investigated the microwave Doherty amplifier, testing for efficiency and linearity. For the experiment, a 1.4 GHz Doherty amplifier has been implemented using a silicon LDMOSFET. The Doherty amplifier-I (a combination of a class B carrier amplifier and a class C peaking amplifier) and the Doherty amplifier-II (a combination of a class AB carrier amplifier and a class C peaking amplifier) have been compared with class B and AB amplifiers, respectively, using single-tone, two-tone, and forward-link CDMA signals. It demonstrated the superior performance of Doherty amplifiers. The results provide a topology selection guide of the CDMA base station power amplifier to achieve both linearity and efficiency enhancements.



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Numerical investigation of vertical contactless transitions for multilayer RF circuits

P. Moretti, J.P. Starski, B.I. Svensson and L. Manholm. "Numerical investigation of vertical contactless transitions for multilayer RF circuits." 2001 MTT-S International Microwave Symposium Digest 01.2 (2001 Vol. II [MWSYM]): 1371-1374 vol.2.

This paper presents some concepts for contactless transitions between different planar transmission lines. These types of transitions are important for use in e.g. multilayer designs. Another important reason to avoid galvanic connections at RF is that they may generate passive intermodulation products (PIM), which can be a serious problem in multifrequency systems. The investigated transitions operate in the extended GSM 900 band (880-960 MHz).

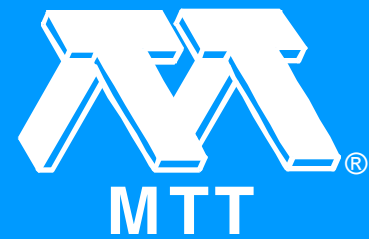
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Direct conversion receiver for digital beamforming at 8.45 GHz

K. Mori, H. Arai, Y. Qian and T. Itoh. "Direct conversion receiver for digital beamforming at 8.45 GHz." 2001 MTT-S International Microwave Symposium Digest 01.2 (2001 Vol. II [MWSYM]): 1375-1378 vol.2.

Direct conversion receiver for digital beamforming (DBF) at 8.45 GHz for next generation wireless telecommunication is presented. In this proposed system, the quadrature hybrid and tuning circuit are partially constructed by digital techniques for the simplification of hardware. We demonstrate the direct conversion FET second harmonic mixers without DC bias at RF part. We also examine this proposed receiver's ability to function as a digital beam former. In this result, the digital beam forming can be realize that side lobe level is below -10 dB and the half power beam width is about 60/spl deg/, in case of scanning range is limited /spl plusmn/20/spl deg/ by using this proposed receiver.



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Reflective antenna arrays based on shorted ring slots

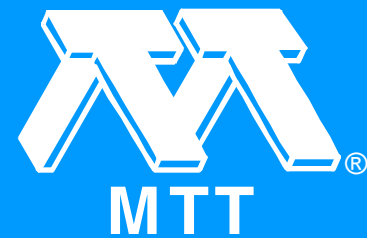
A.E. Martynyuk and J.I. Martinez Lopez. "Reflective antenna arrays based on shorted ring slots." 2001 MTT-S International Microwave Symposium Digest 01.2 (2001 Vol. II [MWSYM]): 1379-1382 vol.2.

Reflective arrays based on shorted ring slots are analyzed. It is proven that reflection angle for the normally incident circularly polarized wave can be effectively changed by proper situation of the conductive shorts. Thus, phased arrays with wide-angle scanning can be built using arrays of shorted ring slots.

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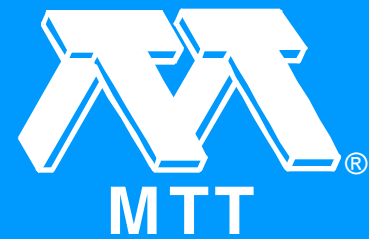
Analysis and design of active antenna arrays

K. Liu, S.M. El-Ghazaly, V. Nair, M. Deshpande, N. El-Zein and H. Goronkin. "Analysis and design of active antenna arrays." 2001 MTT-S International Microwave Symposium Digest 01.2 (2001 Vol. II [MWSYM]): 1383-1386 vol.2.

In this paper, the FDTD method is extended successfully to analyze active antennas using Z-transform method for small signal model and by a stable scheme for large signal model. The two approaches are validated by comparison with analytical impedance expression in frequency domain. Through these approaches, we analyze active antennas and antenna arrays containing tunnel diodes. Effects of various device parameters are investigated in order to find desired oscillations. Single and array active antennas are designed and tested. Experimental and simulated results are given and compared.

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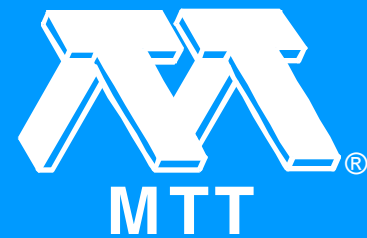
Direction finding using spectral estimation with arbitrary antenna arrays

T. Do-Hong, W. Fisch and P. Russer. "Direction finding using spectral estimation with arbitrary antenna arrays." 2001 MTT-S International Microwave Symposium Digest 01.2 (2001 Vol. II [MWSYM]): 1387-1390 vol.2.

This paper presents direction-finding techniques for smart antennas based on conformal and irregular antenna arrays. Methods of spectral estimation are considered to estimate directions-of-arrival (azimuth and elevation) using two-dimensional arrays and three-dimensional arrays (conformal arrays). The effects of arbitrary arrays on the performance and on the resolution of direction-finding algorithms are illustrated by simulation results.

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Broadband planar antenna with low side lobes levels capabilities and high cross-polarisation rejection for DBS reception

L. Bekraoui. "Broadband planar antenna with low side lobes levels capabilities and high cross-polarisation rejection for DBS reception." 2001 MTT-S International Microwave Symposium Digest 01.2 (2001 Vol. II [MWSYM]): 1391-1394 vol.2.

This contribution describes a novel microstrip array antenna for DBS reception. Specific features are low side lobes levels as well as high cross-polarisation rejection. For the former purpose, a specific arrangement of the antenna elements along the elevation axis is used, enabling a tapering of the array characteristics in the azimuth direction. Based on a virtual symmetry, appropriate broadband feeding networks are designed, eliminating phase errors. Moreover, the two feeding networks, each corresponding to a polarisation state, are separated by a ground plane, which leads to a very good decoupling between the ports.

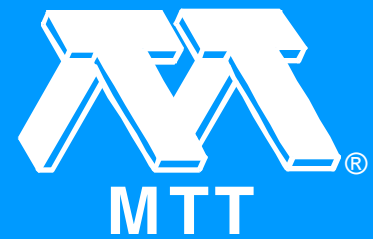
Click on title for a complete paper.



A low noise active integrated antenna receiver for monopulse radar applications

S. Lin, Y. Qian and T. Itoh. "A low noise active integrated antenna receiver for monopulse radar applications." 2001 MTT-S International Microwave Symposium Digest 01.2 (2001 Vol. II [MWSYM]): 1395-1398 vol.2.

A low noise active integrated antenna receiver is presented. This new design consists of a pair of low noise amplifiers (LNA) integrated on each feed of a dual-feed planar quasi-Yagi antenna. The outputs of the LNAs are combined to form a sum and difference radiation pattern suitable for monopulse radar applications. Simulation and measurement methodology for designing a low noise active integrated antenna receiver is also presented. A peak gain of 7.7 dB and minimum noise figure of 3.6 dB is measured for a C-band prototype.



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A quasi-optical linearizer

K.Y. Sung, B. Elamran and W.A. Shiroma. "A quasi-optical linearizer." 2001 MTT-S International Microwave Symposium Digest 01.2 (2001 Vol. II [MWSYM]): 1399-1401 vol.2.

A quasi-optical linearizer array with bias controllable AM-AM and AM-PM predistortion characteristics is presented. The 4/spl times/4 array of Schottky diodes demonstrates 2.5 dB of gain expansion and 25/spl deg/ of phase compensation at L band.

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Study of design parameters in waveguide-based spatial power combining amplifier arrays using FDTD

M. Ozkar, G. Lazzi and A. Mortazawi. "Study of design parameters in waveguide-based spatial power combining amplifier arrays using FDTD." 2001 MTT-S International Microwave Symposium Digest 01.2 (2001 Vol. II [MWSYM]): 1403-1406 vol.2.

Performance measures such as active reflection coefficients, inter-element coupling and excitation uniformity for spatial power combining arrays are investigated. A coax-fed patch antenna array inside an oversized dielectric loaded waveguide is analyzed using a standard finite difference time domain (FDTD) approach with unsplit perfectly matched layer (PML) formulation. Results for a passive 4/spl times/4 waveguide-based quasi-optical array are presented as an example. The effects of design parameters (such as inter-element spacing and the distance of the array to the waveguide walls) on the performance of the array has been investigated for the 4/spl times/4 array example.

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Broadband analysis of a D-band holographic power combining circuit

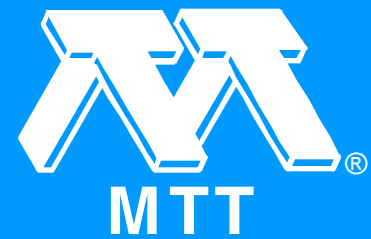
M. Hoft, J. Weinzierl and R. Judaschke. "Broadband analysis of a D-band holographic power combining circuit." 2001 MTT-S International Microwave Symposium Digest 01.2 (2001 Vol. II [MWSYM]): 1407-1410 vol.2.

Holography is a promising technique for power combining applications in the frequency range of short millimeter and submillimeter waves. In this paper, a quasi-optical holographic power combining circuit is investigated. The hologram is designed for 150 GHz and has an efficiency of 92.5% with a 90% bandwidth of 5.3%. With help of a broadband waveguide power splitter and a vector field measurement system, the circuit is analyzed.

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"Index of Authors (2001 Vol. II [MWSYM])." 2001 MTT-S International Microwave Symposium Digest 01.2 (2001 Vol. II [MWSYM]): 1441-1448.



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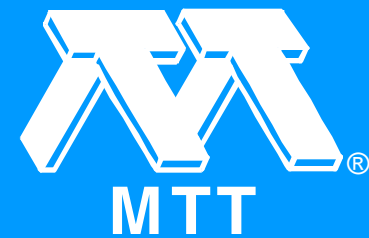
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Front Cover (Vol. III [MWSYM])

"Front Cover (Vol. III [MWSYM])." 2001 MTT-S International Microwave Symposium Digest 01.3 (2001 Vol. III [MWSYM]): i-ii.



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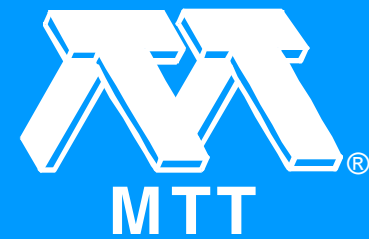
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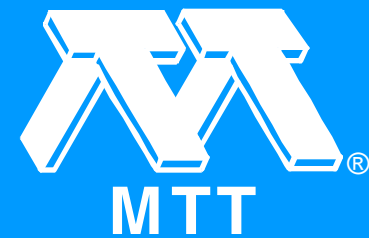
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Technical Program Schedule (2001 Vol. III [MWSYM])

"Technical Program Schedule (2001 Vol. III [MWSYM])." 2001 MTT-S International Microwave Symposium Digest 01.3 (2001 Vol. III [MWSYM]): ix-xxiii.



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Low phase noise, fully integrated monolithic VCO in X band based on HBT technology

Z. Ouarch, F. Arlot, M. Borgarino, M. Prigent, L. Bary and M. Camiade. "Low phase noise, fully integrated monolithic VCO in X band based on HBT technology." 2001 MTT-S International Microwave Symposium Digest 01.3 (2001 Vol. III [MWSYM]): 1415-1418 vol.3.

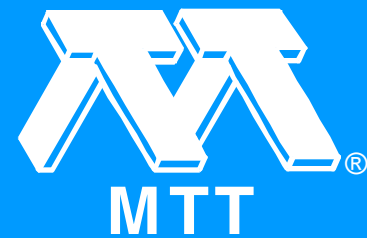
This paper presents a very low phase noise wide band fully integrated VCO in X band. It is based on UMS HBT technology (HB20P process). This circuit has been realized in the frame of ARGOS project in order to carry out a low phase noise frequency synthesizer. HB20P transistor and varactor nonlinear models have been extracted from pulsed measurements. Furthermore, HBT low frequency noise measurements have been performed to evaluate noise sources and then to optimize the operating point in the design. According to these characterizations, we have realized a fully MMIC VCO providing good phase noise performances (-90 dBc/Hz @ 100 KHz), in a wide frequency band (15%) and in a wide temperature range ($-40/\text{spl deg/C} < T < +65/\text{spl deg/C}$).

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Conditions for broadband MMIC voltage-controlled oscillators based on theory and experiments

A. Megej, K. Beilenhoff and H.L. Hartnagel. "Conditions for broadband MMIC voltage-controlled oscillators based on theory and experiments." 2001 MTT-S International Microwave Symposium Digest 01.3 (2001 Vol. III [MWSYM]): 1419-1422 vol.3.

A systematic study of maximally broadband VCO designs is undertaken. The theoretical investigations lead to the practical realization of two fully monolithically integrated VCOs based on reflection-type and feedback design techniques. Employing efficient diode tuning, the practical implementations of PHEMT-MMICs exhibit a variation of output frequency of 30% and 45%, respectively.



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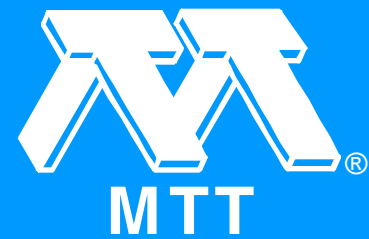
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Solid-state high power RF oscillator

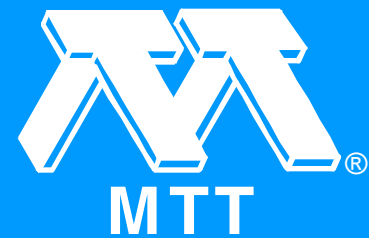
A. Gitsevich, D. Kirkpatrick and L. Dymond, Jr.. "Solid-state high power RF oscillator." 2001 MTT-S International Microwave Symposium Digest 01.3 (2001 Vol. III [MWSYM]): 1423-1426 vol.3.

A new kind of RF solid-state oscillator design is observed. The oscillator has two feedback loops, which provide a safe working condition for the power transistor at high levels of RF output power. The oscillator uses a high power LDMOS transistor, which provides output power greater than 65 W and efficiency better than 65% at the operating frequency of 915 MHz. The oscillator is designed using microstrip lines and lumped components on Rogers R03010/sup TM/ substrate.

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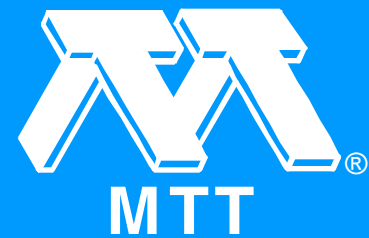
High-power AlGa_N/Ga_N FET-based VCO sources

J.B. Shealy, J.A. Smart and J.R. Shealy. "High-power AlGa_N/Ga_N FET-based VCO sources." 2001 MTT-S International Microwave Symposium Digest 01.3 (2001 Vol. III [MWSYM]): 1427-1430 vol.3.

The first report of multi-watt AlGa_N/Ga_N FET-based voltage-controlled oscillators (VCO's) with high efficiency is presented. Varactor-tuned oscillators implemented using distributed networks oscillate at 3 GHz with high output power (2.7 w), high efficiency (27%), high supply voltage range (3.5 V to 30 V) and high tuning bandwidth (13%) over a control voltage range from 1 to 9 V. The measured output power and circuit efficiency are examined as a function of supply voltage. These results indicate high-power AlGa_N/Ga_N-based VCO's may be used as high-efficiency sources for radio communications.

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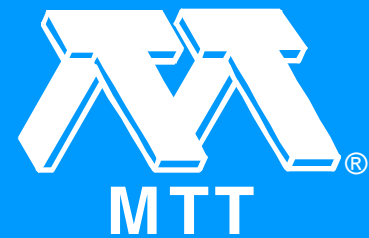
Reduced flicker noise in microwave oscillators using feedforward amplifiers

J.K.A. Everard and C. Broomfield. "Reduced flicker noise in microwave oscillators using feedforward amplifiers." 2001 MTT-S International Microwave Symposium Digest 01.3 (2001 Vol. III [MWSYM]): 1431-1434 vol.3.

Transposed flicker noise removal is demonstrated in a 7.6 GHz microwave oscillator for offsets greater than 10 kHz. This is achieved by using a GaAs based feedforward power amplifier as the oscillation sustaining stage. 20 dB noise suppression is demonstrated at 12.5 kHz offset when the error correcting amplifier is switched on. The phase noise rolls-off at $(1/\text{spl } \Delta F)^2$ for offsets greater than 10 kHz and is therefore set by the thermal noise to within 0-2 dB of the theoretical minimum.

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A wideband voltage-tunable dielectric resonator oscillator controlled by a piezoelectric transducer

Tae-Yeoul Yun, Kai Chang and R.S. Tahim. "A wideband voltage-tunable dielectric resonator oscillator controlled by a piezoelectric transducer." 2001 MTT-S International Microwave Symposium Digest 01.3 (2001 Vol. III [MWSYM]): 1435-1437 vol.3.

A new voltage-controlled dielectric resonator oscillator (VCDRO) is described. A piezoelectric transducer (PET) is used to vary the oscillation frequency by perturbing the electromagnetic fields of the DR. The measured frequency tuning is from -2.0 to +1.7% about the center frequency of 11.78 GHz. The tuning bandwidth is slightly less than that of a mechanical tuning using a micrometer-head controlled tunable DRO with a tuning range of -3.1 to +1.6%. To our knowledge, this is the largest electronic tuning range reported to date for a VCDRO.

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Compact high-order planar ring-resonator filters optimized in noise in coplanar technology

L. Nenert, L. Billonnet, B. Jarry, P. Guillon, C. Quendo, E. Rius and G. Tanne. "Compact high-order planar ring-resonator filters optimized in noise in coplanar technology." 2001 MTT-S International Microwave Symposium Digest 01.3 (2001 Vol. III [MWSYM]): 1441-1444 vol.3.

This paper deals with technological considerations for the compact design of general planar ring-resonator structures that use active elements for frequency tuning and losses compensation. With our approach, noise performance optimization is simultaneously led by purely analytical means. The technique is first applied to a one-pole tunable ring-resonator structure for which we discuss both microstrip and coplanar implementations. We underline the ease in implementing such structures in coplanar technologies and validate our approach with measured results of a two-pole version.

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Tunable active filters having multilayer structure using LTCC (2001 Vol. III [MWSYM])

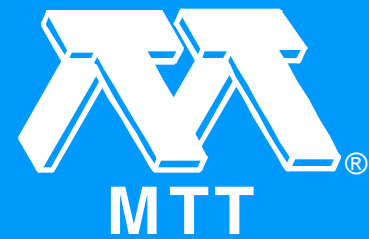
K. Kageyama, K. Saito, H. Murase, H. Utaki and T. Yamamoto. "Tunable active filters having multilayer structure using LTCC (2001 Vol. III [MWSYM])." 2001 MTT-S International Microwave Symposium Digest 01.3 (2001 Vol. III [MWSYM]): 1445-1448 vol.3.

Two types of tunable filter have been developed at 400 MHz and 800 MHz frequency band respectively. These filters have been fabricated with LTCC (low temperature cofired ceramics) multilayer technologies assisted by varactor diodes. Filter size is 5.6/spl times/5.6/spl times/3.0 mm. Each filter has about 11% and 13% tuning range of frequency with controlling voltage of 1-4 V, IL<2.0 dB, and has attenuation more than 40 dB at fo+/-30% respectively. Temperature stability data is also discussed.

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Full wave analysis and design of RF tunable filters

Jian Xu, Xiao-Peng Liang and K. Shamsaifar. "Full wave analysis and design of RF tunable filters." 2001 MTT-S International Microwave Symposium Digest 01.3 (2001 Vol. III [MWSYM]): 1449-1452 vol.3.

In this paper, a systematic design method for the finline structure tunable filter is presented based on filter synthesis and the full wave analysis using Ansoft EM simulation software HFSS. The varactor effects have been discussed. Two filter examples, one in Ka- and the other in K-band, are built and tested to verify the design. The measurement results are in agreement with the simulations.

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Tunable RF filters using thin film barium strontium titanate based capacitors

A. Tombak, F.T. Ayguavives, J.-P. Maria, G.T. Stauf, A.I. Kingon and A. Mortazawi. "Tunable RF filters using thin film barium strontium titanate based capacitors." 2001 MTT-S International Microwave Symposium Digest 01.3 (2001 Vol. III [MWSYM]): 1453-1456 vol.3.

Tunable lowpass and bandpass filters based on barium strontium titanate (BST) capacitors are reported. For the lowpass filter, 40% tunability was achieved at 9 V. Intermodulation distortion generated by the lowpass filters was also measured and predicted using a nonlinear model for the BST capacitors. The bandpass filter showed 45% tunability with an applied DC bias of 10 V.

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Hybrid resonator microstrip line electrically tunable filter

Xiao-Peng Liang and Yongfei Zhu. "Hybrid resonator microstrip line electrically tunable filter." 2001 MTT-S International Microwave Symposium Digest 01.3 (2001 Vol. III [MWSYM]): 1457-1460 vol.3.

A novel hybrid resonator microstrip line electrically tunable filter is presented in this paper. The tunable filter has mixed combline resonators and a hairpin like resonator. With this mixed resonator filter, transmission zeros can be obtained on each side of the passband. This elliptic function filter response is achieved without any nonadjacent coupling. Parascan/sup TM/ dielectric material varactors are then used at the end of each resonator, so that the filter passband is electrically tunable. A 4-pole design example is provided. The transmission zeros are clearly shown in both simulation and measurement.

Design of tunable ferroelectric filters with a constant fractional band width

I. Vendik, O. Vendik, V. Pleskachev, A. Svishchev and R. Wordenweber. "Design of tunable ferroelectric filters with a constant fractional band width." 2001 MTT-S International Microwave Symposium Digest 01.3 (2001 Vol. III [MWSYM]): 1461-1464 vol.3.

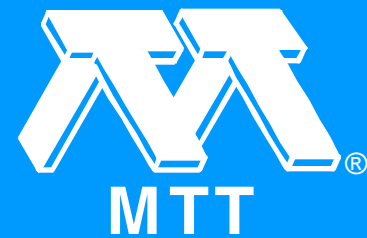
The main principle of design of tunable ferroelectric filters with a constant fractional band width in the tuning range are discussed. Lumped ferroelectric capacitors are used as the tunable components of the microstrip filter. The limitation of the filter performance is determined by the commutation quality factor of the ferroelectric varactor. The influence of the loss factor of the ferroelectric capacitor is analyzed. The 3-pole 1% fractional band pass filter with a 3 band width tuning range without a degradation of the characteristics is designed.

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Design of CT and CQ filters using approximation and optimization (2001 Vol. III [MWSYM])

R. Levy and P. Petre. "Design of CT and CQ filters using approximation and optimization (2001 Vol. III [MWSYM])." 2001 MTT-S International Microwave Symposium Digest 01.3 (2001 Vol. III [MWSYM]): 1467-1470 vol.3.

A new design technique for CT filters has been derived commencing from the well-known Chebyshev all-pole prototype filter. One or more finite frequency poles may be introduced by cross coupling across sets of three nodes, and the filter re-matched by approximate compensation of the element values. Any general optimizer may then be used to obtain a nearly perfect result without undue concern over convergence failures. The method may be combined with a similar previous theory for CQ sections.



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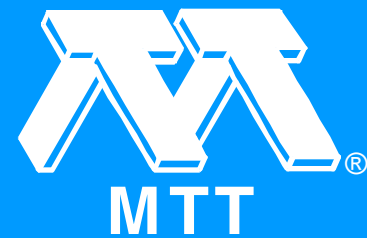


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A method for the direct synthesis of general sections

T. Reeves, N. Van Stigt and C. Rossiter. "A method for the direct synthesis of general sections." 2001 MTT-S International Microwave Symposium Digest 01.3 (2001 Vol. III [MWSYM]): 1471-1474 vol.3.

A network synthesis method is presented that permits the direct synthesis of an arbitrary number of inline general sections from the filter impedance function.



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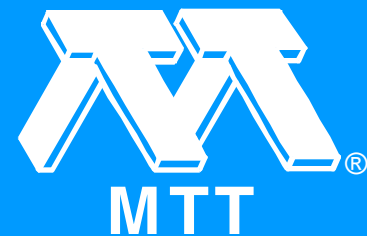
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Temperature characteristics of combline resonators and filters

Hui-Wen Yao and A.E. Atia. "Temperature characteristics of combline resonators and filters." 2001 MTT-S International Microwave Symposium Digest 01.3 (2001 Vol. III [MWSYM]): 1475-1478 vol.3.

Temperature characteristics of combline resonators and filters are investigated with a full wave simulation. For a given combline resonator, perfect temperature compensations may be achieved at two different resonant frequencies by adjusting the tuning screws. A 4 GHz 8-pole filter is designed and tested. Satisfactory temperature compensation is obtained.

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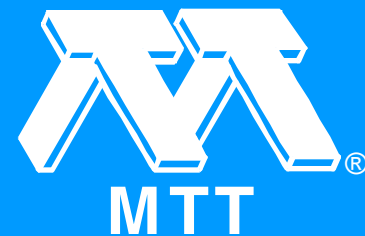


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Periodic structures for original design of voluminous and planar microwave filters

B. Lenoir, D. Baillargeat, S. Verdeyme, P. Guillon, C. Zanchi and J. Puech. "Periodic structures for original design of voluminous and planar microwave filters." 2001 MTT-S International Microwave Symposium Digest 01.3 (2001 Vol. III [MWSYM]): 1479-1482 vol.3.

The main objective of this paper is to demonstrate that a periodic structure can be used to design filters at millimeter frequency band. Theoretical analyses are performed applying the Finite Element Method (FEM) to design a volumic millimeter-wave filter at 35 GHz and a planar microwave filter at 6 GHz. The devices are built and tested at the IRCOM. Theoretical results are compared with success to experimental ones.



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A design of planar elliptic bandpass filter using SMD type partially metallized rectangular dielectric resonators

Hee Yong Hwang, Sang-Won Yun and Ik-Soo Chang. "A design of planar elliptic bandpass filter using SMD type partially metallized rectangular dielectric resonators." 2001 MTT-S International Microwave Symposium Digest 01.3 (2001 Vol. III [MWSYM]): 1483-1486 vol.3.

In this paper, thin planar bandpass filter structures with elliptic, Chebychev, or notch filter response, using 2-D arrays of metallized rectangular dielectric waveguide type resonators on PCB are presented. Electrode pads on open-end surfaces (OEFs) of the resonator are used as coupling ports to microstrip lines. Because the resonant frequency of rectangular waveguide type resonator is not sensitive to height of the resonator, the filters can be used as a planar or thin filter structure on PCB like other SMD chip devices. A 4-pole elliptic function filter is designed and constructed. The measured frequency responses of the filter agreed well with theoretical predictions.

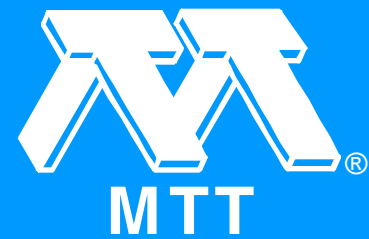
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Full-wave design of canonical waveguide filters by optimization

Tao Shen, K.A. Zaki and A.E. Atia. "Full-wave design of canonical waveguide filters by optimization." 2001 MTT-S International Microwave Symposium Digest 01.3 (2001 Vol. III [MWSYM]): 1487-1490 vol.3.

Full-wave design of canonical waveguide filters by optimization is presented. For full-wave modeling, the filter structure is decomposed into the cascade connection of waveguide step discontinuities, waveguide T-junction discontinuities with branch waveguide cascaded with waveguide step or bifurcation discontinuities. Generalized scattering matrices of each discontinuity are obtained using the mode matching method, from which the filter response can be obtained using the cascading procedure. Interpolation tables of each discontinuity are used to speed up the optimization process. Full-wave synthesis of coupling iris dimensions is also described. A four-cavity filter design example is presented to demonstrate the feasibility of the approach.



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Length reduction of evanescent-mode ridge waveguide bandpass filters

Tao Shen and K.A. Zaki. "Length reduction of evanescent-mode ridge waveguide bandpass filters." 2001 MTT-S International Microwave Symposium Digest 01.3 (2001 Vol. III [MWSYM]): 1491-1494 vol.3.

Length reduction of evanescent-mode ridge waveguide bandpass filters is investigated. A generalized filter configuration is proposed to reduce the filter length. It is found that the filter length can be reduced by enlarging the height of the evanescent waveguide. It is also found that the cutoff frequency of the fundamental mode of the ridge waveguide has a considerable effect on the filter length.

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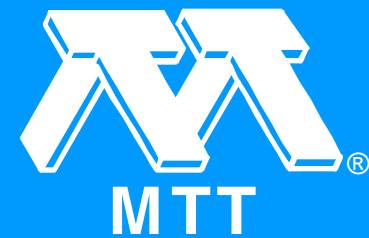


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Zolotarev bandpass filters (2001 Vol. III [MWSYM])

H.C. Bell. "Zolotarev bandpass filters (2001 Vol. III [MWSYM])." 2001 MTT-S International Microwave Symposium Digest 01.3 (2001 Vol. III [MWSYM]): 1495-1498 vol.3.

Zolotarev rational functions may be used in certain bandpass filter applications for which two narrower passbands are required. Coupled-resonator lowpass prototypes for narrow bandpass filters based on even- and odd-degree Zolotarev functions are synthesized using transformed variables.



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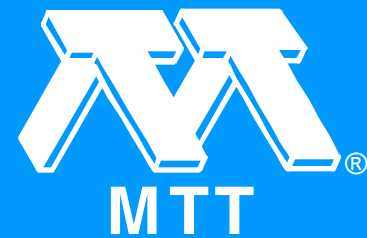
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Current status and emerging trends in RF power FET technologies

K. Shenai and E. McShane. "Current status and emerging trends in RF power FET technologies." 2001 MTT-S International Microwave Symposium Digest 01.3 (2001 Vol. III [MWSYM]): 1501-1504 vol.3.

The growth in ISM and wireless communications markets, and the transition to 3G and embedded transceivers, are motivating an intense study of RFIC technologies. The power amplifier (PA) plays a critical role in the size, efficiency, and thermal requirements of wireless handsets. This paper reviews state-of-the-art and emerging power semiconductor devices for RF PAs. Comparisons are presented in terms of key specifications such as PAE, power gain, VSWR, package thermal resistance, and integrability.

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Abstracts

7-MHz, 1.1-kW demonstration of the new E/F/sub 2,odd/ switching amplifier class

S.D. Kee, I. Aoki and D. Rutledge. "7-MHz, 1.1-kW demonstration of the new E/F/sub 2,odd/ switching amplifier class." 2001 MTT-S International Microwave Symposium Digest 01.3 (2001 Vol. III [MWSYM]): 1505-1508 vol.3.

The first switching amplifier in the new E/F/sub 2,odd/ class belonging to the new E/F/sub x/ family of switching power amplifiers has been successfully demonstrated. This push-pull amplifier exhibits 1.1 kW, 85% drain efficiency and 17 dB gain at 7 MHz. The amplifier uses low cost switching MOSFETs and fits in a small volume of only 900 cm³ including an integrated cooling fan.



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High-efficiency high-level modulator for use in dynamic envelope tracking CDMA RF power amplifiers

D.R. Anderson and W.H. Cantrell. "High-efficiency high-level modulator for use in dynamic envelope tracking CDMA RF power amplifiers." 2001 MTT-S International Microwave Symposium Digest 01.3 (2001 Vol. III [MWSYM]): 1509-1512 vol.3.

There is an inherent tradeoff between linearity and efficiency in modern microwave power amplifiers using spectrally efficient modulation techniques. This paper discusses an envelope modulation technique to improve efficiency while preserving linearity when modulating the supply voltage to the PA. Based on the SEPIC (Single-Ended Primary Inductance Converter) switchmode topology with coupled inductors, a continuous current mode (CCM) converter is used as a high-level class-S supply modulator to track the carrier envelope of a CDMA transmit signal. This results in a considerable improvement in PA efficiency while preserving linearity and modulation accuracy. Modulation frequencies up to 1.25 MHz are reproduced with about 80% efficiency. A SPICE compatible switched average converter model is described with an expression for an average current mode (ACM) control duty cycle generator. Simulated and measured data are presented for the case of a LDMOS class-AB RF amplifier with a SEPIC class-S modulated supply under IS-95 CDMA signal drive conditions.

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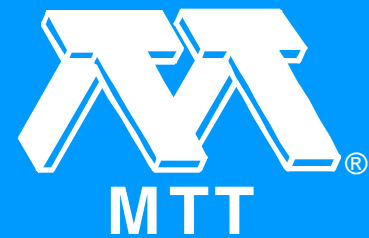
Electronically tunable class-E power amplifier

F.H. Raab. "Electronically tunable class-E power amplifier." 2001 MTT-S International Microwave Symposium Digest 01.3 (2001 Vol. III [MWSYM]): 1513-1516 vol.3.

The 20-W class-E power amplifier (PA) described here is electronically tunable from 19 to 31 MHz (ratio 1.67). This PA employs a single RF-power MOSFET and operates from 25 V. The output-tuning network employs fixed inductors and high-voltage MOSFETs for variable capacitors. The PA achieves an efficiency of 61 to 71 percent and has nearly constant output power across the band. It has excellent amplitude-modulation linearity for Kahn-technique transmitters, with two-tone IMDs at -40.4 dBc.

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A GSM-EDGE high power amplifier utilising digital linearisation

P.B. Kenington, M. Cope, R.M. Bennett and J. Bishop. "A GSM-EDGE high power amplifier utilising digital linearisation." 2001 MTT-S International Microwave Symposium Digest 01.3 (2001 Vol. III [MWSYM]): 1517-1520 vol.3.

This paper describes a single-carrier UHF linear power amplifier for use in GSM-EDGE base station applications. The amplifier employs a sophisticated digital predistortion linearisation system as a method of improving both efficiency and signal vector error (SVE), whilst maintaining a relatively simple architecture. A key benefit of the technique is that it provides an RF input/output interface without the requirement for a local oscillator, which is traditionally required when employing a digital lineariser in an RF amplifier.

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Integrated electro-thermal probe

R.M. Reano, Kyoung Yang, J.F. Whitaker and L.P.B. Katehi. "Integrated electro-thermal probe." 2001 MTT-S International Microwave Symposium Digest 01.3 (2001 Vol. III [MWSYM]): 1523-1526 vol.3.

A method to simultaneously measure electric and thermal fields with a single probe is presented. The probe material is gallium arsenide with the Pockels effect employed to measure electric fields and the effect of photon absorption due to bandtail states used to determine temperature. Measured optical power versus temperature is inversely related and is shown to agree with theory. Experimental results demonstrate a sensitivity of $0.31 \mu\text{W}/^\circ\text{C}$ at 25°C and an accuracy of $\pm 0.5^\circ\text{C}$ between 20°C and 60°C . The magnitude of the electric field is obtained with a normalized standard deviation of 1.3%. The technique is applied to the combined electro-thermal examination of an MMIC in a quasi-optical power-combining array and the calibration of electric field data that was corrupted by temperature dependent effects inherent to the electro-optic probe.



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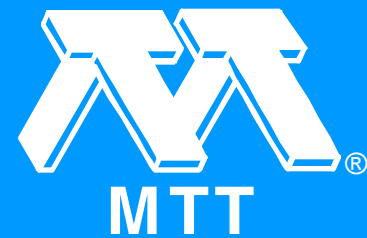
Calibrating electro-optic sampling systems

D.F. Williams, P.D. Hale, T.S. Clement and J.M. Morgan. "Calibrating electro-optic sampling systems." 2001 MTT-S International Microwave Symposium Digest 01.3 (2001 Vol. III [MWSYM]): 1527-1530 vol.3.

We apply frequency-domain impedance mismatch corrections to a temporal electro-optic sampling system and use it to characterize the magnitude and phase response of a photoreceiver that is physically far removed from the point where the voltage waveforms are measured. We identify and evaluate additional sources of measurement uncertainty.

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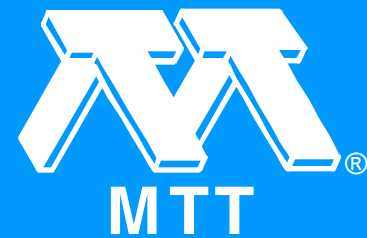
A three-port vector network analyzer - measurement system, calibration and results

Wei-Kung Deng and Tah-Hsiung Chu. "A three-port vector network analyzer - measurement system, calibration and results." 2001 MTT-S International Microwave Symposium Digest 01.3 (2001 Vol. III [MWSYM]): 1531-1534 vol.3.

In this paper a practical three-port vector network analyzer (TVNA) measurement system with its calibration procedures, and results are presented. With this TVNA, the three-port device scattering matrix can be directly measured by using a test fixture or a probe station. It can then reduce the repeatability problem occurred in the use of conventional two-port vector network analyzer by connecting and disconnecting matched load at the different ports of a three-port device. The three-port TRL and LRM calibration procedures are developed and verified with the coaxial circuits. In addition, a three-port SOLR calibration procedure is developed for on-wafer measurement of a three-port MMIC with three orthogonal-oriented pads.

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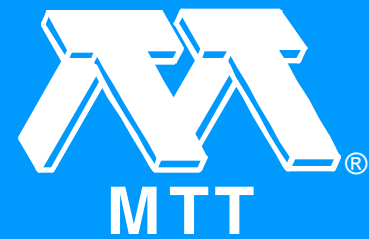
Microwave on-wafer characterization of three-port devices using shield-based test-fixtures

T.E. Kulding, M.B. Jenner and S. Laursen. "Microwave on-wafer characterization of three-port devices using shield-based test-fixtures." 2001 MTT-S International Microwave Symposium Digest 01.3 (2001 Vol. III [MWSYM]): 1535-1538 vol.3.

The capability of shield-based test-fixture design used in conjunction with three-port device measurements is demonstrated. The reduction of forward coupling and common-ground parasitics facilitates simple de-embedding that can easily be applied to multi-port measurements. The procedure is detailed and the capability of the method is demonstrated with gigahertz device measurements.

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Accurate transmission line characterization on high and low-resistivity substrates

G. Carchon, W. De Raedt and B. Nauwelaers. "Accurate transmission line characterization on high and low-resistivity substrates." 2001 MTT-S International Microwave Symposium Digest 01.3 (2001 Vol. III [MWSYM]): 1539-1542 vol.3.

Differences in probe-tip-to-line geometry and substrate permittivity between measurement and calibration wafer deteriorate measurement accuracy. This is especially the case when measurements are performed on lossy Silicon substrates. Two novel general techniques are presented which characterise the discontinuities near the probe-tip based on the measurement of two lines with different length. The equivalent elements representing the discontinuity are extracted at each frequency point together with the propagation constant and the characteristic impedance of the line. The obtained results are superior to previous methods with a reduced number of measurements. The validity of the method is demonstrated with measurements of CPW-lines on low and high resistivity Silicon and GaAs.

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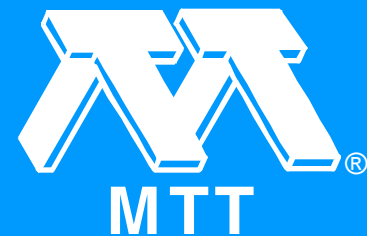
Automated test and tuning system for microwave filters

P. Harscher, R. Vahldieck and S. Amari. "Automated test and tuning system for microwave filters." 2001 MTT-S International Microwave Symposium Digest 01.3 (2001 Vol. III [MWSYM]): 1543-1546 vol.3.

A novel method for computerized diagnosis and automatic tuning of microwave (cavity) filters is introduced. The method is based on equivalent network theory using modified filter synthesis equations, including all characteristic filter parameters like resonant frequency, losses of individual resonators, input-/output couplings and couplings between resonators. Instead of using field simulators to extract filter parameters and associated network sensitivities, a more practical and more accurate parameter extraction process of measured S-parameter data is utilized. Thus automatic tuning becomes a two step process. In the first step the exact parameter values of an untuned filter as well as parameter sensitivities are extracted from a series of S-parameter measurements. In a second step gradient optimization is used on the so corrected model to find the tuning screw positions to give the same parameter set as obtained from the synthesis.

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Low phase-noise GaInP/GaAs-HBT MMIC oscillators up to 36 GHz

H. Kuhnert, F. Lenk, J. Hilsenbeck, J. Wurfl and W. Heinrich. "Low phase-noise GaInP/GaAs-HBT MMIC oscillators up to 36 GHz." 2001 MTT-S International Microwave Symposium Digest 01.3 (2001 Vol. III [MWSYM]): 1551-1554 vol.3.

Monolithic coplanar 18 and 36 GHz oscillators with GaInP/GaAs-HBTs and on-chip resonators are presented. Measured phase-noise reaches -93 dBc/Hz and -91 dBc/Hz at 100 kHz offset for 18 and 36 GHz, respectively. These values demonstrate that GaAs-HBT oscillators yield a phase-noise performance comparable to SiGe-HBTs, with the potential for higher frequencies.

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Monolithic 38 GHz coplanar feedback VCOs fabricated by a production PHEMT technology

H.J. Siweris, H. Tischer and E. Rohrer. "Monolithic 38 GHz coplanar feedback VCOs fabricated by a production PHEMT technology." 2001 MTT-S International Microwave Symposium Digest 01.3 (2001 Vol. III [MWSYM]): 1555-1558 vol.3.

A set of coplanar 38 GHz voltage-controlled oscillators has been developed. The oscillators are based on a feedback topology and consist of a two-stage amplifier, a frequency selective feedback network, and a voltage-controlled phase shifter. The monolithic circuits also include a buffer stage and were fabricated by a production-oriented PHEMT technology. By employing different feedback networks and phase shifters according to a building block concept, several versions with tuning bandwidths between 0.6 GHz and 1.3 GHz have been realized. The oscillators show a high tuning linearity and an almost constant output power of typically 12 dBm.

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Low phase-noise PHEMT-based MMIC VCOs for LMDS applications

A. Boudiaf, M. Ahdjoudj and P. Pouvil. "Low phase-noise PHEMT-based MMIC VCOs for LMDS applications." 2001 MTT-S International Microwave Symposium Digest 01.3 (2001 Vol. III [MWSYM]): 1559-1562 vol.3.

This paper presents Pseudomorphic High Electron-Mobility Transistor based K-band voltage-controlled oscillators, which have exhibited low phase-noise properties in conjunction with output powers greater than previously reported. An appropriate nonlinear design methodology based on the optimization of transistor's load cycles was applied. A tuning range over 14% bandwidth (22.4-25.8 GHz) for the first one, and 12% bandwidth (27.8-31.5 GHz) for the second one, were obtained. Constant output power of 6 dBm and 10 dBm respectively were measured over the tuning range. Markedly low phase noise level of -89 dBc/Hz at 100 kHz offset from the carrier (24.4 GHz), and -78 dBc/Hz at 100 kHz offset from the carrier (30 GHz) were achieved. To our knowledge, these are one of the best characteristics reported for K-band solid state VCOs.

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Coplanar and microstrip oscillators in SiGe SIMMWIC technology

K.M. Strohm, C.N. Rheinfelder, J.-F. Luy, P. Nuechter, T. Hess, W. Heinrich, H. Kuhnert, M. Nadarassin, C. Warns and W. Menzel. "Coplanar and microstrip oscillators in SiGe SIMMWIC technology." 2001 MTT-S International Microwave Symposium Digest 01.3 (2001 Vol. III [MWSYM]): 1563-1566 vol.3.

Oscillators in SiGe SIMMWIC HBT technology have been realized in coplanar and a newly developed microstrip environment. Coplanar 24 GHz LC oscillators show 8.7 dBm output power and a phase noise of -99 dBc/Hz @ 100 kHz offset. Coplanar 27 GHz VCO's yield 12.5 dBm output power and a tuning range of 1.28 GHz. Microstrip 27 GHz VCO's show 5 dBm output power and a phase noise better than -90 dBc/Hz @ 100 kHz offset.

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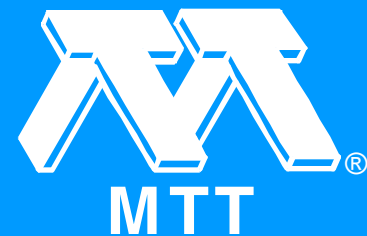


Abstracts

Low jitter silicon bipolar based VCOs for applications in high speed optical communication systems

A.P.S. Khanna, E. Topacio, E. Gane and D. Elad. "Low jitter silicon bipolar based VCOs for applications in high speed optical communication systems." 2001 MTT-S International Microwave Symposium Digest 01.3 (2001 Vol. III [MWSYM]): 1567-1570 vol.3.

This paper describes the design of silicon bipolar-based planar microstrip low noise VCO at 10 GHz. Using this VCO with GaAs PHEMT MMIC frequency multipliers, 20 GHz and 40 GHz VCOs are reported. Applications include OC-192 and OC-768 optical communication systems. Demonstrated phase noise of -113 dBc/Hz@100 KHz represents the best phase noise of a 10 GHz microstrip VCO reported to date.



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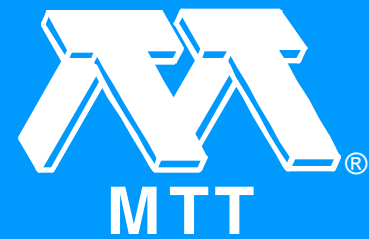
Push-push oscillators for 94 and 140 GHz applications using standard pseudomorphic GaAs HEMTs

S. Kudszus, W.H. Haydl, A. Tessmann, W. Bronner and M. Schlechtweg. "Push-push oscillators for 94 and 140 GHz applications using standard pseudomorphic GaAs HEMTs." 2001 MTT-S International Microwave Symposium Digest 01.3 (2001 Vol. III [MWSYM]): 1571-1574 vol.3.

Millimeter wave harmonic oscillators taking advantage of the push-push principle are demonstrated, allowing the use of the second harmonic of the oscillators to extend the applicable frequency range of standard pseudomorphic HEMTs to 94 and 140 GHz. Two configuration schemes are realized. An improved approach using a drain-connected pair of oscillators for efficient and compact circuit design and high output power is presented. Using this approach, oscillators at 94 GHz and 135 GHz were developed, with more than 0 dBm and -2 dBm output power and a high suppression of the fundamental signal of 38 dBc and 20 dBc, respectively. All MMICs were realized in a standard 0.13 μm /m pHEMT technology using optical stepper lithography.

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Negative resistance optimized in noise for losses compensation in microstrip resonators

A. Zaitsev, B. Kapilevich, L. Billonnet, B. Jarry and P. Guillon. "Negative resistance optimized in noise for losses compensation in microstrip resonators." 2001 MTT-S International Microwave Symposium Digest 01.3 (2001 Vol. III [MWSYM]): 1577-1580 vol.3.

A new design concept of low noise negative resistance circuit is presented considering stability conditions. Low noise properties of a negative resistance circuit are guaranteed by an optimal value of the transistor feedback. Based on this circuit, a low-noise 2nd-order 3 GHz active bandpass filter has been designed and fabricated.

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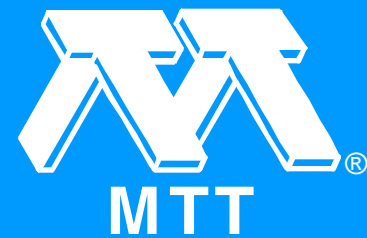


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Using a negative capacitance to increase the tuning range of a varactor diode in MMIC technology (2001 Vol. III [MWSYM])

S. Kolev, B. Delacressonniere and J.-L. Gautier. "Using a negative capacitance to increase the tuning range of a varactor diode in MMIC technology (2001 Vol. III [MWSYM])." 2001 MTT-S International Microwave Symposium Digest 01.3 (2001 Vol. III [MWSYM]): 1581-1584 vol.3.

An original method to increase the tuning range of a MMIC varactor diode is presented. An active circuit simulating a negative capacitance is connected to the varactor diode. This method allows to increase the varactor's tuning range more than ten times. A MMIC simulating a negative capacitance have been successfully fabricated and measured and we hope to be able to present measured results of a complete active varactor by the time of the symposium.



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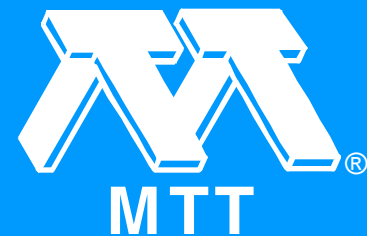
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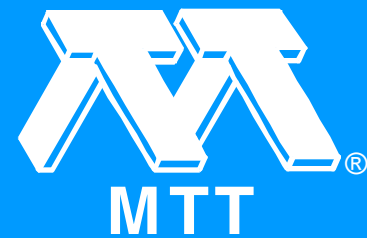
Compact MMIC active inductor

G. Avitabile, B. Chellini, E. Limiti and F. Giannini. "Compact MMIC active inductor." 2001 MTT-S International Microwave Symposium Digest 01.3 (2001 Vol. III [MWSYM]): 1585-1588 vol.3.

An active inductor implementation suitable for microwave and millimeter wave applications is introduced. The circuit is very simple, compact and can be easily realized in a floating configuration. Simulations, based on Philips smart library ED0D2AH, show that the component can have a quality factor in excess of 100 at 22 GHz with a current consumption of 5.5 mA @ 2.5 V bias. A monolithic implementation in PHEMT technology is reported and discussed.

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Microstrip miniaturized loop-filters with high out-of-band rejection for future 3G mobile terminals

Y. Toutain, J.-P. Coupez and C. Person. "Microstrip miniaturized loop-filters with high out-of-band rejection for future 3G mobile terminals." 2001 MTT-S International Microwave Symposium Digest 01.3 (2001 Vol. III [MWSYM]): 1589-1592 vol.3.

This paper deals about the implementation of miniaturized microstrip band-pass filters operating on a very narrow bandwidth. We propose an original synthesis for achieving high out-of-band rejection by means of a 2nd order resonant structure, for which transmission zeros are introduced through mutual coupling effects. Quite good performances are obtained regarding losses, size and spurious resonances for the proposed topology, which can be considered as a good solution for future mobile on-board equipments.

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Wideband bandpass filter design with three-line microstrip structures

Jen-Tsai Kuo and Eric Shih. "Wideband bandpass filter design with three-line microstrip structures." 2001 MTT-S International Microwave Symposium Digest 01.3 (2001 Vol. III [MWSYM]): 1593-1596 vol.3.

Systematic procedure is described for designing bandpass filters with wide bandwidths based on parallel coupled three-line microstrip structures. It is found that the tight gap sizes between the resonators of end stages and feed lines, required for wideband filters based on traditional coupled line design, can be greatly released. The relation between the circuit parameters of a three-line coupling section and an admittance inverter circuit is derived. A design graph for substrate with $\epsilon_r = 10.2$ is provided. Two filters of orders 3 and 5 with fractional bandwidths 40% and 50%, respectively, are fabricated and measured. Good agreement between prediction and measurement is obtained.

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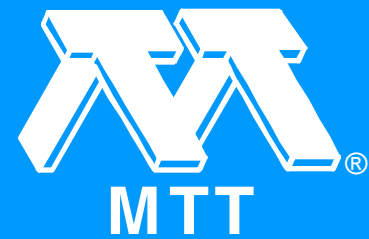
A 60 GHz-band planar dielectric waveguide filter for flip-chip modules (2001 Vol. III [MWSYM])

M. Ito, K. Maruhashi, K. Ikuina, T. Hashiguchi, S. Iwanaga and K. Ohata. "A 60 GHz-band planar dielectric waveguide filter for flip-chip modules (2001 Vol. III [MWSYM])." 2001 MTT-S International Microwave Symposium Digest 01.3 (2001 Vol. III [MWSYM]): 1597-1600 vol.3.

A planar dielectric waveguide filter with CPW I/O ports suitable for flip-chip bonding is proposed and demonstrated for 60 GHz-band applications. The filter is formed incorporating via holes in an alumina substrate. In order to improve a stop-band rejection, short-circuited CPW resonators with half wavelength are added to waveguide-to-CPW transitions. A fabricated 4-resonator filter exhibits an insertion loss of 2.8 dB with a 3 dB-bandwidth of 3.0 GHz and a rejection of 35 dB at a 3 GHz-lower-separation from a center frequency of 58.5 GHz. The filter is successfully mounted in a multi-layer ceramic package using flip-chip bonding.

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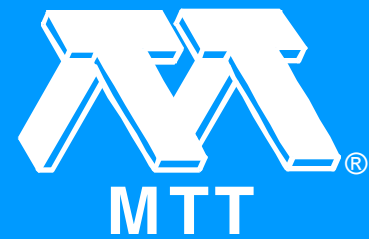
Design of coupled resonators group delay equalizers

Heng-Tung Hsu, Hui-Wen Yao, A. Zaki and A.E. Atia. "Design of coupled resonators group delay equalizers." 2001 MTT-S International Microwave Symposium Digest 01.3 (2001 Vol. III [MWSYM]): 1603-1606 vol.3.

A systematic design procedure for coupled resonators cavity group delay equalizers is presented. The procedure consists of solving the approximation problem by optimization and solving the synthesis problem. The error function for the optimization is computed from filter's group delay and the zeros and poles of the input impedance of the equalizer. Convergence of the optimization is fast and insensitive to the initial guess even when the number of resonators is large. Two examples together with experimental results are presented to show the powerfulness and effectiveness of the proposed procedure.

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High power C-band dielectric resonator filters for output multiplexers

Y. Latouche, D. Gasperoni and J.J. Herren. "High power C-band dielectric resonator filters for output multiplexers." 2001 MTT-S International Microwave Symposium Digest 01.3 (2001 Vol. III [MWSYM]): 1607-1610 vol.3.

This paper presents a new type of Dielectric Resonator filter for space application with high power behavior. Two filters was built and tested under high RF power in space environment. We applied up to 150 Watts at the input of the first filter and until 280 watt at the input of the second without any mechanical or electrical degradation. Out-of-band carrier and multipactor tests were also performed on this last filter with very good results. Band pass Dielectric Resonator filters for Output Multiplexer (OMUX) applications could be then considered.

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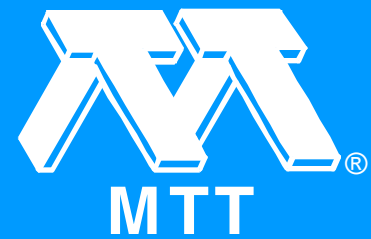


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Analysis of power handling capacity of band pass filters

Chi Wang and K.A. Zaki. "Analysis of power handling capacity of band pass filters." 2001 MTT-S International Microwave Symposium Digest 01.3 (2001 Vol. III [MWSYM]): 1611-1614 vol.3.

A general analysis method on power handling of the microwave band pass filter is presented. The total stored energy in each resonator of the filter is computed from the normalized general two-port network. By comparing the stored energy to the maximum electric field in the resonator, the power handling capacity of the filter can be accurately determined. The method is general and can be applied to any coupling matrix of the filter and type of the resonator used. An inductive window waveguide filter has been analyzed to verify theory by comparing the results with that obtained by full wave mode matching method and shown to be in excellent agreement.



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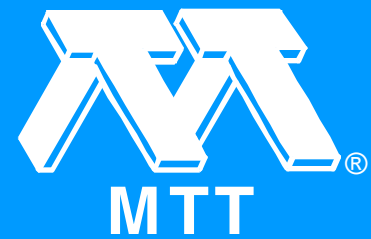
Low-loss filters in rectangular waveguide with rigorous control of spurious responses through a smart modal filter

F. Alessandri, M. Comparini and F. Vitulli. "Low-loss filters in rectangular waveguide with rigorous control of spurious responses through a smart modal filter." 2001 MTT-S International Microwave Symposium Digest 01.3 (2001 Vol. III [MWSYM]): 1615-1617 vol.3.

Low-loss performance is one of the main drivers in the design of microwave input filters and diplexer, used on satellite communication transponders. In addition, a careful control of spurious responses is also required in order to guarantee an adequate protection from high-level input interfering signals, which may degrade the performance of the receiver. Both these requirements can be accomplished by a simple and cost-effective design approach, based on rectangular waveguide resonator. Fast and accurate simulation and measured response of a specific design are also compared, demonstrating that the proposed solution is practical and reliable.

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Observations on the stopband performance of tapped line filters

R.J. Wenzel and D.G. Swanson, Jr.. "Observations on the stopband performance of tapped line filters." 2001 MTT-S International Microwave Symposium Digest 01.3 (2001 Vol. III [MWSYM]): 1619-1621 vol.3.

Current circuit based models for filters with tapped line inputs are shown to be accurate for predicting passband performance and inaccurate for predicting stopband performance. EM field-solver computations are shown to be capable of accurate performance predictions in both the passband and stopband. Significant differences in stopband performance are shown to be possible with different types of input/output coupling.

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Stop-band improvement of rectangular waveguide filters using different width resonators: selection of resonator widths

M. Morelli, I. Hunter, R. Parry and V. Postoyalko. "Stop-band improvement of rectangular waveguide filters using different width resonators: selection of resonator widths." 2001 MTT-S International Microwave Symposium Digest 01.3 (2001 Vol. III [MWSYM]): 1623-1626 vol.3.

Rectangular waveguide resonators having different widths can be mixed in order to improve the stopband performance of band-pass filters. Two effective procedures for the choice of the resonator widths are presented and implemented to realise X-band 6-cavity filters which hold 30 dB of attenuation over a frequency range 40% wider than a standard filter. Theoretical and experimental results are shown and commented on.

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Diplexer design using pre-synthesized waveguide filters with strongly dispersive inverters

S. Amari, J. Bornemann, W. Menzel and F. Alessandri. "Diplexer design using pre-synthesized waveguide filters with strongly dispersive inverters." 2001 MTT-S International Microwave Symposium Digest 01.3 (2001 Vol. III [MWSYM]): 1627-1630 vol.3.

An approximate synthesis technique for strongly dispersive inverters is introduced. The technique allows the prescription of transmission zeros at finite frequencies on either side of the filter passband - symmetrically or asymmetrically - as required for diplexer applications. Several direct-coupled resonator filters with additional attenuation poles and a related diplexer design at 18.5 GHz are presented. The computerized design procedure is based on CIET (coupled-integral-equations technique) and MMT (mode-matching technique) modules. Excellent agreement between measurements and theoretical predictions is achieved.

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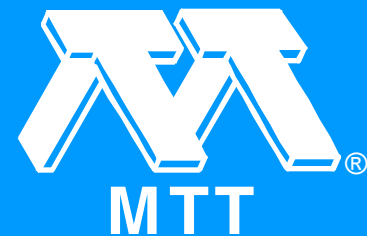
Filter topologies with minimum peak stored energy

C. Ernst, V. Postoyalko, R. Parry and I. Hunter. "Filter topologies with minimum peak stored energy." 2001 MTT-S International Microwave Symposium Digest 01.3 (2001 Vol. III [MWSYM]): 1631-1634 vol.3.

In this paper the question of enhancing the power handling capability of resonator filters by choosing a suitable filter topology which maximally reduces the peak time averaged stored energy (t.a.s.e.) is addressed. A well known network transformation that alters the filter topology but leaves the 2-port parameter of the network unchanged is employed. After defining the cost function a stochastic search method is used to find the global minimum. Results presented include Butterworth filter topologies of degree 2 to 5.

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2.7 THz waveguide tripler using monolithic membrane diodes

F. Maiwald, S. Martin, J. Bruston, A. Maestrini, T. Crawford and P.H. Siegel. "2.7 THz waveguide tripler using monolithic membrane diodes." 2001 MTT-S International Microwave Symposium Digest 01.3 (2001 Vol. III [MWSYM]): 1637-1640 vol.3.

The description and performance of an 850 to 2550 GHz waveguide tripler is presented. The tripler utilizes GaAs monolithic membrane diodes (MOMED) in single and antiparallel pairs. Output power of/spl ap/0.1 /spl mu/W is reported.

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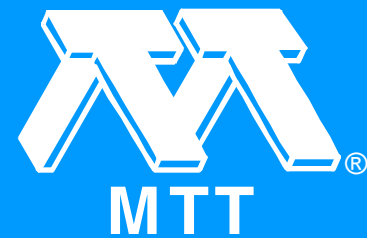
Fabrication of 200 to 2700 GHz multiplier devices using GaAs and metal membranes

S. Martin, B. Nakamura, A. Fung, P. Smith, J. Bruston, A. Maestrini, F. Maiwald, P. Siegel, E. Schlecht and I. Mehdi. "Fabrication of 200 to 2700 GHz multiplier devices using GaAs and metal membranes." 2001 MTT-S International Microwave Symposium Digest 01.3 (2001 Vol. III [MWSYM]): 1641-1644 vol.3.

Multiplier device fabrication techniques have been developed to enable robust implementation of monolithic circuits well into the THz frequency range. To minimize the dielectric loading of the waveguides, some circuits are realized entirely on a 3 μm thick GaAs membrane with metal beamleads acting as RF probes and DC contact points. Other designs retain some thicker GaAs as a support and handling structure, allowing a membrane of bare metal or thin GaAs to be suspended across an input or output waveguide. Extensive use is made of selective etches, both reactive ion (RIE) and wet chemical, to maintain critical dimensions. Electron beam (e-beam) lithography provides the small contact areas required at the highest frequencies. Planar multiplier circuits for 200 GHz to 2700 GHz have been demonstrated using a variety of metal and GaAs membrane configurations made available by these fabrication techniques.

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A 200-300 GHz SIS mixer-preamplifier with 8 GHz IF bandwidth

E.F. Lauria, A.R. Kerr, M.W. Pospieszalski, S.-K. Pan, J.E. Effland and A.W. Lichtenberger. "A 200-300 GHz SIS mixer-preamplifier with 8 GHz IF bandwidth." 2001 MTT-S International Microwave Symposium Digest 01.3 (2001 Vol. III [MWSYM]): 1645-1648 vol.3.

A 200-300 GHz SIS mixer-preamplifier with an IF bandwidth of 8 GHz is described. The mixer uses Nb/Al-oxide/Nb tunnel junctions in a circuit with low IF capacitance and inductance. The mixer block is designed to mount directly on the body of the 4-12 GHz InP HFET preamplifier and mixer bias is provided through the input circuit of the preamplifier. At a LO frequency of 230 GHz, the mixer-preamp gain is 30-35 dB, and the DSB receiver noise temperature is 45-57 K across the whole IF band. This is the largest instantaneous bandwidth reported to date for an SIS receiver.

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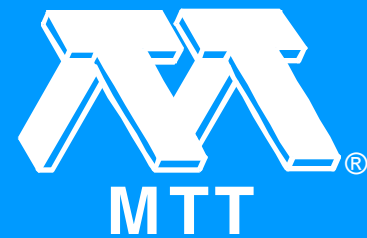
200, 400 and 800 GHz Schottky diode "substrateless" multipliers: design and results

E. Schlecht, G. Chattopadhyay, A. Maestrini, A. Fung, S. Martin, D. Pukala, J. Bruston and I. Mehdi. "200, 400 and 800 GHz Schottky diode "substrateless" multipliers: design and results." 2001 MTT-S International Microwave Symposium Digest 01.3 (2001 Vol. III [MWSYM]): 1649-1652 vol.3.

Several sub-millimeter doubler circuits have been designed and built using a new fabrication technology. To reduce the RF losses in the passive circuitry, the substrate under the transmission lines is etched away, leaving the metal suspended in air held by its edges on a GaAs frame. This allows the circuit to be handled and mounted easily, and makes it very robust. To demonstrate this technology, broadband balanced planar doublers have been built and tested at 400 GHz. The next generation 200, 400 and 800 GHz doublers with improved performance are also discussed. The 368-424 GHz circuits were measured and achieved 20% efficiency at 387 GHz. The 3 dB bandwidth of the fix-tuned doubler is around 9%. The maximum output power measured is around 8 mW and drops down to 1 mW at 417 GHz. This represents the highest frequency waveguide based planar doubler to date in the literature.

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An I-Q mixer at 76.5 GHz using flip-chip mounted silicon Schottky diodes

M.M. Kaleja, A.J. Herb, R.H. Rasshofer and E.M. Biebl. "An I-Q mixer at 76.5 GHz using flip-chip mounted silicon Schottky diodes." 2001 MTT-S International Microwave Symposium Digest 01.3 (2001 Vol. III [MWSYM]): 1653-1656 vol.3.

Silicon Schottky diodes show the advantages of low $1/f$ noise combined with low cost. We use these diodes in hybrid flip-chip configuration to build a novel I-Q mixer at 76.5 GHz for automotive applications. The realized mixer shows promising features such as 10 dB conversion loss @ 100 kHz IF, LO-to-RF isolation better than 25 dB, and average IF noise power of -80 dBm.

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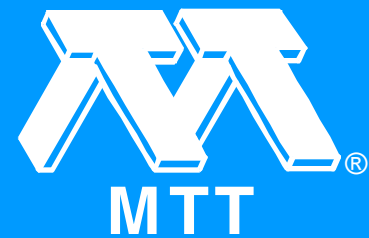
Performance of a 1.2 THz frequency tripler using a GaAs frameless membrane monolithic circuit

A. Maestrini, J. Bruston, D. Pukala, S. Martin and I. Mehdi. "Performance of a 1.2 THz frequency tripler using a GaAs frameless membrane monolithic circuit." 2001 MTT-S International Microwave Symposium Digest 01.3 (2001 Vol. III [MWSYM]): 1657-1660 vol.3.

The first ever planar Schottky diode multiplier working over a THz will be presented in this paper. A tunerless 1.2 THz waveguide frequency tripler has been designed, fabricated and tested. The frequency multiplier consists of a 3 micron-thick GaAs frameless-membrane monolithic circuit, mounted in a split waveguide-block, which includes a built-in Picket-Potter horn. The 1.2 THz membrane tripler is driven by a 400 GHz solid-state chain composed of HEMT based power amplifiers followed by two tunerless planar diode frequency doublers. At room temperature, output power up to 80 microwatts was measured at 1126 GHz with a peak-efficiency of 0.9% and a 3 dB bandwidth of about 3.5%. The output power of the multiplier chain increased dramatically with a decrease of the ambient temperature-up to 195 microwatts was measured at 120 K. When further cooled to 50 K the chain delivers power levels as high as 250 microwatts. To the best of our knowledge, this is the first demonstration of a fully planar multiplier chain at these frequencies, along with performance that supercedes current state-of-the-art performance of whisker-contacted sources.

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A 5 mW-290 GHz heterostructure barrier tripler in a waveguide configuration

T. David, M. Guillon, S. Arscott, A. Maestrini, T. Akalin, B. Lecomte, J. Carbonell, M. Chaubet, P. Mounaix, G. Beaudin and D. Lippens. "A 5 mW-290 GHz heterostructure barrier tripler in a waveguide configuration." 2001 MTT-S International Microwave Symposium Digest 01.3 (2001 Vol. III [MWSYM]): 1661-1664 vol.3.

An output power of 5 mW has been demonstrated at 290 GHz by tripling a primary signal in the W band. The nonlinear devices are high performance InP-based heterostructure barrier varactors mounted in mechanically tuned waveguide harmonic multiplier. The flange-to-flange maximum efficiency was 5% whereas the bandwidth is around 30 GHz. These results are the highest to date for an HBV multiplier operating at these frequencies.

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A method to compare vector nonlinear network analyzers

K.A. Remley, D.C. DeGroot, J.A. Jargon and K.C. Gupta. "A method to compare vector nonlinear network analyzers." 2001 MTT-S International Microwave Symposium Digest 01.3 (2001 Vol. III [MWSYM]): 1667-1670 vol.3.

We address the difficult problem of determining measurement consistency between two vector nonlinear network analyzers, a new class of stimulus response instruments that acquire multiharmonic waveform data instead of normalized network parameters. We develop a set of nonlinear verification devices and a method to compare the systems, and then demonstrate that measurements from three different nonlinear network analyzers are consistent to within 1.3% of the amplitude of the applied stimulus signal.

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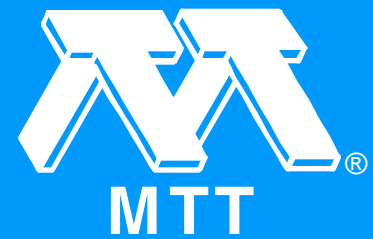
Analysis and measurement of multi-tone intermodulation distortion of microwave frequency converters

J.C. Pedro and N.B. Carvalho. "Analysis and measurement of multi-tone intermodulation distortion of microwave frequency converters." 2001 MTT-S International Microwave Symposium Digest 01.3 (2001 Vol. III [MWSYM]): 1671-1674 vol.3.

Using a time-variant 3rd order model, it is shown that the distortion arising in microwave frequency converters can be identified by signal-uncorrelated distortion components, but also by another signal-correlated part. Because this correlated contribution cannot be observed with conventional intermodulation set-ups, a new measurement bench is proposed and tested.

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NPR and co-channel distortion ratio: a happy marriage?

A. Geens, Y. Rolain and W. Van Moer. "NPR and co-channel distortion ratio: a happy marriage?." 2001 MTT-S International Microwave Symposium Digest 01.3 (2001 Vol. III [MWSYM]): 1675-1678 vol.3.

This paper investigates the disagreement that exists between Noise Power Ratio (NPR) measurements and a recently published statement that those measurements always underestimate the real nonlinear in-band distortions. This disagreement is only a matter of definition of what one considers to be a distortion. The properties of the input signal are the criterion for using the classical NPR method or the alternative. A general measurement technique (using a nonlinear vectorial network analyzer) is presented that is valid in both cases. Next, measurement are performed to validate the theory.

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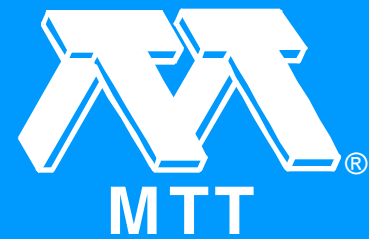
Linearity optimization of a distributed base station amplifier using an automated high-speed measurement protocol

M.P. van der Heijden, J.R. Gajadharsing, B. Rejaei and L.C.N. de Vreede. "Linearity optimization of a distributed base station amplifier using an automated high-speed measurement protocol." 2001 MTT-S International Microwave Symposium Digest 01.3 (2001 Vol. III [MWSYM]): 1679-1682 vol.3.

This paper describes a high-speed measurement protocol using a high-order implementation of the complex power series representation (CPSR). The CPSR is used to relate AM-AM and AM-PM conversion (large signal S_{21}) to the 3rd-order intermodulation distortion (IM3) of an amplifier up to gain compression. This method requires the use of a network analyzer only and eliminates the need for a spectrum analyzer speeding-up the measurements tremendously. The method has proven to be very powerful in a real-time optimization of bias parameter of a novel linear distributed amplifier for base stations.

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Ultra-linear power amplifier characterization using dynamic range extension techniques

R. Hassun, N. Kuhn, R. Posner, R. Sweeney and B. Vassilakis. "Ultra-linear power amplifier characterization using dynamic range extension techniques." 2001 MTT-S International Microwave Symposium Digest 01.3 (2001 Vol. III [MWSYM]): 1683-1686 vol.3.

The rapid growth of the wireless industry requires more efficient utilization of the available frequency spectrum. This has resulted in requirements for highly linear Multi-Channel Power Amplifiers (MCPAs) to support increases in voice and data traffic. To characterize the resulting ultra-linear MCPAs and to comply with intermodulation levels less than -80 dBc requires measurement systems with dynamic range performance beyond what is currently available. A new instrument, which extends the dynamic range of current distortion measurement systems by at least 25 dB, has been developed to meet this challenge.

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Direct measurement of the maximum operating region in GaAs HBTs for RF power amplifiers

A. Inoue, S. Nakatsuka, S. Suzuki, K. Yamamoto, T. Shimura, R. Hattori and Y. Mitsui. "Direct measurement of the maximum operating region in GaAs HBTs for RF power amplifiers." 2001 MTT-S International Microwave Symposium Digest 01.3 (2001 Vol. III [MWSYM]): 1687-1690 vol.3.

Current and voltage waveforms of GaAs HBTs at 1 GHz have been directly measured using a microwave waveform measurement system. The maximum operating region has been experimentally investigated by sweeping load lines. The limits of a small input power are found to come from the thermal runaway and avalanche breakdown of the device. With large input power, the HBT is found to operate beyond the DC limit of thermal runaway.

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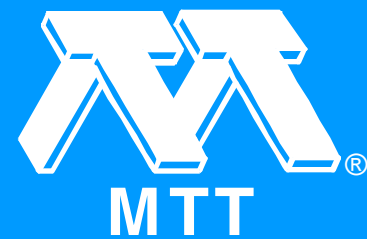
Benefits of SiGe over silicon bipolar technology for broadband mixers with bandwidth above 10 GHz

S. Hackl, M. Wurzer, J. Bock, T.F. Meister, H. Knapp, K. Aufinger, S. Boguth, L. Treitinger and A.L. Scholtz. "Benefits of SiGe over silicon bipolar technology for broadband mixers with bandwidth above 10 GHz." 2001 MTT-S International Microwave Symposium Digest 01.3 (2001 Vol. III [MWSYM]): 1693-1696 vol.3.

Future broadband wireless services will use carrier frequencies in the range of 10 GHz to 40 GHz. This raises the question which semiconductor technologies are suited for realization of the key RF building blocks like LNAs, mixers, oscillators and, in a later phase, for the complete monolithic integration of receivers and transmitters. This work investigates the benefits of SiGe bipolar technology in comparison to silicon at identical feature size for broadband mixers with bandwidth in the range mentioned above.

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40 Gb/s 4:1 multiplexer and 1:4 demultiplexer IC module using SiGe HBTs

T. Masuda, K. Ohhata, N. Shiramizu, E. Ohue, K. Oda, R. Hayami, H. Shimamoto, M. Kondo, T. Harada and K. Washio. "40 Gb/s 4:1 multiplexer and 1:4 demultiplexer IC module using SiGe HBTs." 2001 MTT-S International Microwave Symposium Digest 01.3 (2001 Vol. III [MWSYM]): 1697-1700 vol.3.

A 4:1 multiplexer and a 1:4 demultiplexer IC module were developed by using 0.2 μm self-aligned selective-epitaxial-growth SiGe HBTs. For the data retiming, the multiplexer and the demultiplexer include a frequency divider that operates at over 40 GHz. 50-Gb/s operation for the multiplexer and 48-Gb/s operation for the demultiplexer were observed by measurements using on-wafer probes. We concluded that these modules, which mounted the IC on a ceramic substrate with a brass block, are applicable to transmitter and receiver functions of a 40-Gb/s optical transmission system.

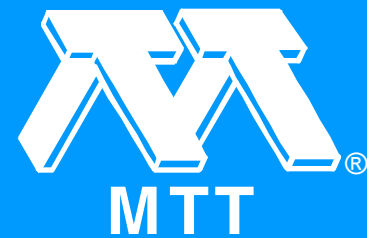


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40 Gb/s analog IC chipset for optical receivers - AGC amplifier, full-wave rectifier and decision circuit implemented using self-aligned SiGe HBTs

K. Ohhata, F. Arakawa, T. Masuda, N. Shiramizu and K. Washio. "40 Gb/s analog IC chipset for optical receivers - AGC amplifier, full-wave rectifier and decision circuit implemented using self-aligned SiGe HBTs." 2001 MTT-S International Microwave Symposium Digest 01.3 (2001 Vol. III [MWSYM]): 1701-1704 vol.3.

40 Gb/s analog IC chipset, an AGC amplifier, a full-wave rectifier and a decision circuit, for optical receivers were developed using SiGe HBT technology. The high performance SiGe HBT and optimized circuit configuration make possible an AGC amplifier with a 47.8 GHz bandwidth, a full-wave rectifier, and a decision circuit with 40 Gb/s operation.



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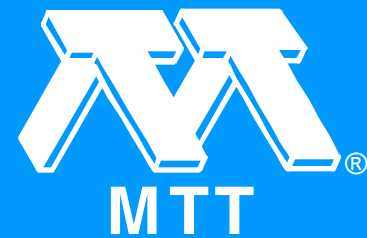
Low-frequency noise and phase noise behavior of advanced SiGe HBTs

L. Bary, G. Cibiel, J. Ibarra, O. Llopis, R. Plana, J. Graffeuil, G. Niu, J.D. Cressler, Z. Jin, S. Zhang and A.J. Joseph. "Low-frequency noise and phase noise behavior of advanced SiGe HBTs." 2001 MTT-S International Microwave Symposium Digest 01.3 (2001 Vol. III [MWSYM]): 1705-1708 vol.3.

This paper addresses low frequency noise and residual phase noise in advanced SiGe HBTs featuring different Ge profile shape. Under certain bias conditions, increasing the Ge content decreases the base current fluctuations and hence improves the residual phase noise performance. Additional low frequency noise and phase noise measurements have provided a better insight into the physical location of the $1/f$ noise sources in these devices.

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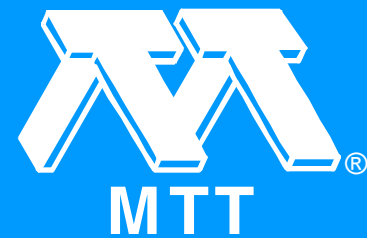
SiGe power heterojunction bipolar transistors (HBTs) fabricated by fully self-aligned double mesa technology

Liang-Hung Lu, S. Mohammadi, Zhenqiang Ma, G.E. Ponchak, S.A. Alterovitz, K.M. Strohm, J.-F. Luy, P. Bhattacharya and L.P.B. Katehi. "SiGe power heterojunction bipolar transistors (HBTs) fabricated by fully self-aligned double mesa technology." 2001 MTT-S International Microwave Symposium Digest 01.3 (2001 Vol. III [MWSYM]): 1709-1712 vol.3.

Multi-finger SiGe HBT's have been fabricated using a novel fully self-aligned double-mesa technology. With the advanced process technology, a maximum oscillating frequency ($f_{\text{sub max}}$) of 78 GHz and a cut-off frequency ($f_{\text{sub T}}$) of 37 GHz were demonstrated for a common-emitter device with emitter area of $2/\text{spl times}/2/\text{spl times}/30 \text{ /spl mu/m/sup } 2/$. For class-A operations, 10-finger devices ($A_{\text{sub E}}=2/\text{spl times}/2/\text{spl times}/30 \text{ /spl mu/m/sup } 2/$) exhibit an output power of 24.13 dBm with a maximum power added efficiency (PAE) of 26.9% at 8.5 GHz.

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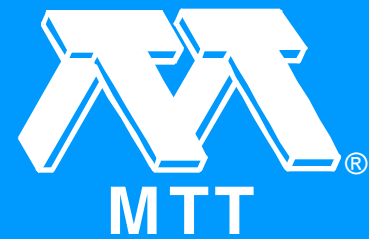
185 GHz monolithic amplifier in InGaAs-InAlAs transferred-substrate HBT technology

M. Urteaga, D. Scott, T. Mathew, S. Krishnan, Y. Wei and M.J.W. Rodwell. "185 GHz monolithic amplifier in InGaAs-InAlAs transferred-substrate HBT technology." 2001 MTT-S International Microwave Symposium Digest 01.3 (2001 Vol. III [MWSYM]): 1713-1716 vol.3.

We report a single-stage tuned amplifier that exhibits a peak small signal gain of 3.0 dB at 185 GHz. To the best of our knowledge, this is the first reported HBT result for a tuned amplifier at this frequency, and the gain-per-stage compares favorably with results from HEMT technologies. The amplifier was designed in a transferred-substrate HBT technology that has exhibited record values of extrapolated $f_{\text{sub max/}}$ (>1 THz).

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A new via fence structure for crosstalk reduction in high density stripline packages

J. Gipprich and D. Stevens. "A new via fence structure for crosstalk reduction in high density stripline packages." 2001 MTT-S International Microwave Symposium Digest 01.3 (2001 Vol. III [MWSYM]): 1719-1722 vol.3.

Via fences are often placed between stripline conductors to suppress unwanted parallel plate mode coupling. However, if the striplines are too close to a fence, the coupling between the striplines is enhanced rather than reduced. In this paper we analyze the coupling between two striplines separated by a via fence using electromagnetic simulation for various dimensional parameters. Finally, we introduce a new via structure that significantly reduces the unwanted coupling.

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Coupling between microstrip lines embedded in polyimide layers for 3D-MMICs on Si

G.E. Ponchak, E.M. Tentzeris and J. Papapolymerou. "Coupling between microstrip lines embedded in polyimide layers for 3D-MMICs on Si." 2001 MTT-S International Microwave Symposium Digest 01.3 (2001 Vol. III [MWSYM]): 1723-1726 vol.3.

Three-dimensional circuits built upon multiple layers of polyimide are required for constructing Si-SiGe monolithic microwave/millimeter-wave integrated circuits on CMOS (low resistivity) Si wafers. However, the closely spaced transmission lines are susceptible to high levels of coupling, which degrades circuit performance. In this paper, Finite Difference Time Domain (FDTD) analysis and measured characteristics of novel shielding structures that significantly reduce coupling between embedded microstrip lines are presented.

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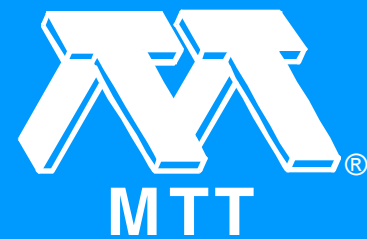


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Silicon substrate coupling noise modeling, analysis, and experimental verification for mixed signal integrated circuit design

W. Jin, Y. Eo, J.I. Shim, W.R. Eisenstadt, M.Y. Park and H.K. Yu. "Silicon substrate coupling noise modeling, analysis, and experimental verification for mixed signal integrated circuit design." 2001 MTT-S International Microwave Symposium Digest 01.3 (2001 Vol. III [MWSYM]): 1727-1730 vol.3.

The frequency-variant characteristics of a silicon substrate were physically modeled, analytically investigated, and experimentally verified. The scalable circuit model parameter extraction methodology was newly developed. Thus, the proposed technique can provides the efficient performance evaluations as well as the accurate design guidelines concerned with the complicated mixed signal integrated circuit designs.



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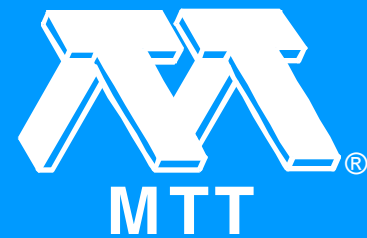
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RF-microwave multi-layer integrated passives using fully organic System on Package (SOP) technology

M.F. Davis, A. Sutono, K. Lim, J. Laskar, V. Sundaram, J. Hobbs, G.E. White and R. Tummala. "RF-microwave multi-layer integrated passives using fully organic System on Package (SOP) technology." 2001 MTT-S International Microwave Symposium Digest 01.3 (2001 Vol. III [MWSYM]): 1731-1734 vol.3.

This paper presents high-density, fully organic multi-layer interconnects and integrated passives for RF and microwave System on Package (SOP) development. The components developed in this technology include novel CPW-microstrip transitions, high Q passives, as well as a planar antenna on a package. High Q passives, designed to be implemented using the featured CPW-microstrip transitions in this organic multi-layer technology, demonstrate the feasibility of implementing SOP technology for RF and microwave applications. This technology also employs a lifted slot antenna with vertical feed to reduce loss at the feeding point and to minimize pattern distortion.

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Design of embedded high Q-inductors in MCM-L technology

S. Dalmia, Woopoung Kim, Sung Hwan Min, M. Swaminathan, V. Sundaraman, Fuhan Liu, G. White and R. Tummala. "Design of embedded high Q-inductors in MCM-L technology." 2001 MTT-S International Microwave Symposium Digest 01.3 (2001 Vol. III [MWSYM]): 1735-1738 vol.3.

Although discrete surface mount passive components (resistors, capacitors and inductors) have been popular in mixed signal designs, the development of integrated passive components suitable for integration with printed wiring boards is relatively recent. This integration is imperative since in some mixed signal designs, off-chip passive components take up more real estate on the boards than the analog and digital signal processing units. This paper shows the possibility of fabricating a large number of MCM's with high wiring density and integrated passives using standard PWB technology. However, the presence of inherent lossy materials in standard PWB technology reduces the Q factor of embedded passives in the more traditional components such as spiral inductors. In this paper, the embedded passives were modeled using coupled line parameters obtained using quasi-TEM approximations. This modeling approach provides advantages and greater insight over the more traditional methods for modeling embedded passives. Based on this modeling approach, a systematic method to improve the quality (Q) factors of the integrated inductors is also presented based on a layout optimization scheme. By departing from the traditional spiral inductors, a max Q-factor of 103 was obtained for an 11 nH inductor at 2.2 GHz with a resonant frequency of 3.6 GHz. Several other inductors have been obtained with Q-factors ranging from 23-38 for inductors ranging from 28 nH to 20 nH respectively. The authors believe that this is the first paper showing such high Q-factors for embedded passives in organic technology.

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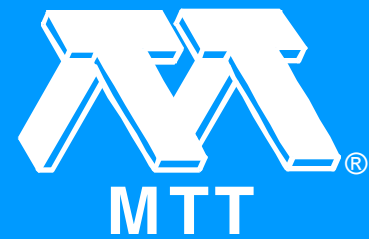
A highly integrated transceiver module for 5.8 GHz OFDM communication system using multi-layer packaging technology

Kyutae Lim, A. Obatoyinbo, A. Sutono, S. Chakraborty, Chang-Ho Lee, E. Gebara, A. Raghavan and J. Laskar. "A highly integrated transceiver module for 5.8 GHz OFDM communication system using multi-layer packaging technology." 2001 MTT-S International Microwave Symposium Digest 01.3 (2001 Vol. III [MWSYM]): 1739-1742 vol.3.

A highly integrated transceiver module for 5.8 GHz OFDM communication system is presented. The antenna and filter are directly fabricated on the module using multi-layer packaging technology in order to reduce size and interconnection losses. A cavity backed patch antenna with a vertical feed and an embedded 3D filter have been designed and integrated on the package using a low-temperature cofired ceramic (LTCC) process. RF functional blocks including PA, LNA, mixers and VCO are developed using GaAs-based MMICs and are attached on the surface of the LTCC board. RF blocks are vertically stacked and connected through via structures. The specifications of the functional blocks have been determined and verified through system simulations based on the IEEE 802.11a standard. The total size of the module is 14/spl times/19/spl times/2 mm/sup 3/. Measurement and simulation results of the components and the module are also presented.



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EM-based multidimensional parameterized modeling of general passive planar components

T. Dhaene, J. De Geest and D. De Zutter. "EM-based multidimensional parameterized modeling of general passive planar components." 2001 MTT-S International Microwave Symposium Digest 01.3 (2001 Vol. III [MWSYM]): 1745-1748 vol.3.

A new adaptive algorithm is presented for building multidimensional parameterized analytical models for general passive planar components. The component models are based on multiple full-wave electromagnetic (EM) simulations. The modeling accuracy level is chosen by the user. Models can be generated for arbitrary geometries and substrates, and they can be easily implemented and used in commercial circuit simulators. The adaptive model generation process is an up-front time investment and requires multiple EM simulations. The model extraction provides EM-accuracy and generality at traditional circuit simulation speed.

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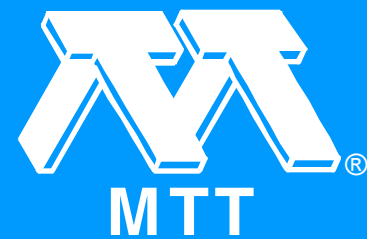


Abstracts

Using efficient multivariate adaptive sampling by minimizing the number of computational electromagnetic analysis needed to establish accurate interpolation models

R. Lehmensiek and P. Meyer. "Using efficient multivariate adaptive sampling by minimizing the number of computational electromagnetic analysis needed to establish accurate interpolation models." 2001 MTT-S International Microwave Symposium Digest 01.3 (2001 Vol. III [MWSYM]): 1749-1752 vol.3.

An efficient multivariate adaptive sampling algorithm based on rational interpolation, that establishes accurate surrogate models of microwave circuits, is presented. The technique optimally samples the parameter space in order to minimize the number of CEM analyses, without assuming any a priori knowledge of the data. The technique is evaluated on passive microwave structures.



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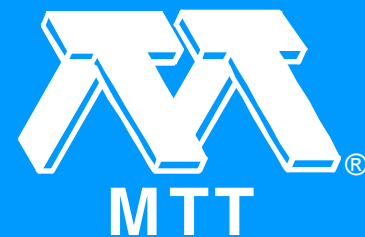


Abstracts

Accurate closed-form expressions for the frequency-dependent line parameters of on-chip interconnects on lossy silicon substrate

A. Weisshaar and Hai Lan. "Accurate closed-form expressions for the frequency-dependent line parameters of on-chip interconnects on lossy silicon substrate." 2001 MTT-S International Microwave Symposium Digest 01.3 (2001 Vol. III [MWSYM]): 1753-1756 vol.3.

Accurate closed-form expressions for the frequency-dependent R,L,G,C line parameters of microstrip lines on lossy silicon substrate are presented. The closed-form expressions for the frequency-dependent series impedance parameters are obtained using a complex image method. The frequency-dependent shunt admittance parameters are expressed in closed form in terms of the shunt capacitances obtained in the low and high frequency limits. The proposed closed-form solutions are shown to be in good agreement with the electromagnetic solutions.



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Microstrip line on ground plane with closely spaced perforations-simple CAD formulas by synthetic asymptote

Y.L. Chow, K.L. Wan, T.K. Sarkar and B. Kolundzija. "Microstrip line on ground plane with closely spaced perforations-simple CAD formulas by synthetic asymptote." 2001 MTT-S International Microwave Symposium Digest 01.3 (2001 Vol. III [MWSYM]): 1757-1760 vol.3.

Simple CAD formulas, of a microstrip line on a ground plane with periodic perforations, closely spaced and at low frequency, are derived for possible application in the multi-layer circuits in an LTCC package. The derivation is done by the novel technique of synthetic asymptote. Compared with the hardware experiment, the average error of the CAD formulas can be as low as 2.5%. The formulas have no arbitrary constants and give good physical insights.

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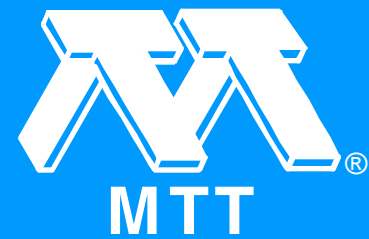
An extrinsic-inductance independent approach for direct extraction of HBT intrinsic circuit parameters (2001 Vol. III [MWSYM])

T.S. Horng, J.M. Wu and H.H. Huang. "An extrinsic-inductance independent approach for direct extraction of HBT intrinsic circuit parameters (2001 Vol. III [MWSYM])." 2001 MTT-S International Microwave Symposium Digest 01.3 (2001 Vol. III [MWSYM]): 1761-1764 vol.3.

A new analytical procedure has been developed for direct extraction of the intrinsic elements in a hybrid- π equivalent circuit of heterojunction bipolar transistors (HBTs). The method differs from previous ones by formulating impedance-parameter based expressions that are exclusive of the extrinsic parasitic inductances associated with the base, emitter and collector. It is therefore not susceptible to variation of the extrinsic reactances from DC to high frequencies and can lead to very accurate extraction of the intrinsic elements under different bias conditions.

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Consistent small-signal and RF-noise parameter modelling of carbon doped InP/InGaAs HBT

M. Agethen, S. Schuller, P. Velling, W. Brockerhoff and F.-J. Tegude. "Consistent small-signal and RF-noise parameter modelling of carbon doped InP/InGaAs HBT." 2001 MTT-S International Microwave Symposium Digest 01.3 (2001 Vol. III [MWSYM]): 1765-1768 vol.3.

In this work a consistent small-signal and rf-noise parameter model of InP/InGaAs HBT is presented. This model is based on the typical three-mesa design of HBT and correlates intrinsic noise sources to specific device regions. Bias dependent investigation of S- and RF-noise parameters proves the consistency of the model.

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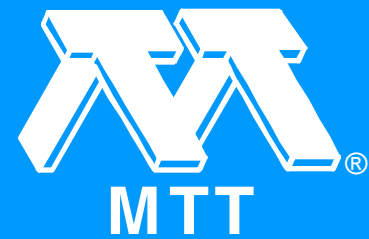
Dual-mode and quad-mode Mobius bandpass filters

J.M. Pond, Shaojun Liu and N. Newman. "Dual-mode and quad-mode Mobius bandpass filters." 2001 MTT-S International Microwave Symposium Digest 01.3 (2001 Vol. III [MWSYM]): 1771-1774 vol.3.

Dual-mode and quad-mode Mobius wire-loaded cavity resonators are being developed for compact bandpass filter applications. Initial results on tuned filters indicate that excellent filter characteristics can be attained in devices that are significantly smaller than traditional wire loaded cavity technology. A novel quad-mode Mobius resonator is presented which occupies the same volume as a dual-mode Mobius resonator. Precisely-controlled dielectric loading of dual-mode Mobius wire loaded bandpass filters has been recently implemented. The passband characteristics are quite encouraging despite the limited tuning used to date.

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Analysis and design of mass-producible cross-coupled, folded E-plane filters

E. Ofli, R. Vahldieck and S. Amari. "Analysis and design of mass-producible cross-coupled, folded E-plane filters." 2001 MTT-S International Microwave Symposium Digest 01.3 (2001 Vol. III [MWSYM]): 1775-1778 vol.3.

Mass-producible, folded E-plane metal-insert filters with and without finite transmission zeros are introduced for the first time. The metallic inserts and the separating wall between the inserts can be accurately fabricated to $\pm 1 \mu\text{m}$ tolerances using electroforming techniques. Source-load coupling as well as (negative) coupling between resonators can be realized. The resulting filters are much shorter than traditional E-plane filters and show significantly improved slope selectivity.

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Modified conductor loaded cavity resonator with improved spurious performance

H. Salehi, R.R. Mansour and V. Dokas. "Modified conductor loaded cavity resonator with improved spurious performance." 2001 MTT-S International Microwave Symposium Digest 01.3 (2001 Vol. III [MWSYM]): 1779-1782 vol.3.

The paper introduces a new resonator configuration to realize conductor-loaded cavity filters with improved spurious performance. Theoretical results are presented for the field distribution and resonant frequencies of the proposed structure. The results show that shaping the metal resonator inside the cavity can considerably improve its spurious performance. Experimental results are presented to verify the concept presented in this paper.

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A practical triple-mode monoblock bandpass filter for base station applications

Chi Wang, W. Wilber and B. Engst. "A practical triple-mode monoblock bandpass filter for base station applications." 2001 MTT-S International Microwave Symposium Digest 01.3 (2001 Vol. III [MWSYM]): 1783-1786 vol.3.

A practical triple-mode dielectric monoblock band pass filter integrated with a wide bandwidth pre-select mask bandpass filter and a microstrip low pass filter for WCDMA base station application is presented. The dielectric monoblock triple-mode filter was designed and optimized using 3D EM simulation software incorporating the equivalent circuit model. The pre-select filter and low pass filter were used to clean up the spurious response of the triple-mode filter up to 12 GHz. Both triple mode and mask filters are directly mounted on the PCB to minimize the cost and loss.

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Low-cost dual-mode asymmetric filters in rectangular waveguide

M. Guglielmi, O. Roquebrun, P. Jarry, E. Kerherve, M. Capurso and M. Piloni. "Low-cost dual-mode asymmetric filters in rectangular waveguide." 2001 MTT-S International Microwave Symposium Digest 01.3 (2001 Vol. III [MWSYM]): 1787-1790 vol.3.

Dual-mode microwave filters are extensively used in modern communication equipment because they can implement sophisticated and selective filter transfer functions. Their most common implementation is based on circular-waveguide technology and generally requires a rather complex development procedure. In this paper we describe a new implementation of dual-mode filters in standard rectangular waveguide that can be used to produce asymmetric transfer functions. The proposed filter structure can be analyzed and optimized very efficiently using multimode equivalent network representations thus leading to a simple and rapid development procedure. In addition to theory, the measured performance of several filter structures are also presented thereby fully validating the proposed filter concept.

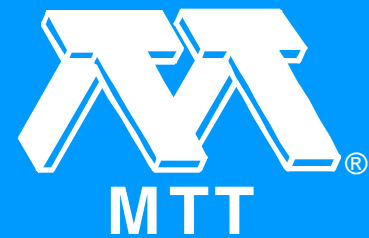
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Analysis and design of grooved circular waveguide dual-mode filters

N. Yoneda and M. Miyazaki. "Analysis and design of grooved circular waveguide dual-mode filters." 2001 MTT-S International Microwave Symposium Digest 01.3 (2001 Vol. III [MWSYM]): 1791-1794 vol.3.

This paper presents a novel type of circular waveguide dual-mode filter with grooves for coupling orthogonal resonant modes and correcting resonant frequency. The presented dual-mode filter is suitable for realizing high performance without tuning elements in Ka-band and above because of the simple structure. A Ka-band elliptic function type dual-mode filter has been designed by accurate and fast full-wave analysis performed using mode-matching techniques.



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Small filters based on slotted cylindrical ring resonators (2001 Vol. III [MWSYM])

R.F. Mostafavi, D. Mirshekar-Syahkal and Y.C.M. Lim. "Small filters based on slotted cylindrical ring resonators (2001 Vol. III [MWSYM])." 2001 MTT-S International Microwave Symposium Digest 01.3 (2001 Vol. III [MWSYM]): 1795-1798 vol.3.

The realization of a small four-pole Chebyshev filter using four matched slotted cylindrical ring (SCR) resonators, is explained. This filter, which does not need tuning screws, is low-cost to manufacture and suitable for mobile communications. The filter has a bandwidth of 75 MHz centered at 1.73 GHz. To obtain the coupling distances between the resonators, a new technique based on the quasi-magneto-static finite-difference method, is also reported.





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Dual-mode filters for cellular base stations using metallized dielectric resonators

M. Fumagalli, G. Macchiarella and G. Resnati. "Dual-mode filters for cellular base stations using metallized dielectric resonators." 2001 MTT-S International Microwave Symposium Digest 01.3 (2001 Vol. III [MWSYM]): 1799-1802 vol.3.

A novel configuration for dual-mode filters employing dielectric ring resonators is presented. The coupling between two orthogonal polarized modes (HEM/sub 11/) within each dielectric ring is realized through a rectangular metallic strip deposited on the boundary of the ring (inner or outer). The coupling coefficient so obtained is large enough to allow the realization of high selectivity filters for cellular radio base stations. A 4 resonators test filter has been designed and realized using the novel resonators: the performances obtained are reported in the paper.

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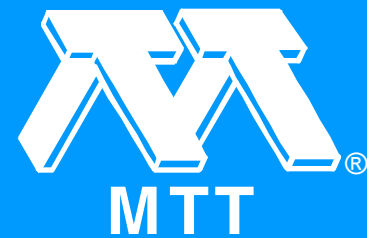


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65-145 GHz InP MMIC HEMT medium power amplifiers

L. Samoska and Yoke Choy Leong. "65-145 GHz InP MMIC HEMT medium power amplifiers." 2001 MTT-S International Microwave Symposium Digest 01.3 (2001 Vol. III [MWSYM]): 1805-1808 vol.3.

In this paper, we present two MMIC power amplifier designs utilizing InP HEMT technology. The first amplifier covers two full waveguide bands, WR10 (75-110 GHz) and WR8 (90-140 GHz), yielding a maximum output power of at least 25 mW between 65-140 GHz. The second design is optimized for the WR10 waveguide band and provides at least 13 dB of large signal gain over 75-110 GHz, and an output power of 40-50 mW.



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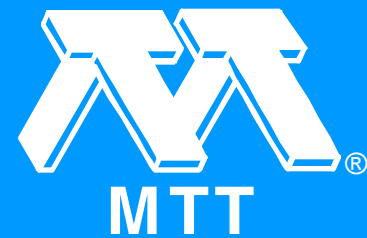
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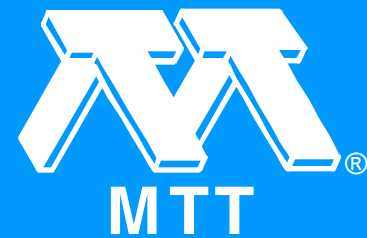
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A new direct millimeter wave six-port receiver (2001 Vol. III [MWSYM])

S.O. Tatu, E. Moldovan, Ke Wu and R.G. Bosisio. "A new direct millimeter wave six-port receiver (2001 Vol. III [MWSYM])." 2001 MTT-S International Microwave Symposium Digest 01.3 (2001 Vol. III [MWSYM]): 1809-1812 vol.3.

A new direct conversion wide band (23 GHz-31 GHz) six-port millimeter wave receiver suitable for integrated circuit fabrication is proposed to satisfy mass-market wireless communications. The receiver contains one multi chip module (MCM) consisting of a wide band six-port junction, four RF detectors (Schottky diodes), video amplifiers and I&Q decoder. The prototype circuits are fabricated in hybrid integrated circuits, and the receiver topology is suitable for fabrication in microwave monolithic integrated circuits (MMICs). This new hardware receiver is proposed as a robust, rugged, low cost receiver for use in wide band wireless mass market QPSK communications. Hand held and laptop terminals for future e-mail/multimedia services are a prime example of communication equipment needing such receivers. BER measurements and simulation results are presented in the presence of noise, adjacent signal interference, local oscillator (LO) phase shift and LO phase noise.





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Wireless multi-channel TV-signal distribution system by using NRD guide transmitter and receiver at 60 GHz

F. Kuroki, S. Shinke, E. Suematsu, H. Sato and T. Yoneyama. "Wireless multi-channel TV-signal distribution system by using NRD guide transmitter and receiver at 60 GHz." 2001 MTT-S International Microwave Symposium Digest 01.3 (2001 Vol. III [MWSYM]): 1813-1816 vol.3.

Millimeter-wave transmitter and receiver have been developed for multi-channel TV-signal distribution system based on the NRD guide technology. Main emphasis is placed on the development of band-widening techniques for NRD guide circuit components. The distribution test of the TV-signals with more than 100 channels can be performed by using them successfully.

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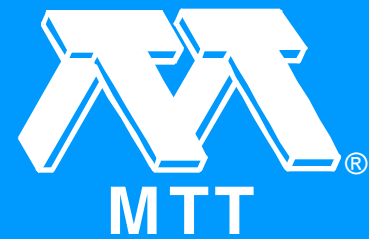
Wideband low-phase-noise high-power W-band signal sources

E.W. Bryerton, D.L. Thacker, K.S. Saini and R.F. Bradley. "Wideband low-phase-noise high-power W-band signal sources." 2001 MTT-S International Microwave Symposium Digest 01.3 (2001 Vol. III [MWSYM]): 1817-1820 vol.3.

This paper describes the development of electronically-tunable wideband low-phase-noise millimeter-wave signal sources. These sources are designed to drive cooled Schottky multipliers to supply the LO for the ALMA telescope array. Each phase-locked driver consists of a YTO, active multiplier chain (AMC), and a power amplifier. Measurements of a prototype driver electronically tunable from 72-85 GHz with greater than 50 mW output power are presented. Additive phase noise of individual amplifiers and multipliers is described. Long-term phase drift measurements are reported. Preliminary W-band amplitude noise measurements using a SIS mixer with a YTO-based driver chain and Gunn oscillator LO are also presented. All measurements indicate that the stringent ALMA LO specifications can be met with this architecture.

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155 Mbit/s data transmission at 60 GHz using a $1/\sqrt{4}$ patch array antenna with variable optical delay lines

G. Grosskopf, R. Eggemann, D. Rohde and M.S. Choi. "155 Mbit/s data transmission at 60 GHz using a $1/\sqrt{4}$ patch array antenna with variable optical delay lines." 2001 MTT-S International Microwave Symposium Digest 01.3 (2001 Vol. III [MWSYM]): 1821-1824 vol.3.

155 Mbit/s data transmission at 60 GHz was carried out successfully with bit error rates below 10^{-9} . The experimental transmission system included a $1/\sqrt{4}$ patch array antenna. It was fed by optically generated RF-signals and its beam was steered by tunable optical delay lines. Bit error rates below 10^{-3} could be maintained for azimuthal angles over a range of 120 degrees. The antenna is part of an experimental radio-over-fiber system for proof-of-concept of optical beamforming to be applied in broadband mobile communication systems.





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Fault tolerance analysis and measurement of a spatial power amplifier

S. Ortiz, M. Ozkar, A. Yakovlev, M. Steer and A. Mortazawi. "Fault tolerance analysis and measurement of a spatial power amplifier." 2001 MTT-S International Microwave Symposium Digest 01.3 (2001 Vol. III [MWSYM]): 1827-1830 vol.3.

The performance degradation due to device failures in a spatial power combining system is presented in this paper, including analysis and measurement. For this study, a 5/spl times/5 amplifier array, employing 17 dBm (P1 dB) MMIC amplifiers, has been designed and tested. Individual unit cells have been turned off in order to represent a system with device failures. Results for both simulated and measured array performance versus device failures are given.

Click on title for a complete paper.



A K-band full-duplex transmit-receive lens array

M. Forman, J. Vian and Z. Popovic. "A K-band full-duplex transmit-receive lens array." 2001 MTT-S International Microwave Symposium Digest 01.3 (2001 Vol. III [MWSYM]): 1831-1834 vol.3.

A K-band full-duplex transmit-receive lens antenna array using uniplanar circuitry is reported. The array transmits at 19 GHz and receives at 21 GHz by means of two independent unit cells. Orthogonal antenna polarization and bandpass circuitry provide a simulated isolation of 42 dB between transmit and receive channels. The measured gains of the active array are 3.0 and 8.3 dB above passive with an on-off ratio of 10 and 15 dB for transmit and receive modes respectively.

Quasi-optical power amplifier using TEM waveguide concept

M. Belaid and Ke Wu. "Quasi-optical power amplifier using TEM waveguide concept." 2001 MTT-S International Microwave Symposium Digest 01.3 (2001 Vol. III [MWSYM]): 1835-1838 vol.3.

A new E-plane quasi-optical waveguide power amplifier with an innovative low-loss integrated transition array of finline and microstrip is presented, which employs a concept of TEM mode waveguide. This TEM waveguide was proposed on a patterned surface or usually called uniplanar compact photonic bandgap (UC-PBG) structure. Our Ku-band back-to-back transition array demonstrates a return loss better than -17.5 dB and an insertion loss better than -0.65 dB. The TEM waveguide is found to have a 1 GHz bandwidth centered at 14.5 GHz. The use of such a frequency-selective surface has showed that one could implement more power cards inside this TEM waveguide. The space power combiner is used to combine the output powers of twelve 20 mW MMIC amplifier chips. The power module yields a 21.08 dBm output power including the loss of transition and a combining efficiency of 89% is observed in this work.



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A 16-element reflection grid amplifier with improved heat sinking

A. Guyette, R. Swisher, F. Lecuyer, A. Al-Zayed, A. Kom, Su-Tak Lei, M. Oliveira, Ping Li, M. De Lisio, K. Sato, A. Oki, A. Gutierrez-Aitken, R. Kagiwada and J. Cowles. "A 16-element reflection grid amplifier with improved heat sinking." 2001 MTT-S International Microwave Symposium Digest 01.3 (2001 Vol. III [MWSYM]): 1839-1842 vol.3.

We present a 16-element hybrid grid amplifier with improved heat sinking. This is a higher-power version of a previously reported reflection grid amplifier. The grid uses custom-made differential-pair chips with TRW InP Heterojunction Bipolar Transistors (HBTs) as the active devices. We measure a peak gain of 15 dB at 8.4 GHz. Measured gain is consistent with theoretical predictions. The grid was able to dissipate up to 4 W of dc bias power without any apparent thermal damage. Measurements on passive resistor arrays demonstrate this architecture's superior thermal performance.

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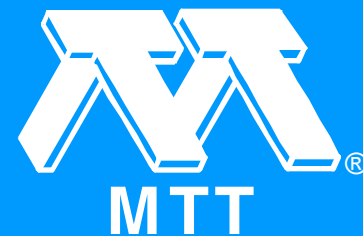


Abstracts

A 1 watt, 38 GHz monolithic grid oscillator

B. Deckman, D. Rutledge, J.J. Rosenberg, E. Sovero and D.S. Deakin, Jr.. "A 1 watt, 38 GHz monolithic grid oscillator." 2001 MTT-S International Microwave Symposium Digest 01.3 (2001 Vol. III [MWSYM]): 1843-1845 vol.3.

We have demonstrated a monolithic grid oscillator that shows 1 watt of effective transmitter power at 38 GHz. Use of a wire twist reflector as an external feedback element added to a successful monolithic grid amplifier allows a tuning range from 37.5 GHz to 41 GHz. Impedance matching is accomplished by a double-slug tuner and the movable back-short of the twist reflector.



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A 94-GHz overmoded waveguide oscillator with Gunn diodes

Jongsuck Bae, M. Fujita and K. Mizuno. "A 94-GHz overmoded waveguide oscillator with Gunn diodes." 2001 MTT-S International Microwave Symposium Digest 01.3 (2001 Vol. III [MWSYM]): 1847-1850 vol.3.

Spatial power combining of Gunn diodes with an efficiency of more than 80% has been demonstrated at W-band using an overmoded waveguide resonator with an array of TE/sub 10/ mode waveguides. This resonator makes use of selective coupling between an mxn TE/sub 10/ mode in the waveguide Gunn diode array and the TE/sub m0/ mode in the overmoded waveguide to produce high power. An efficiency of 84 % and an output power of about 0.23 W at 94 GHz, has been achieved using three Gunn diodes. The output mode of TE/sub 30/ in the oscillator has been converted to the fundamental TE/sub 10/ mode with an efficiency of about 80 % using an oversized waveguide with an H-corner.

A retrodirective diode grid array using four-wave mixing

Wenyan Ding, Su-Tak Chad Lei and M.P. DeLisio. "A retrodirective diode grid array using four-wave mixing." 2001 MTT-S International Microwave Symposium Digest 01.3 (2001 Vol. III [MWSYM]): 1851-1854 vol.3.

We report retrodirection using quasi-optical diode grid arrays operating at 4 GHz. Phase conjugation is achieved through a process analogous to four-wave mixing. Antiparallel diode pairs provide the third-order nonlinearity. We report retrodirection of beams with incidence angles of up to 60/spl deg/ in both the E-plane and the H-plane. Measured antenna patterns are consistent with theoretical predictions.



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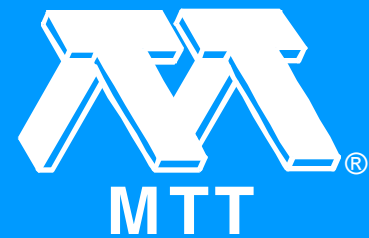
An experimental and theoretical characterization of a broadband arbitrarily-polarized rectenna array

J.A. Hagerty and Z. Popovic. "An experimental and theoretical characterization of a broadband arbitrarily-polarized rectenna array." 2001 MTT-S International Microwave Symposium Digest 01.3 (2001 Vol. III [MWSYM]): 1855-1858 vol.3.

Planar rectenna arrays for rectification of broadband electromagnetic waves of arbitrary polarization are designed and characterized. The performance of the arrays is accurately predicted using a combination of full-wave analysis for the passive part of the rectenna and harmonic balance simulations for the nonlinear rectification process. The arrays used in this paper to demonstrate the principles of operation consist of self-similar right-hand and left-hand polarized spirals which are simulated and measured over a 2.5:1 band (6-15 GHz). Two arrays with different diodes exhibit conversion efficiencies from 5 to 45% under monochromatic linearly polarized illumination with power densities from 1-1.6 mW/cm/sup 2/.

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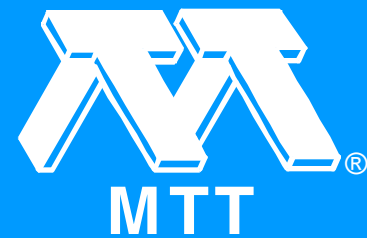
5.8 GHz circular polarized rectifying antenna for microwave power transmission

B. Strassner and Kai Chang. "5.8 GHz circular polarized rectifying antenna for microwave power transmission." 2001 MTT-S International Microwave Symposium Digest 01.3 (2001 Vol. III [MWSYM]): 1859-1862 vol.3.

This paper reports a new 5.8 GHz circular polarized (CP) high gain, high-efficiency rectifying antenna (rectenna). The CP rectenna can be rotated and still maintain a constant output voltage. A high-gain dual rhombic loop antenna and a reflecting plane are used to achieve a circular polarized antenna gain of 10.5 dB, a 2:1 VSWR bandwidth of 10 %, and average beamwidths of 43/spl deg/ and 59/spl deg/ In the E- and H-planes, respectively. The rectenna circuit has a coplanar stripline (CPS) band reject filter (BRF) which suppresses the re-radiated harmonics by 20 dB. A highly efficient Schottky diode is used for RF to DC conversion with an efficiency of approximately 80%.

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A 1-10 GHz 0.18/ μ m CMOS chipset for multi-mode wireless applications

M. Madihian, H. Fujii, H. Yoshida, H. Suzuki and T. Tamazaki. "A 1-10 GHz 0.18/ μ m CMOS chipset for multi-mode wireless applications." 2001 MTT-S International Microwave Symposium Digest 01.3 (2001 Vol. III [MWSYM]): 1865-1868 vol.3.

Performance results for a 1-10 GHz chipset developed in a low-cost two-metal 0.18 μ m CMOS technology are described. The developed chips include RF and IF amplifiers, down- and up-mixers, VCO, and receiver/transmitter circuits. Each chip's circuit parameters as well as transistors gate widths are optimized for maximum frequency of operation. The receiver and transmitter chips have a conversion gain higher than 25 dB over 2.4-5.8 GHz, and higher than 16 dB for any other frequency within 1-10 GHz.

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A 0.18 μm foundry RF CMOS technology with 70 GHz $F_{\text{sub } t/}$ for single chip system solutions

Heng-Ming Hsu, Jui-Yu Chang, Jiong-Guang Su, Chao-Chieh Tsai, Shyh-Chyi Wong, C.W. Chen, K.R. Peng, S.P. Ma, C.N. Chen, T.H. Yeh, C.H. Lin, Y.C. Sun and C.Y. Chang. "A 0.18 μm foundry RF CMOS technology with 70 GHz $F_{\text{sub } t/}$ for single chip system solutions." 2001 MTT-S International Microwave Symposium Digest 01.3 (2001 Vol. III [MWSYM]): 1869-1872 vol.3.

This paper presents a high performance RF CMOS technology with a complete portfolio of RF and base band components for single-chip systems. Using optimized CMOS topology and deep n-well isolation, we obtain a $F_{\text{sub } t/}$ of 60 GHz and $F_{\text{sub max } /}$ of 55 GHz at 10 mA, a $F_{\text{sub } t/}$ of 70 GHz and $F_{\text{sub max } /}$ of 58 GHz at maximum-transconductance bias, and minimum noise figure of 1.5 dB without ground-shielded signal pad. High quality-factor inductors are obtained using Cu interconnect giving a quality factor of 18 at 1.7 nH. MIM capacitors, as well as accumulation and junction varactors are also optimized for enhancing quality factor. For the purpose of eliminating inter-block coupling noise penetrating through substrate, a deep n-well isolation and p-ring have been adopted to suppress the substrate noise by 25 dB and 10 dB respectively. This technology provides a complete solution for single-chip wireless systems.





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Deep trench guard technology to suppress coupling between inductors in silicon RF ICs

Cheon Soo Kim, Piljae Park, Joung-Woo Park, Nam Hwang and Hyu Kyu Yu. "Deep trench guard technology to suppress coupling between inductors in silicon RF ICs." 2001 MTT-S International Microwave Symposium Digest 01.3 (2001 Vol. III [MWSYM]): 1873-1876 vol.3.

Trench guard technology was proposed to suppress the coupling between inductors, and to reduce crosstalk in silicon RF ICs. The test structure adopting a deep trench guard ring showed a coupling less than -40 dB in the frequency range of 0.5-20 GHz, and negligible change in designed inductance value up to 10 GHz. Furthermore, it can be also used to isolate a noisy circuit block from other quiet blocks in mixed signal silicon RF ICs.

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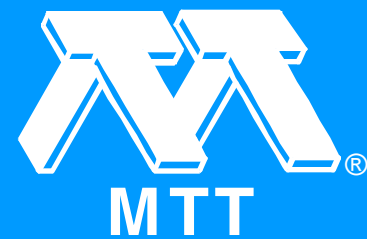


Abstracts

Physics and compact modeling of SOI substrates with buried ground plane (GPSOI) for substrate noise suppression

S. Stefanou, J.S. Hamel, M. Bain, P. Baine, B.M. Armstrong, H.S. Gamble, R. Mauntel and M. Haung. "Physics and compact modeling of SOI substrates with buried ground plane (GPSOI) for substrate noise suppression." 2001 MTT-S International Microwave Symposium Digest 01.3 (2001 Vol. III [MWSYM]): 1877-1880 vol.3.

The physical mechanisms responsible for superior crosstalk suppression are identified in a new class of silicon-on-insulator substrate (GPSOI) that incorporates a buried metallic ground plane below the active silicon and buried oxide layers. It has been shown that this technology exhibits a factor of ten reduction in crosstalk power between components through the substrate compared to existing state-of-the-art silicon-based substrates using standard s/sub 21/ magnitude measurements in a microwave coplanar transmission test structure. The dominant crosstalk mechanisms are identified and compared to other existing crosstalk suppression technologies using numerical electromagnetic simulations and lumped element compact model development.



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Low-loss passive components on BCB-based 3D MMIC technology

K. Nishikawa, S. Sugitani, K. Inoue, T. Ishii, K. Kamogawa, B. Piernas and K. Araki. "Low-loss passive components on BCB-based 3D MMIC technology." 2001 MTT-S International Microwave Symposium Digest 01.3 (2001 Vol. III [MWSYM]): 1881-1884 vol.3.

This paper proposes low-loss passive components that use newly developed trench-type transmission line together with BCB-based 3D MMIC technology. The trench-type transmission lines and via holes for 3D interconnection are fabricated simultaneously. The trench-type lines effectively reduce the transmission loss of passive components due to their high metal volume, resulting in high performance 3D MMICs. They are especially suitable for low frequency applications in which loss reduction is critical. Transmission lines and spiral/solenoidal inductors using the proposed trench-type line are demonstrated in this paper. These components offer low-loss and high quality factors. The design flexibility of the trench-type line is very high. This technology promises low cost, high performance, and highly integrated millimeter-wave MMICs including RF and IF circuits.

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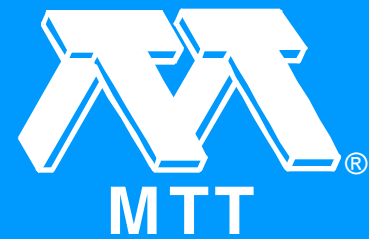
Microwave noise and power performance of metamorphic InP heterojunction bipolar transistors (HBTs) (2001 Vol. III [MWSYM])

S. Halder, Y.Z. Xiong, G.I. Ng, H. Wang, H.Q. Zheng, K. Radhakrishnan and J.C.M. Hwang. "Microwave noise and power performance of metamorphic InP heterojunction bipolar transistors (HBTs) (2001 Vol. III [MWSYM])." 2001 MTT-S International Microwave Symposium Digest 01.3 (2001 Vol. III [MWSYM]): 1885-1888 vol.3.

For the first time, microwave noise and power performance of metamorphic InP HBTs (MM-HBTs) grown on GaAs substrates are reported. We find that microwave performance of MM-HBTs are comparable to that of lattice-matched InP HBTs (LM-HBTs) of identical design but fabricated on an InP substrate. The preliminary results imply that the superior performance of InP HBTs can be confidently exploited with the more mature manufacturing technology of GaAs.

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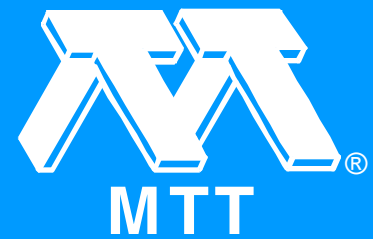
Broadband time-domain characterization of multiple flip-chip interconnects

P. Li, Hui Wu, Tong Li, K. Chin and Wenquan Sui. "Broadband time-domain characterization of multiple flip-chip interconnects." 2001 MTT-S International Microwave Symposium Digest 01.3 (2001 Vol. III [MWSYM]): 1891-1894 vol.3.

This paper presents a comprehensive approach for the characterization of multiple flip-chip interconnects by three-dimensional finite-difference time-domain (FDTD) method. The behaviors of transition discontinuities in three coplanar waveguide (CPW) layers and four flip-chip bump interconnects are investigated for optimal packaging performance. The relationship between the reflection loss and the cross-section of bumps is discussed in detail. Results in this paper shows that FDTD is a reliable method to simulate and aid design of complicated package structures.

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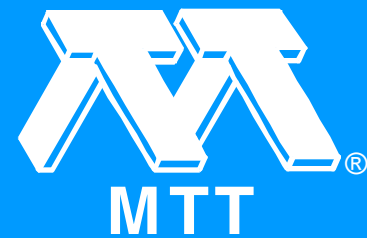
Ka band power pHEMT technology for space power flip-chip assembly

E. Rogeaux, J.-P. Fraysse, C. Schaffauser, S. George, D. Pons, P. Fellon, D. Geiger, D. Theron, N. Haese, S. Verdeyme, R. Quere, D. Baillargeat, E. Ngoya, S. Long and L. Escotte. "Ka band power pHEMT technology for space power flip-chip assembly." 2001 MTT-S International Microwave Symposium Digest 01.3 (2001 Vol. III [MWSYM]): 1895-1898 vol.3.

This paper proposes a released power pHEMT process for flip-chip mounting. The potential of this flip-chip process is demonstrated for power and low-noise applications in Ka-band.

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Design and analysis of low cost IC package solution for 10 Gbit/s applications

M. Megahed, P. Zilaro and M. Khaw. "Design and analysis of low cost IC package solution for 10 Gbit/s applications." 2001 MTT-S International Microwave Symposium Digest 01.3 (2001 Vol. III [MWSYM]): 1899-1902 vol.3.

Low cost IC package solution for 10 Gbit/s applications will be presented. The RF-LGA, laminate based CSP will be used. Design and analysis, in the frequency and time domains, of the RF-LGA is demonstrated. Results show that RF-LGA package, with wirebond technology, could achieve the required electrical performance for 10 Gbit/s applications.

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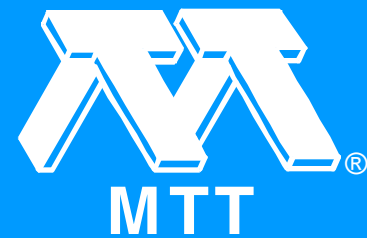


Abstracts

LTCC as MCM substrate: design of strip-line structures and flip-chip interconnects

F.J. Schmuckle, A. Jentzsch, W. Heinrich, J. Butz and M. Spinnler. "LTCC as MCM substrate: design of strip-line structures and flip-chip interconnects." 2001 MTT-S International Microwave Symposium Digest 01.3 (2001 Vol. III [MWSYM]): 1903-1906 vol.3.

LTCC multilayer substrates offer a cost-effective MCM solution for frequencies around 20 GHz and beyond. This paper reports on LTCC-specific transmission-line structures using a commercially available process. For the chip interconnect, a flip-chip approach contacting the backside is chosen, which, in a first step, is realized on conventional ceramics.



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Vertical transitions in low temperature co-fired ceramics for LMDS applications

A. Panther, C. Glaser, M.G. Stubbs and J.S. Wight. "Vertical transitions in low temperature co-fired ceramics for LMDS applications." 2001 MTT-S International Microwave Symposium Digest 01.3 (2001 Vol. III [MWSYM]): 1907-1910 vol.3.

To realize the advantages of low temperature co-fired ceramics (LTCC), such as highly integrated and low cost microwave packages, a library of repeatable and low loss vertical transitions is necessary. This paper presents measured results of three LTCC vertical transitions: stripline to coplanar waveguide (CPW), CPW to CPW, and CPW to microstrip. A novel grounding structure for intermediate ground planes is presented and discussed. The measured results demonstrate vertical transitions with good performance across the LMDS range.

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Characterization of high-density micromachined interconnects

J.L. Haley and R.F. Drayton. "Characterization of high-density micromachined interconnects." 2001 MTT-S International Microwave Symposium Digest 01.3 (2001 Vol. III [MWSYM]): 1911-1914 vol.3.

Silicon micromachining is used to locally reduce the substrate height of large diameter wafers in order to maintain single-mode microstrip propagation. Effective dielectric constant and attenuation are shown up to 45 GHz for a 50-ohm microstrip line that is printed across a thick (400 /spl mu/m) and thin (100 /spl mu/m) silicon area. Discontinuity effects for the dielectric and conductor show lower reflection (-10 dB above 15 GHz) and smoother transmission characteristics for the abrupt conductor transition compared to the tapered one. Loss performance of the reduced height interconnects are comparable to full height constant thickness designs and interconnect densities as high a factor of 4 can be achieved.

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Design and optimization for coaxial-to-microstrip transition on multilayer substrates

Hongwei Liang, J. Laskar, H. Barnes and D. Estreich. "Design and optimization for coaxial-to-microstrip transition on multilayer substrates." 2001 MTT-S International Microwave Symposium Digest 01.3 (2001 Vol. III [MWSYM]): 1915-1918 vol.3.

We present the design and optimization of a coaxial-to-microstrip transition on multilayer substrates for 10 GHz microwave applications. A parasitic parallel-plate line mode due to the multiple metal layers in the substrate has been observed from a careful electromagnetic field analysis. The parasitic mode causes serious leakage which can affect the embedded circuitry in the substrate significantly. A parasitic inductance has also been identified and suppressed. We apply an efficient comprehensive design method to develop a low-cost edge launch coaxial-to-microstrip interconnect on a six-metal-layer substrate. The new design shows no parasitic mode and no parasitic inductance. The final design demonstrates a return loss better than 20 dB at 10 GHz.

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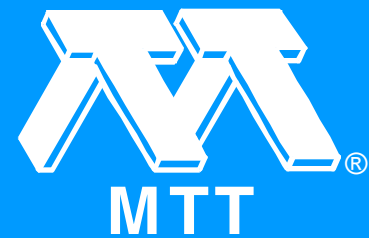
Temperature compensated planar narrow-band notch filter with fully automated laser-trimming

M. Schallner. "Temperature compensated planar narrow-band notch filter with fully automated laser-trimming." 2001 MTT-S International Microwave Symposium Digest 01.3 (2001 Vol. III [MWSYM]): 1919-1922 vol.3.

A new narrow-band notch filter using a planar dual mode ring resonator (RR) is presented. The resonator operates at harmonic frequencies and is manufactured on a temperature stable calcium magnesium titanate substrate, using photo-lithographic thin film processes. An innovative fully automated active laser-trimming procedure is used to adjust the center frequency and the bandwidth of the filter. High unloaded quality factors of more than 400 have been obtained at Ka-band frequencies. With these high quality factors a 3 dB bandwidth of less than 1% in conjunction with a notch depth of more than 40 dB can be achieved. In addition, the frequency tuning range of the laser-trimming is larger than 10% without any significant change of the filter characteristic or the quality factor of the resonator. The measured temperature coefficient of the filter is -2 ppm/K. We use a notch filter with an electrical length of four wavelengths to suppress the undesired residual local oscillator signal in the transmitter chain of our latest microwave Point-to-Point (PP) and Point-to-Multipoint (PMP) transceivers.

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MoM/BI-RME analysis of boxed microwave circuits based on arbitrarily shaped elements

M. Bozzi, L. Perregrini, A.A. Melcon, M. Guglielmi and G. Conciauro. "MoM/BI-RME analysis of boxed microwave circuits based on arbitrarily shaped elements." 2001 MTT-S International Microwave Symposium Digest 01.3 (2001 Vol. III [MWSYM]): 1925-1928 vol.3.

In this paper, we propose a novel approach for the analysis of shielded microstrip circuits, composed of a number of thin metallic areas with arbitrary shapes and finite conductivity, embedded in a multilayered lossy medium. The analysis is based on the solution of an Integral Equation (IE) obtained by enforcing the proper boundary condition to the electric field on the metallic areas. The solution of the IE is obtained by the Method of Moments (MoM) with entire domain basis functions, which are numerically determined by the Boundary Integral-Resonant Mode Expansion (BI-RME) method. The use of the BI-RME method allows for the efficient calculation of entire domain basis functions in the case of metallic areas with arbitrary shapes, thus permitting the analysis of a wide class of circuits. Two examples demonstrate the accuracy, rapidity, and flexibility of the proposed method.

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Fast electromagnetic analysis of dense shielded integrated circuits using the adaptive integral method (AIM)

V.I. Okhmatovski and A.C. Cangellaris. "Fast electromagnetic analysis of dense shielded integrated circuits using the adaptive integral method (AIM)." 2001 MTT-S International Microwave Symposium Digest 01.3 (2001 Vol. III [MWSYM]): 1929-1932 vol.3.

The adaptive integral method (AIM) is used to accelerate the electromagnetic solution of dense integrated circuits inside metallic enclosures of rectangular cross section. The computational complexity and memory requirements for the proposed AIM-based electromagnetic solver scale as $O(N \log N)$ and $O(N)$, respectively, where N is the number of unknowns in the discrete approximation of the governing integral equation. The accuracy and efficiency of the solver is demonstrated through its application to the modeling of a shielded patch array used for spatial power combining.

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Full wave analysis of electromagnetic coupling in realistic RF multilayer PCB layouts using cascaded parallel plate waveguide model

M.R. Abdul-Gaffoor, H.K. Smith, A.A. Kishk and A.W. Glisson. "Full wave analysis of electromagnetic coupling in realistic RF multilayer PCB layouts using cascaded parallel plate waveguide model." 2001 MTT-S International Microwave Symposium Digest 01.3 (2001 Vol. III [MWSYM]): 1933-1936 vol.3.

Realistic multilayer Printed Circuit Boards (PCBs) used in RF applications have large amount of metalization and a number of vias to provide good shielding and connectivity between nets in different layers. Taking advantage of these physical properties and using the equivalence principle, the multilayer PCB is modeled as a cascade of parallel plate waveguides with half-space regions residing above and below the PCB. Instead of formulating the problem in terms of electric currents in the horizontal metal layers, it is formulated using equivalent magnetic currents in the non-metallic regions of layer interfaces. The equivalent magnetic currents at the dielectric interfaces are expressed in terms of the Rao-Wilton-Glisson (RWG) basis functions. The electric currents flowing on the vias inside dielectric layers are assumed constant in the vertical direction. These vertical electric currents radiate TEM modes in the parallel plate environment. Integral equations based on simple parallel plate and free-space Green's functions enforcing the boundary conditions are set up and solved using the Method of Moments. The equivalent magnetic currents in each layer interact with currents in the adjacent layers only, thereby resulting in a "chained-block-banded" matrix. Excitation is provided through ports defined at each pair of pads, or between a pad and nearby ground. These ports are located only on the top and the bottom layers of the PCB where the circuit components and IC pins are mounted. This formulation requires the computation of the MoM matrix only once per frequency for any number of ports. Further, the solution for only those unknown equivalent magnetic currents around the port regions is required to obtain the N-port impedance parameter characterization of the PCB. Consequently, a memory efficient block matrix solution process can be used to solve problems of large size for a given memory. Realistic PCB example is given to illustrate the validity of this approach.

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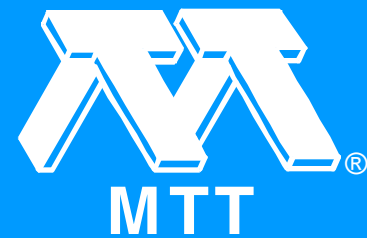


Abstracts

A new global-analysis model for microwave circuits with lumped elements

Chi-Hsueh Wang, Huei Wang and Chun Hsiung Chen. "A new global-analysis model for microwave circuits with lumped elements." 2001 MTT-S International Microwave Symposium Digest 01.3 (2001 Vol. III [MWSYM]): 1937-1940 vol.3.

A new global full-wave analysis model by using the gap-current ports to analyze the microwave circuits with linear or nonlinear lumped elements is proposed. Based on this model, all electromagnetic effects due to the distributed parts of circuit structures can be easily characterized. In this study, the proposed model is applied to analyze and design a singly balanced diode mixer circuit using the slotline T-junction as a 180/spl deg/ hybrid.



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Analysis of multi-layer integrated inductors with wave concept iterative procedure (WCIP)

S. Akatimagool, D. Bajon and H. Baudrand. "Analysis of multi-layer integrated inductors with wave concept iterative procedure (WCIP)." 2001 MTT-S International Microwave Symposium Digest 01.3 (2001 Vol. III [MWSYM]): 1941-1944 vol.3.

In this paper, we present the WCIP iterative procedure (wave concept iterative procedure) for solving continuity conditions in terms of waves rather than in term of tangential fields providing a mixed resolution in spatial and spectral domain taking the best advantage of each resolution domain and lower computation time. The spiral inductor with patterned ground shield is taken as an example of multi-layer structures; the results are in reasonably good agreement with the experimental data.

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Numerical cost of gradient computation within the method of moments and its reduction by means of a novel boundary-layer concept

S. Amari. "Numerical cost of gradient computation within the method of moments and its reduction by means of a novel boundary-layer concept." 2001 MTT-S International Microwave Symposium Digest 01.3 (2001 Vol. III [MWSYM]): 1945-1948 vol.3.

A rigorous investigation of the numerical cost of sensitivity analysis (gradient computation) of complex structures within moment method is presented. It is shown that, when the number of variables N used in the analysis is large, a common situation in complex structures, the ratio r of the number of flops required to evaluate the sensitivity of the response to structural changes to the number of flops required to determine the response at a single point is such that $r=O(1/N)$ as long as the number of flops required to fill the matrix is not dominant. For the latter important case, a new boundary layer concept is introduced to reduce the CPU time for the gradient computation. A simple example of an iris in a rectangular waveguide is used to illustrate the concept and show its validity.

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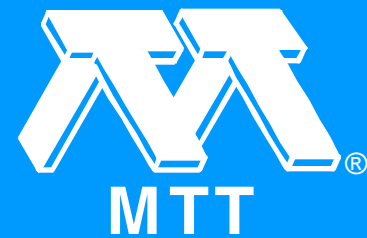


Abstracts

Automated intelligent mode selection for fast mode matching analysis of waveguide discontinuities

C.A.W. Vale and P. Meyer. "Automated intelligent mode selection for fast mode matching analysis of waveguide discontinuities." 2001 MTT-S International Microwave Symposium Digest 01.3 (2001 Vol. III [MWSYM]): 1949-1952 vol.3.

This paper presents a novel scheme for mode selection in mode matching problems. The technique is capable of reducing the size of a system considerably whilst retaining high accuracy. A procedure for efficient cascade analysis with the technique is also presented.



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A 183 GHz low noise amplifier module with 5.5 dB noise figure for the conical-scanning microwave imager sounder (CMIS) program

R. Raja, M. Nishimoto, B. Osgood, M. Barsky, M. Sholley, R. Quon, G. Barber, P. Liu, R. Lai, F. Hinte, G. Haviland and B. Vacek. "A 183 GHz low noise amplifier module with 5.5 dB noise figure for the conical-scanning microwave imager sounder (CMIS) program." 2001 MTT-S International Microwave Symposium Digest 01.3 (2001 Vol. III [MWSYM]): 1955-1958 vol.3.

We present the development of a low noise amplifier (LNA) module which demonstrates gain >24 dB and noise figure (NF)<5.5 dB at 183 GHz. Our previous results reported NF<8.3 dB [1], This improvement was achieved by inserting a single-ended microwave monolithic integrated circuit (MMIC) LNA utilizing TRW's 0.08 /spl mu/m gate InP MMIC technology. This paper discusses the development of the new MMIC LNA, reviews the previous results and presents the new data that was obtained,.

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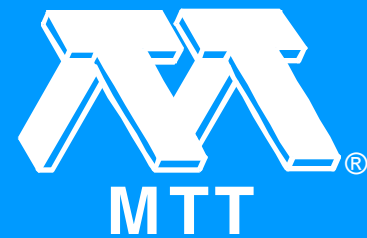
Low noise amplifiers in InP technology for pseudo correlating millimeter wave radiometer

P. Kangashlahti, T. Gaier, D. Dawson, J. Tuovinen, T. Karttaavi, M. Lahdes, N.J. Hughes, T.L. Cong, P. Jukkala, P. Sjoman and S. Weinreb. "Low noise amplifiers in InP technology for pseudo correlating millimeter wave radiometer." 2001 MTT-S International Microwave Symposium Digest 01.3 (2001 Vol. III [MWSYM]): 1959-1962 vol.3.

This decade will be very important for cosmology due to several missions to measure the cosmic microwave background radiation. These measurements require highly sensitive radiometers operating over a very wide frequency spectrum. The millimeter wave radiometers are best developed as pseudo correlating radiometers due to the inherent stability and high sensitivity of this instrument. To miniaturize the size and power consumption of these radiometers we have developed the critical low noise amplifier and phase switch MMICs using high-performance InP technologies. The low noise amplifiers achieved record 2.3 dB noise figure over the 60-80 GHz frequency band at room temperature and less than 25 K noise temperature at 20 K ambient temperature. These MMICs form the building blocks for 70 GHz highly sensitive correlating radiometers, that are needed e.g. in the ESA Planck mission.

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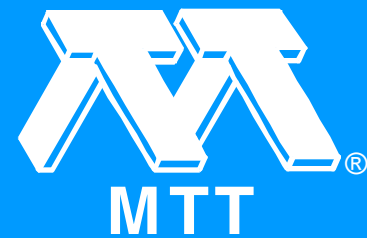
Simple model for dynamic range estimate of GaAs amplifiers

Z.M. Nosal. "Simple model for dynamic range estimate of GaAs amplifiers." 2001 MTT-S International Microwave Symposium Digest 01.3 (2001 Vol. III [MWSYM]): 1963-1966 vol.3.

The method to estimate the dynamic range of low bias power low noise GaAs amplifiers for portable radio communication equipment is presented. The method uses the extension of a simple linear noise model of the microwave FET, major components of which are bias dependent. Both noise figure and intermodulation distortion of an amplifier may be predicted with this model and the dynamic range is easily calculated as a function of bias current and transistor width. The model unifies small signal and nonlinear properties in a form suitable for manual computation.

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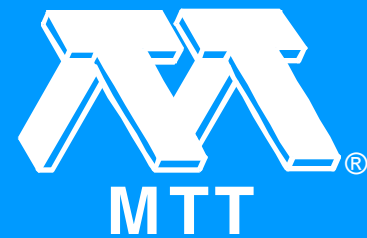
Modeling of low-frequency noise in GaInP/GaAs hetero-bipolar transistors

P. Heymann, M. Rudolph, R. Doerner and F. Lenk. "Modeling of low-frequency noise in GaInP/GaAs hetero-bipolar transistors." 2001 MTT-S International Microwave Symposium Digest 01.3 (2001 Vol. III [MWSYM]): 1967-1970 vol.3.

Accurate low-frequency noise modeling is a prerequisite for oscillator phase-noise simulation. In this paper, the LF noise sources of GaInP/GaAs HBTs are investigated. It turns out that the 1/f-noise model must contain two sources, the base-emitter diode and the emitter resistance. Quantitatively, excess noise power at 100 kHz scales with the square of collector current-density.

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Microwave noise and small-signal parameters scaling of InP/InGaAs DHBT with high DC current gain

Y.Z. Xiong, G.I. Ng, H. Wang, C.L. Law, K. Radhakrishnan and J.S. Fu. "Microwave noise and small-signal parameters scaling of InP/InGaAs DHBT with high DC current gain." 2001 MTT-S International Microwave Symposium Digest 01.3 (2001 Vol. III [MWSYM]): 1971-1974 vol.3.

Scaling of microwave noise and small-signal parameters of InP-based Double Heterojunction Bipolar Transistors (DHBTs) with high DC current gain is presented. Three different sizes of InP/InGaAs DHBT are investigated in this work. Because of the low surface and intrinsic recombination of the InP-based DHBT with high current gain, the extrinsic parasitic effect of the device can be neglected. Thus, the microwave parameters of large size InP DHBT can be obtained by scaling the parameters of the smaller emitter size device. Good agreement was obtained between the measured and the calculated results. This scaling technique is very useful for the design of high frequency circuits using InP-based HBTs.





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An all-cryogenic low phase-noise hybrid K-band oscillator for satellite communications

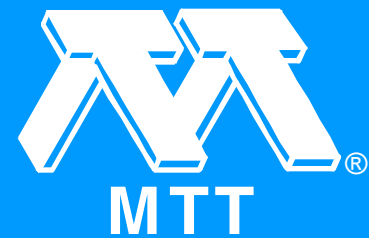
S. Vitusevich, K. Schieber, N. Klein, I.S. Ghosh and M. Spinnler. "An all-cryogenic low phase-noise hybrid K-band oscillator for satellite communications." 2001 MTT-S International Microwave Symposium Digest 01.3 (2001 Vol. III [MWSYM]): 1977-1980 vol.3.

Within the frame of the German research programme "High-temperature superconductor systems for satellite communication", a low phase-noise K-band oscillator, based on space qualified technology, materials and parts, has been developed. Our approach is an all-cryogenic hybrid oscillator based on a sapphire whispering-gallery mode resonator and a low-noise PHEMT amplifier. Despite the simple concept of the oscillator, phase noise values superior to quartz stabilized oscillators operating at the same frequency have been achieved. In addition to low phase noise, the oscillator possesses mechanical and electrical frequency tunability. This type of oscillator shows potential to greatly enhance the performance of the carrier frequency generation in future satellite payloads.

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Dual 5 MHz PCS receiver front end

E.R. Soares, K.F. Raihn and J.D. Fuller. "Dual 5 MHz PCS receiver front end." 2001 MTT-S International Microwave Symposium Digest 01.3 (2001 Vol. III [MWSYM]): 1981-1984 vol.3.

The American Personal Communications Service (PCS) uplink spectrum is divided into 6 frequency bands located between 1850 MHz and 1910 MHz. One of the consequences of this frequency division is that a single service provider can have multiple non-adjacent frequency bands in the same region. STI has developed and built a dual 5 MHz front-end system for PCS base stations. Each channel in the system consists of two double-diplexed 5 MHz wide band pass filters and a balanced cryogenic low noise amplifier (LNA). Each pseudo-elliptic band pass filter consists of 8 resonators and two cross-coupling paths.

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Compact quasi-lumped element HTS microstrip filters

Hieng Tiong Su, F. Huang and M.J. Lancaster. "Compact quasi-lumped element HTS microstrip filters." 2001 MTT-S International Microwave Symposium Digest 01.3 (2001 Vol. III [MWSYM]): 1985-1988 vol.3.

This paper demonstrates the design of two quasi-elliptic and one linear phase filter. Different methods of cross coupling, which result in different advanced filtering characteristics, are investigated and verified experimentally. Each of these filters is designed to have a fractional bandwidth of 15 MHz and a centre frequency of 1.7775 GHz. All the filters are in basic quadruplex form and can be used for higher order filter design. These filters are good candidates for wireless and mobile communication systems.



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Optoelectronic RF harmonic generation and mixing in high-T/sub c/ superconducting film

A.H. Majedi, S.K. Chaudhuri, R. Mansour and S. Safavi-Naeini. "Optoelectronic RF harmonic generation and mixing in high-T/sub c/ superconducting film." 2001 MTT-S International Microwave Symposium Digest 01.3 (2001 Vol. III [MWSYM]): 1989-1992 vol.3.

We demonstrate for the first time the possibility of RF harmonic generation and signal mixing in HTS thin films by optoelectronic technique. Using HTS photoresponse, the inductance of the HTS film is modulated by an RF carrier frequency, which is the envelope of the optical signal. In the presence of a DC or sinusoidal current, second harmonic generation and RF signal mixing are achieved respectively using YBaCuO thin film by temporal and frequency analysis. This novel device can be useful for low-noise/low-power HTS microwave-photonic systems and interconnects.

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Novel method for calculation and measurement of unloaded Q-factor of superconducting dielectric resonators

M.V. Jacob, J. Mazierska, K. Leong and J. Krupka. "Novel method for calculation and measurement of unloaded Q-factor of superconducting dielectric resonators." 2001 MTT-S International Microwave Symposium Digest 01.3 (2001 Vol. III [MWSYM]): 1993-1996 vol.3.

The dielectric resonator technique is recognised as the best method for the measurement of surface resistance ($R_{\text{sub } s}$) of High Temperature Superconducting thin films. The $R_{\text{sub } s}$ is calculated from the Unloaded Q-factor ($Q_{\text{sub } 0}$) of the resonator, and to obtain accurate values of the $Q_{\text{sub } 0}$ -factor multi-frequency measurements of $S_{\text{sub } 21}$, $S_{\text{sub } 11}$ and $S_{\text{sub } 22}$ and data circle fitting are required. As a result, surface resistance measurements at varying temperatures are very time consuming. In this paper we introduce a simplified method for calculations the $Q_{\text{sub } 0}$ -factor, which require measurements of $S_{\text{sub } 11}$ and $S_{\text{sub } 22}$ at the lowest temperature only. For all other temperatures only $S_{\text{sub } 21}$ measurements are needed. The method has shown to give sufficiently accurate $Q_{\text{sub } 0}$ values and hence the surface resistance.

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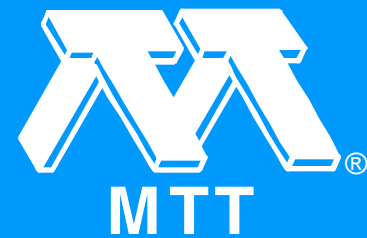


Abstracts

Generalized multi-gridding technique for the TLM method using the symmetrical super-condensed node (SSCN)

G.N. Mulay and K.S. Jog. "Generalized multi-gridding technique for the TLM method using the symmetrical super-condensed node (SSCN)." 2001 MTT-S International Microwave Symposium Digest 01.3 (2001 Vol. III [MWSYM]): 1999-2002 vol.3.

This paper extends Wlodarczyk's TLM multi-gridding-technique to the generalized one and two dimensional cases wherein the fine meshes can have different lengths and widths. The advantage is that it is no longer necessary to divide the problem space into separate 'coarse' and 'fine' regions which provides for considerable meshing flexibility. Equations describing the connection procedure for the SSCN are derived. Modelling of crosstalk between PCB tracks is implemented with this new method and the simulation results compared with experiments.



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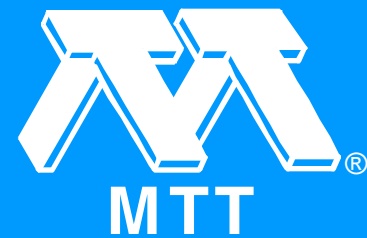


Abstracts

A novel adaptive approach to modeling MEMS tunable capacitors using MRTD and FDTD techniques

N. Bushyager, M.M. Tentzeris, L. Gatewood and J. DeNatale. "A novel adaptive approach to modeling MEMS tunable capacitors using MRTD and FDTD techniques." 2001 MTT-S International Microwave Symposium Digest 01.3 (2001 Vol. III [MWSYM]): 2003-2006 vol.3.

This paper introduces a novel full wave technique for modeling MEMS tunable capacitors that is based on the coupling of physical motion of the MEMS device with Maxwell's equations through the modification of the MRTD/FDTD techniques. The difficulties of modeling MEMS devices are discussed, and ways to compensate for several of these are presented. The proposed approach is validated through comparison of simulation results to measurement for an interdigitated capacitor.



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A multi-threaded time domain TLM algorithm for symmetric multi-processing computers

P.P.M. So and W.J.R. Hoefer. "A multi-threaded time domain TLM algorithm for symmetric multi-processing computers." 2001 MTT-S International Microwave Symposium Digest 01.3 (2001 Vol. III [MWSYM]): 2007-2010 vol.3.

A multi-threaded TLM algorithm will be presented in this paper. The algorithm enables time domain field simulators to exploit the full computing power of multi-processor computers, resulting in improved performance of field solver based CAD tools running on multi-processor computers.



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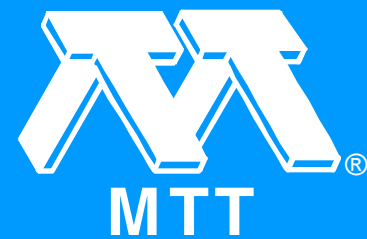
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Construction of solutions to electromagnetic problems in terms of two collinear vector potentials

N. Georgieva. "Construction of solutions to electromagnetic problems in terms of two collinear vector potentials." 2001 MTT-S International Microwave Symposium Digest 01.3 (2001 Vol. III [MWSYM]): 2011-2014 vol.3.

In this work, the construction of solutions to general transient EM problems in terms of two collinear vector potentials (VPs) is subjected to a careful theoretical study and numerical verification. The problems are considered to be general in the sense that the medium can be inhomogeneous, lossy and may contain sources. Anisotropy is not considered in this paper. First, the completeness of the solution in terms of the two VPs is addressed. Second, the behavior of the VPs at interfaces and edges is investigated. Finally, a number of simple but relevant numerical tests are performed to verify the theoretical model. This work is part of the effort to establish the solid theoretical background of a novel efficient method for the analysis of transient EM propagation.

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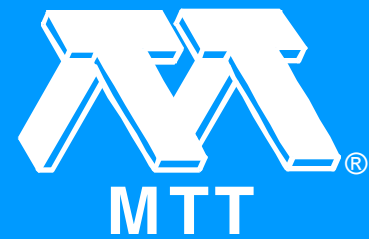
Analysis of lumped element transistor structures using MRTD: the equivalent source method

R.L. Robertson and L.P.B. Katehi. "Analysis of lumped element transistor structures using MRTD: the equivalent source method." 2001 MTT-S International Microwave Symposium Digest 01.3 (2001 Vol. III [MWSYM]): 2015-2018 vol.3.

The Multiresolution Time Domain (MRTD) method is applied to Maxwell's equations and used to simulate lumped element transistor circuits. These lumped element circuits are expressed in terms of equivalent sources, or difference equations derived a priori to describe the behavior of the transistor. In this formulation, the transistor is modeled as a current source truncating the computation region. MRTD results are compared to those generated by LIBRA and good correlation is noted.

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Efficient time-domain electromagnetic analysis using CDF biorthogonal wavelet expansion

T. Dogaru and L. Carin. "Efficient time-domain electromagnetic analysis using CDF biorthogonal wavelet expansion." 2001 MTT-S International Microwave Symposium Digest 01.3 (2001 Vol. III [MWSYM]): 2019-2022 vol.3.

The multi-resolution time-domain (MRTD) algorithm is implemented using Cohen-Daubechies-Feauveau (CDF) wavelet bases, resulting in a computationally efficient numerical scheme for electromagnetic field analysis. The application to a simple scattering problem demonstrates the advantages of the method versus the conventional finite-difference time-domain (FDTD) technique.

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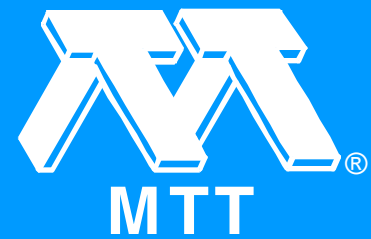


Abstracts

A wavelet-based FDTD-multigrid-method

M. Walter, P. Waldow and I. Wolff. "A wavelet-based FDTD-multigrid-method." 2001 MTT-S International Microwave Symposium Digest 01.3 (2001 Vol. III [MWSYM]): 2023-2026 vol.3.

In the past years, several methods combining FDTD-like algorithms and wavelets have been developed in order to reduce simulation times. We present a method that directly transforms Yee's three-dimensional FDTD-algorithm into the wavelet domain at arbitrary scale. We derive an analytic and stable multigrid-like method and present simulation results.



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Analysis and design of a planar antenna for a millimetre-wave emitter using TLM

K.P. Heppenheimer, L. Vietzorreck and P. Russer. "Analysis and design of a planar antenna for a millimetre-wave emitter using TLM." 2001 MTT-S International Microwave Symposium Digest 01.3 (2001 Vol. III [MWSYM]): 2027-2030 vol.3.

In this paper we investigate and design a planar patch antenna using the Transmission Line Matrix method (TLM). The planar antenna is part of a monolithic integrated millimeter-wave emitter, working in the 60 GHz range on a high resistivity silicon substrate. The active part will be realized by a negative impedance amplifier, here an IMPATT diode, the patch antenna is used as resonator as well as radiating element. For designing an appropriate resonator the design criteria are the desired frequency, an impedance match with the impedance of the IMPATT diode and the radiation characteristic and efficiency. For technological reasons a 525 μm substrate had to be chosen, which naturally will deteriorate not only the radiation features of the antenna, but also the behaviour of the impedance. The requirements concerning the impedance are a very low real part of the input impedance of the antenna ($\text{Re}\{Z_{\text{in}}\} \ll \text{Re}\{Z_{\text{diode}}\}$), smaller than the negative impedance of the IMPATT diode in order to enable exponentially increasing oscillations. The imaginary part of the antenna has to show a steep gradient above the resonant frequency up to values $\text{Im}\{Z_{\text{in}}\} \approx 30, 40 \Omega$. In order to find a design which will fulfil those critical requirements, a full wave analysis is demanded. The TLM method has proven to be a very powerful and flexible numerical method for the analysis of various planar and three-dimensional topologies, especially useful for the investigation of broadband structures, but yet has not been utilized extensively for the analysis of radiating structures. It will be shown, how TLM can be used for antenna modeling, the necessary steps for the design of the patch antenna will be demonstrated and results will be validated by comparison with spectral domain methods.



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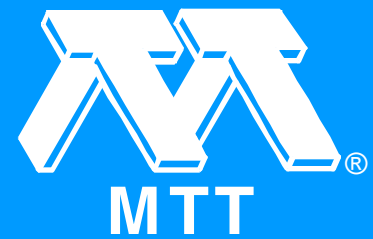
Analysis of differential vias in a multilayer parallel plate environment using a physics-based CAD model

R. Abhari, G.V. Eleftheriades and E. van Deventer-Perkins. "Analysis of differential vias in a multilayer parallel plate environment using a physics-based CAD model." 2001 MTT-S International Microwave Symposium Digest 01.3 (2001 Vol. III [MWSYM]): 2031-2034 vol.3.

A lumped-element physics-based equivalent circuit for differential vias in multilayer parallel plate environments is presented. The TEM parallel plate mode excited by differential vias is quantified by implementing the developed model in a commercial CAD tool. The corresponding CAD simulations are performed in a matter of a few seconds on an Ultra 5 SUN workstation and compare well with Time Domain Reflectometry (TDR) measurements and Finite Difference Time Domain (FDTD) simulations.

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3D-FDTD subgridding technique applied to radiating structures

M. Bonilla, Man-Fai Wong, J. Wiat, G. Alquie and V.F. Hanna. "3D-FDTD subgridding technique applied to radiating structures." 2001 MTT-S International Microwave Symposium Digest 01.3 (2001 Vol. III [MWSYM]): 2035-2038 vol.3.

A 3D-FDTD subgridding technique based on a finite element formulation is presented. This subgridding technique is applied to compute the input impedance of a mobile phone antenna. The obtained results are in good agreement with those obtained using a uniform mesh, while the CPU time and the used computer memory are largely less important.

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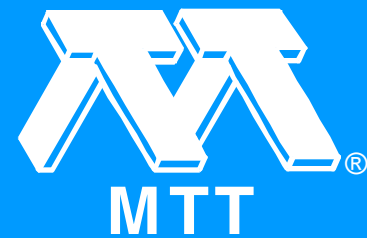


Abstracts

Enhanced forward coupling phenomena between microstrip lines on periodically patterned ground plane

Chin-Chang Chang, Yongxi Qian and Tatsuo Itoh. "Enhanced forward coupling phenomena between microstrip lines on periodically patterned ground plane." 2001 MTT-S International Microwave Symposium Digest 01.3 (2001 Vol. III [MWSYM]): 2039-2042 vol.3.

Strong forward coupling and slow-wave effects have been observed between two parallel microstrip lines on a periodically patterned ground plane, even though the two lines are separated with very large gap spacing. The even- and odd-mode effective dielectric constants have been calculated using the FDTD method to investigate this phenomenon. The slow-wave effects and enhanced coupling will help in the design of forward-wave directional couplers with reduced line lengths and relaxed gap spacing requirements.



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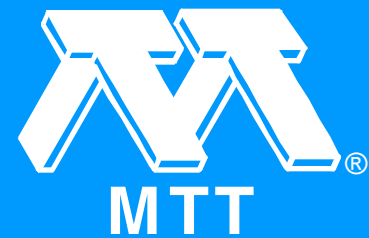
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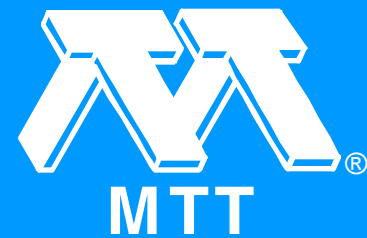
Coupled TLM-thermal analysis in the time domain

Wei Liu, P.P.M. So and W.J.R. Hoefer. "Coupled TLM-thermal analysis in the time domain." 2001 MTT-S International Microwave Symposium Digest 01.3 (2001 Vol. III [MWSYM]): 2043-2046 vol.3.

A coupled time domain TLM-thermal analysis technique is presented in this paper. It is a hybrid combination of algorithms comprising TLM, FDTD and ray optical algorithms for evaluating the transient thermal behavior of objects placed inside a cavity or waveguide. Electromagnetic fields are calculated using a GSCN 3D TLM algorithm. We have developed the analysis procedure primarily for evaluating power handling capability of waveguide and microstrip structures. Nevertheless, this procedure can be applied to general microwave heating problems.

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Lumped and distributed device embedding techniques in time domain TLM field models

J.W. Park, P.P.M. So and W.J.R. Hoefer. "Lumped and distributed device embedding techniques in time domain TLM field models." 2001 MTT-S International Microwave Symposium Digest 01.3 (2001 Vol. III [MWSYM]): 2047-2050 vol.3.

There exist several techniques for embedding devices into TLM networks. These techniques yield in general slightly different results when the mesh size is finite. In this paper, we classify these techniques, compare results obtained with different embedding methods, and show how SPICE models of active and passive lumped element circuits can be incorporated into 2D and 3D TLM networks. Recommendations as to the best method for a given device type will be formulated.

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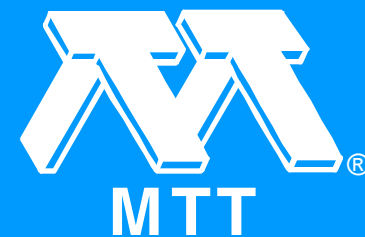


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Analysis of multiport waveguide structures by a higher-order FDTD methodology based on non-orthogonal curvilinear grids

N.V. Kantartzis, M. Gatzianas, T.I. Kosmanis and T.D. Tsiboukis. "Analysis of multiport waveguide structures by a higher-order FDTD methodology based on non-orthogonal curvilinear grids." 2001 MTT-S International Microwave Symposium Digest 01.3 (2001 Vol. III [MWSYM]): 2051-2054 vol.3.

A generalized methodology for the construction of nonstandard higher-order finite-difference time-domain schemes, as well as their application to complex electromagnetic problems in curvilinear non-orthogonal coordinate systems, are presented in this paper. As a consequence, a new class of low-dispersion operators is designed for the approximation of spatial and temporal derivatives. Their extension to curvilinear non-orthogonal coordinates is attained by a higher-order variation of the covariant and contravariant vector component theory, in which all metric terms are taken into account. Finally, the proposed method is validated by the analysis of diverse multiport microwave structures with realistic features.



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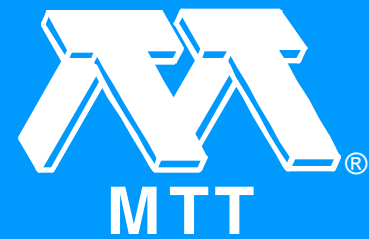
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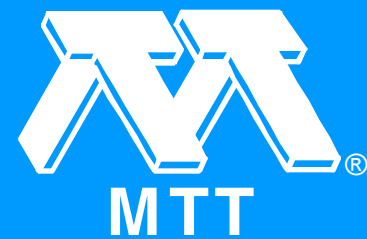
FDTD study of resonance processes in microstrip ring resonators with different excitation geometries

E. Semouchkina, Wenwu Cao and R. Mittra. "FDTD study of resonance processes in microstrip ring resonators with different excitation geometries." 2001 MTT-S International Microwave Symposium Digest 01.3 (2001 Vol. III [MWSYM]): 2055-2058 vol.3.

The Finite Difference Time Domain (FDTD) method is employed in this paper to study resonance processes in microstrip ring resonators in both time and frequency domains. It is shown that the geometry of the excitation strongly affects wave propagation and standing wave formation in the structures; in particular, it causes resonance mode splitting in side-coupled ring resonators.

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An unconditionally stable finite element time domain solution of active nonlinear microwave circuits using perfectly matched layers

Hsiao-Ping Tsai, Yuanxun Wang and Tatsuo Itoh. "An unconditionally stable finite element time domain solution of active nonlinear microwave circuits using perfectly matched layers." 2001 MTT-S International Microwave Symposium Digest 01.3 (2001 Vol. III [MWSYM]): 2059-2062 vol.3.

This paper proposes an extension of the unconditionally stable finite element time domain (FETD) method for the global electromagnetic analysis of active microwave circuits. This formulation has two advantages. First, the time step size is no longer governed by the spatial discretization of the mesh, but rather by the Nyquist sampling criterion. Second, the implementation of the truncation by the perfectly matched layers is straightforward. A benchmark test on a microwave amplifier indicates that this extended FETD algorithm is not only superior than FDTD-based algorithm in mesh flexibility and simulation accuracy, but also reduces computation time dramatically.

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Optimal shape design of dielectric structure using FDTD and topology optimization

Young-Seek Chung and Changyul Cheon. "Optimal shape design of dielectric structure using FDTD and topology optimization." 2001 MTT-S International Microwave Symposium Digest 01.3 (2001 Vol. III [MWSYM]): 2063-2066 vol.3.

In this paper, an optimal design method based on the FDTD technique and the topology optimization is proposed. Topology Optimization is a scheme to search an optimal shape by adjusting the material properties of design space. And by introducing the adjoint variable method, we can effectively estimate a derivative of objective function with respect to design variable. In order to verify our method, a shape design problem of dielectric structure is tested in the TM/sup Z/ case. In this example, the permittivity density at each grid is taken as design variable.



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Electronic design assistance tool for circuit optimization: application to microwave power amplifiers

C. Duperrier, M. Campovecchio, J. Rousset, R. Quere, S. Mons, A. Mallet and L. Lapierre.
"Electronic design assistance tool for circuit optimization: application to microwave power amplifiers." 2001 MTT-S International Microwave Symposium Digest 01.3 (2001 Vol. III [MWSYM]): 2067-2070 vol.3.

An electronic design automation tool is being developed to assist the designer in optimizing RF and microwave nonlinear circuits. This paper reports the first version of this software dedicated to power amplifier design. This tool does not intend to simulate nonlinear circuits because CAD tools are already available and reliable. It intends to develop an efficient and predictive design process from reusable knowledge databases (components, circuits, methodologies, etc.). The reported assistance tool has been implemented into an open computing environment using the DB2 database, C/sup ++/ programs, template files, Java interfaces and the ADS software for simulation. The design process starts off from circuit specifications. Either, the history database is explored to find already carried out circuits demonstrating performances close to specifications or the component database is explored to select appropriate active device(s) and to generate a first-cut amplifier architecture meeting the requested specifications. Then, this assistance tool guides the designer at each step by proposing suited methods and specific helps (substitute generators, matching, nonlinear stability, linearity, etc.) up to yield analysis.





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Nonlinear statistical modeling of large-signal device behavior

W. Stiebler, F. Rose and J. Selin. "Nonlinear statistical modeling of large-signal device behavior." 2001 MTT-S International Microwave Symposium Digest 01.3 (2001 Vol. III [MWSYM]): 2071-2074 vol.3.

A novel technique for modeling the nonlinear statistics of large- and small-signal device model parameters is proposed. It features transformation of individual random variables and introduces a new criterion for optimum statistical variable transformation based on Quantile-Quantile plots. Subsequently, multivariate methods are applied to build an inherently nonlinear statistical model. The models are easily implemented into current CAD tools and are suited to accurately predict yield in the presence of process variations and process shifts. Results for devices and MMIC circuits operated under small- and large signal excitation validate the accuracy of the method.

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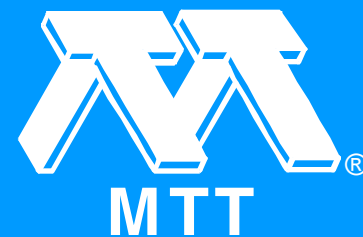


Abstracts

A computer aided design technique for hybrid and monolithic microwave amplifiers employing distributed equalizers with lumped discontinuities

A. Aksen and B.S. Yarman. "A computer aided design technique for hybrid and monolithic microwave amplifiers employing distributed equalizers with lumped discontinuities." 2001 MTT-S International Microwave Symposium Digest 01.3 (2001 Vol. III [MWSYM]): 2075-2078 vol.3.

This paper will address the use of mixed lumped and distributed elements in the matching equalizers of microwave amplifiers for hybrid and monolithic MIC realizations. In this work we show how the computer aided real frequency technique can be extended to design broadband amplifiers employing distributed equalizers with lumped discontinuities. The scattering based two-variable description of lossless equalizers with mixed lumped-distributed elements will be discussed and the potential benefits of the approach will be indicated by examples.



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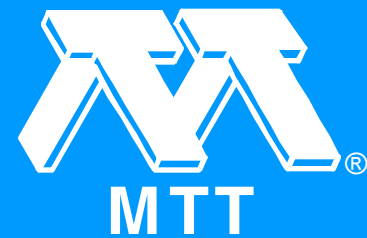


Abstracts

Statistical construction of a representative CAD model from a measured population for RF design applications

W. Leiker and K. Naishadham. "Statistical construction of a representative CAD model from a measured population for RF design applications." 2001 MTT-S International Microwave Symposium Digest 01.3 (2001 Vol. III [MWSYM]): 2079-2082 vol.3.

Component models available in CAD software do not consider statistical variation and layout or package parasitic effects of components. Because of the complexity of device packages, EM simulation can only be used to analyze relatively simple circuits. In this paper, we present a methodology to statistically construct a representative SMD component model from a measured population, and show how such a model can be used in a circuit simulator for effective first-pass design, which incorporates all the parasitic effects through measurements. Using measured component data in optimization and yield analysis is expected to enable CAD packages to reduce considerably the number of design cycles.



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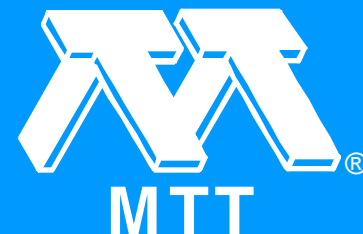


Abstracts

SMX - A novel object-oriented optimization system

M.H. Bakr, J.W. Bandler, Q.S. Cheng, M.A. Ismail and J.E. Rayas-Sanchez. "SMX - A novel object-oriented optimization system." 2001 MTT-S International Microwave Symposium Digest 01.3 (2001 Vol. III [MWSYM]): 2083-2086 vol.3.

The novel, object-oriented SMX optimization system implements the powerful Surrogate Model-based Space Mapping (SMSM) algorithm, which is automated for the first time. SMX is capable of driving commercial EM, circuit and user-supplied simulators. The SMX architecture permits easy integration of new simulators and optimization tools. The power of SMX is illustrated through an optimization example exploiting Momentum.



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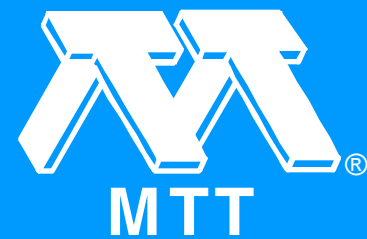
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A robust algorithm for automatic development of neural network models for microwave applications (2001 Vol. III [MWSYM])

V. Devabhaktuni, M.C.E. Yagoub and Qi-Jun Zhang. "A robust algorithm for automatic development of neural network models for microwave applications (2001 Vol. III [MWSYM])." 2001 MTT-S International Microwave Symposium Digest 01.3 (2001 Vol. III [MWSYM]): 2087-2090 vol.3.

In this paper, we propose a robust algorithm for automating the neural network based RF/Microwave model development process. The algorithm can build a neural model starting with zero amount of training/test data, and then proceeding with neural network training in a stage-wise manner. In each stage, the algorithm utilizes neural network error criteria to determine additional training/test samples required and their location in model input space. The algorithm dynamically generates these new data samples during training, by automatic driving of simulation tools, e.g., OSA90, Ansoft-HFSS. Initially, fewer hidden neurons are used, and the algorithm adjusts the neural network size whenever it detects under-learning. Our technique integrates all the sub-tasks involved in neural modeling, thereby facilitating a more efficient and automated model building process. It significantly reduces the intensive human effort demanded by the conventional step-by-step neural modeling approach. The algorithm is demonstrated through MESFET and Embedded Capacitor examples.

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Steady-state determination for RF circuits using Krylov-subspace methods in SPICE

M.A. Kleiner and R.N. Afsar. "Steady-state determination for RF circuits using Krylov-subspace methods in SPICE." 2001 MTT-S International Microwave Symposium Digest 01.3 (2001 Vol. III [MWSYM]): 2091-2094 vol.3.

A SPICE-based direct shooting-Newton method for the determination of the steady-state response of RF circuits has been developed. Different Krylov-subspace methods, including GMRES, CGS, BiCG, QMR, and BiCGSTAB, were used to solve the iterative equations generated by the shooting-Newton algorithm. The public-domain circuit simulator, SPICE, was used for the implementation of the new steady-state analysis. Compared to standard transient analysis for the determination of the steady-state response for non-linear circuits encountered in RF design, this new method is much more efficient. RF circuits that are difficult to simulate are evaluated. For larger circuits, the GMRES, QMR, and BiCGSTAB algorithms show the most improvement in the time to calculate the steady-state.

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Interactive "visual" design of matching and compensation networks for microwave active circuits

L.I. Babak and M.V. Cherkashin. "Interactive "visual" design of matching and compensation networks for microwave active circuits." 2001 MTT-S International Microwave Symposium Digest 01.3 (2001 Vol. III [MWSYM]): 2095-2098 vol.3.

A new interactive "visual" technique is presented for designing lossless two-port matching and passive two-terminal compensation networks used in different RF and microwave active circuits. It relies on a visual representation of design process. The technique allows the user to select a suitable network configuration and to directly control all the network elements for successful fabrication. Lumped, distributed noncommensurate-line and mixed (lumped-distributed) networks of moderate complexity can be designed. The approach is implemented in the software tool LOCUS, offering a simple and fast means to produce solutions without the need for complicated circuit theory and mathematics.

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Efficient sensitivity analysis of lossy multiconductor transmission lines with nonlinear terminations (2001 Vol. III [MWSYM])

A. Dounavis, R. Achar and M. Nakhla. "Efficient sensitivity analysis of lossy multiconductor transmission lines with nonlinear terminations (2001 Vol. III [MWSYM])." 2001 MTT-S International Microwave Symposium Digest 01.3 (2001 Vol. III [MWSYM]): 2099-2102 vol.3.

An efficient approach for sensitivity analysis of lossy multiconductor transmission lines in the presence of nonlinear terminations, is described. Sensitivity information is based on the recently developed closed-form matrix-rational approximation based transmission-line model. The method enables sensitivity analysis of interconnect structures with respect to both electrical and physical parameters. An important advantage of the proposed approach is that the derivatives of the MNA matrices with respect to per-unit-length parameters are obtained analytically.

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Software tool for the design of narrow band band-pass filters

A. Garcia-Lamperez, M. Salazar-Palma, M. Padilla and I. Hidalgo-Carpintero. "Software tool for the design of narrow band band-pass filters." 2001 MTT-S International Microwave Symposium Digest 01.3 (2001 Vol. III [MWSYM]): 2103-2106 vol.3.

An efficient and versatile CAD tool for the design and synthesis of narrow band, band-pass microwave filters with generalized Chebyshev transfer function has been developed. The program allows transfer function zeros at prescribed positions to be synthesized. Thus, it is suitable for asymmetric response or self-equalized filters. The location of the zeros can be optimized in order to comply with insertion loss and/or group delay specification masks. Subsequent band-pass prototypes may be obtained with several topologies, namely canonical, in-line, cascaded triplets, cascaded quadruplets and combinations of them. In certain particular cases, some properties (symmetry, even degree) are exploited to simplify and improve the results. The software is specially meant for space filter applications with strict selectivity requirements. Some of its features are very well suited for predistortion techniques and easy tuning of dielectric resonator filters.

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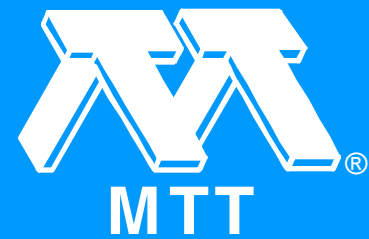
Optimization of waveguide diplexers using shadow specifications

D.A. Cargill, T. Dolan and P. Pramanick. "Optimization of waveguide diplexers using shadow specifications." 2001 MTT-S International Microwave Symposium Digest 01.3 (2001 Vol. III [MWSYM]): 2107-2110 vol.3.

This paper uses a new optimization technique for determining the frequency response of waveguide diplexers. The proposed technique is considerably more advantageous than the conventional waveguide filter optimization techniques. The technique uses only six variables in the penalty function irrespective of the orders of the two channel filters. This drastically reduces the chances of convergence to a local minimum as well as the computer storage and processing requirements. Two examples are presented to support the validity of this new technique. This technique will be extremely valuable in designing waveguide multiplexers.

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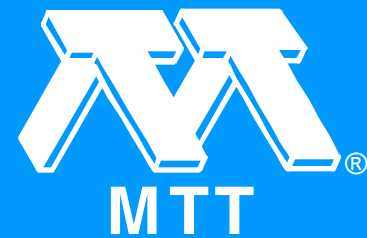
Micromachined RF MEMS tunable capacitors using piezoelectric actuators

J.Y. Park, Y.J. Yee, H.J. Nam and J.U. Bu. "Micromachined RF MEMS tunable capacitors using piezoelectric actuators." 2001 MTT-S International Microwave Symposium Digest 01.3 (2001 Vol. III [MWSYM]): 2111-2114 vol.3.

In this paper, RF MEMS tunable capacitors with low operation voltage, high linearity, high quality factor, and large tuning ratio have been fabricated by utilizing micromachined piezoelectric actuators. The fabricated tunable capacitor has a $C_{\text{sub max}}/C_{\text{sub min}}$ ratio of 3.1 to 1 at bias voltages of 6 V and a quality factor of 210 at 1 GHz.

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Digitally controllable variable high-Q MEMS capacitor for RF applications

N. Hoivik, M.A. Michalick, Y.C. Lee, K.C. Gupta and V.M. Bright. "Digitally controllable variable high-Q MEMS capacitor for RF applications." 2001 MTT-S International Microwave Symposium Digest 01.3 (2001 Vol. III [MWSYM]): 2115-2118 vol.3.

This paper describes the novel design of an electrostatic digitally controllable variable MEMS capacitor constructed using Cronos MUMPS technology and flip-chip technology processing. The capacitor consists of an array of individual plates of equal area, which are connected to the bonding pads by springs of varying width. This creates a cascading snap-down effect when actuated by electrostatic forces. The capacitor has a measured Q-factor of 140 at 750 MHz, and a tuning ratio of 4:1.

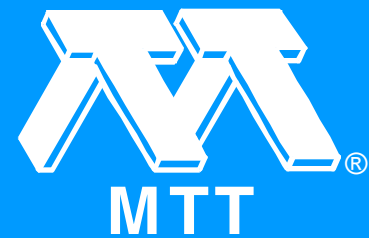
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Nonlinear electro-mechanical modeling of MEMS switches

J.B. Muldavin and G.M. Rebeiz. "Nonlinear electro-mechanical modeling of MEMS switches." 2001 MTT-S International Microwave Symposium Digest 01.3 (2001 Vol. III [MWSYM]): 2119-2122 vol.3.

We present an accurate model of the switching mechanism of MEMS switches. The model is based on a electro-mechanical analysis which takes into account the varying force and damping versus position (time). The model also calculates the switching current taking into account both the capacitance change and the voltage change versus time. The model accurately predicts the switching time, the switching current, the velocity versus position (and time) of the MEMS bridge, and the energy consumed in the switching process. It is found that the current can be very large and the total switching energy is larger than predicted by simple models due to the damping underneath the MEMS bridge.



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An electromechanical model for MEMS switches

D. Mercier, P. Blondy, D. Cros and P. Guillon. "An electromechanical model for MEMS switches." 2001 MTT-S International Microwave Symposium Digest 01.3 (2001 Vol. III [MWSYM]): 2123-2126 vol.3.

This paper presents a new dynamic and parametric model of a capacitive micro-electromechanical switch electro-statically actuated. It is built of elementary electrical equivalent-circuit blocks constructed of voltage-controlled current sources. The model describes the nonlinear mechanical behavior of the membrane movement, which allows the computation of the bridge capacitance. It can be inserted as a model to perform simulations at microwave frequencies. All the switch parameters such as dimensions and materials properties are adjustable.

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Digital generation of RF signals for wireless communications with band-pass delta-sigma modulation

J. Keyzer, J. Hinrichs, A. Metzger, M. Iwamoto, I. Galton and P. Asbeck. "Digital generation of RF signals for wireless communications with band-pass delta-sigma modulation." 2001 MTT-S International Microwave Symposium Digest 01.3 (2001 Vol. III [MWSYM]): 2127-2130 vol.3.

This paper demonstrates a high speed digital technique to produce binary (digital) signals that encode representative RF signals (with time varying envelope) as needed for wireless communications. Specifically, it shows that IS-95 format CDMA signals can be generated with a single bit digital data stream at 3.6 Gb/S. The technique uses band-pass delta-sigma modulation so that the quantization noise is shaped out of the frequency band of interest. This approach points the way to single-chip, DSP-based transmitters, used in conjunction with switching mode power amplifiers and simple analog filters, to implement all the functions of a wireless transmitter.

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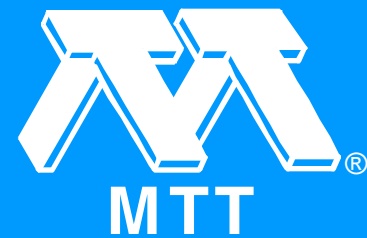


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A CMOS 6-bit, 1 GHz ADC for IF sampling applications

K. Uyttenhove and M. Steyaert. "A CMOS 6-bit, 1 GHz ADC for IF sampling applications." 2001 MTT-S International Microwave Symposium Digest 01.3 (2001 Vol. III [MWSYM]): 2131-2134 vol.3.

The design plan and measurement results of a very high speed 6-bit CMOS Flash Analog-to-digital converter (ADC) are presented. The very high acquisition speed is obtained by improved comparator design and optimized pre-amplifier design. At these high frequencies power-efficient error correction logic is necessary. Measurements show the high conversion speed of the ADC. Maximum acquisition speed is above 1 GHz.



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A silicon-on-insulator 28-V RF power LDMOSFET for 1-GHz integrated power amplifier applications

E. McShane, K. Shenai and S.K. Leong. "A silicon-on-insulator 28-V RF power LDMOSFET for 1-GHz integrated power amplifier applications." 2001 MTT-S International Microwave Symposium Digest 01.3 (2001 Vol. III [MWSYM]): 2135-2138 vol.3.

This paper presents the first results of a 1-GHz SOI RF power LDMOSFET with 115 mW of output power. A 6-W P/sub OUT/ (competitive with comparable bulk LDMOSTs) can be achieved by scaling the FET dimensions with little degradation of RF performance. Both DC and RF characteristics are presented, and model parameters are extracted. Class A amplifier results are shown to deliver a PAE of 25%, power gain of 16 dB, and 1-dB compression of 40 mW. These results are extremely encouraging for IPA development with SOI RF power LDMOSFETs.

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A software GPS receiver for weak signals

D.M. Lin and J.B.Y. Tsui. "A software GPS receiver for weak signals." 2001 MTT-S International Microwave Symposium Digest 01.3 (2001 Vol. III [MWSYM]): 2139-2142 vol.3.

The paper reports the approach and results of a stand alone software Global Positioning System (GPS) receiver. The receiver is specially designed to receive weak signals without aids from other information sources. The approaches for the acquisition, first navigation phase detection, and tracking are discussed. The different kinds of thresholds with different signal-to-noise ratio (SNR) are developed. Under the best operating condition a signal can be 15 dB below the normal noise level and still be processed.



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Simple design equations for broadband class E power amplifiers with reactance compensation

A. Grebennikov. "Simple design equations for broadband class E power amplifiers with reactance compensation." 2001 MTT-S International Microwave Symposium Digest 01.3 (2001 Vol. III [MWSYM]): 2143-2146 vol.3.

In this paper, a simple analytical design approach to determine the parameters of the loading networks to design broadband class E amplifiers is presented. The design equations are given for each element of single and double resonant loading circuits. The analysis and simulation were performed on the example of high-voltage LDMOSFET power amplifier, which show that in octave-band of 100-200 MHz the power gain of 10 dB with deviation of only ± 0.5 dB and the drain efficiency of about 70% and higher can be achieved.

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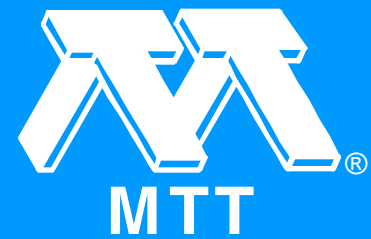


Multi-harmonic tuning behavior of MOSFET RF power amplifiers

YuCai Zhang and C.A.T. Salama. "Multi-harmonic tuning behavior of MOSFET RF power amplifiers." 2001 MTT-S International Microwave Symposium Digest 01.3 (2001 Vol. III [MWSYM]): 2147-2150 vol.3.

This paper categorizes, for the first time, multi-harmonic tuning behavior into four basic modes: both odd/even harmonics SHORT (SS), odd harmonics SHORT and even harmonics OPEN (SO), odd harmonics OPEN and even harmonics SHORT (OS), and both odd/even harmonics OPEN (OO). Conventional power amplifiers (class AB, E, F, etc.) can be characterized using these modes of operation in so far as multi-harmonic tuning is concerned and a systematic simulation procedure can be used to find the optimal harmonic terminations. A simulation and experimental study of the multi-harmonic tuning behavior of MOSFET RF power amplifiers reveals that the odd/even harmonics OPEN (OO) mode results in the highest efficiency for such devices.

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Study of self-heating effects in GaN HEMTs

S. Nuttinck, E. Gebara, J. Laskar and M. Harris. "Study of self-heating effects in GaN HEMTs." 2001 MTT-S International Microwave Symposium Digest 01.3 (2001 Vol. III [MWSYM]): 2151-2154 vol.3.

Pulsed RF and I-V characterizations are performed on power GaN HEMTs. These measurements are carried out at different temperatures for the first time to understand self-heating effects and to investigate the possibility of improving heat dissipation mechanisms. These measurements are the basis for robust large-signal models.

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InGaP PHEMTs for wireless power applications

E. Lan, B. Pitts, M. Mikhov and O. Hartin. "InGaP PHEMTs for wireless power applications." 2001 MTT-S International Microwave Symposium Digest 01.3 (2001 Vol. III [MWSYM]): 2155-2157 vol.3.

This paper shows that we have successfully fabricated a InGaP PHEMT device with a tight threshold voltage distribution of 22 mV by using InGaP as barrier layer material. Fabricated device performance is similar to our standard AlGaAs PHEMT for low voltage operation. A 15 mm device delivers 30 dBm output power, 10.2 dB associated gain, and 67% power added efficiency at 1 dB compression point while operated at 3.5 V and 1.9 GHz.

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Novel asymmetric gate-recess engineering for sub-millimeter-wave InP-based HEMTs

K. Shinohara, T. Matsui, T. Mimura and S. Hiyamizu. "Novel asymmetric gate-recess engineering for sub-millimeter-wave InP-based HEMTs." 2001 MTT-S International Microwave Symposium Digest 01.3 (2001 Vol. III [MWSYM]): 2159-2162 vol.3.

A self-aligned asymmetric gate-recess structure for ultra-high speed InGaAs-InAlAs high electron mobility transistors (HEMTs) is successfully fabricated. A 50 nm T-shaped-gate HEMT with a longer drain-side recess exhibits a much-improved maximum oscillation frequency (f_{max}) of 503 GHz, while retaining a similarly high current-gain cutoff frequency (f_{t}) of 307 GHz compared to that with a conventional symmetric recess structure. This result indicates reduced electric field between gate and drain while keeping a small source resistance (R_{s}) in the developed asymmetrically recessed HEMT.

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Abstracts

A calibrated RF/IF monolithic vector analyzer

J. Cowles and B. Gilbert. "A calibrated RF/IF monolithic vector analyzer." 2001 MTT-S International Microwave Symposium Digest 01.3 (2001 Vol. III [MWSYM]): 2163-2166 vol.3.

This work presents the first monolithic integrated circuit that provides precise, scaled measurements of gain and phase difference between two signals up to 3 GHz. A 60 dB gain range and 180 degree phase range are achieved with 30 mV/dB and 10 mV/degree scaling, respectively. This function has wide application for in-situ measurement of vector RF parameters and in linearization of transmission systems such as power amplifiers.



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Design techniques of reducing chip area and highly integrated MMIC for W-band application

Y. Mimino, K. Nakamura, K. Sakamoto, Y. Aoki, S. Kuroda and T. Tokumitsu. "Design techniques of reducing chip area and highly integrated MMIC for W-band application." 2001 MTT-S International Microwave Symposium Digest 01.3 (2001 Vol. III [MWSYM]): 2167-2170 vol.3.

In this paper, several novel techniques for minimizing chip area are presented. In order to demonstrate these features, we have developed a three stage W-band amplifier. This MMIC exhibits more than 15 dB gain from 75 GHz to 90 GHz, and size of this MMIC is less than 0.5 mm/sup 2/. We have also designed and fabricated a single chip 77 GHz T/R MMIC for automotive radar. This MMIC includes 25 active circuits in one chip, and size of this MMIC is less than 8.5 mm/sup 2/.

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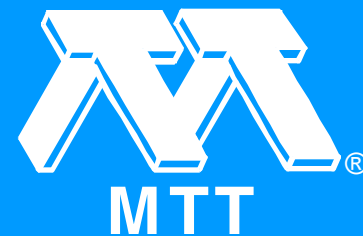


Abstracts

A novel accurate design method for the hairpin type coupled line bandpass filter

Jun-Sik Yun, Jun-Seok Park, Dal Ahn, Kwan Sun Choi and Juno Kim. "A novel accurate design method for the hairpin type coupled line bandpass filter." 2001 MTT-S International Microwave Symposium Digest 01.3 (2001 Vol. III [MWSYM]): 2171-2174 vol.3.

In this paper, the novel design formula is proposed for the design of a hairpin type coupled-line bandpass filter, which has arbitrary coupled-line lengths and image impedance. Employing the derived design formula promotes convenience in designing and implementing the hairpin type coupled-line bandpass filter. Measured results on fabricated hairpin type coupled-line bandpass filters including a duplexer show good agreements with theoretical results.



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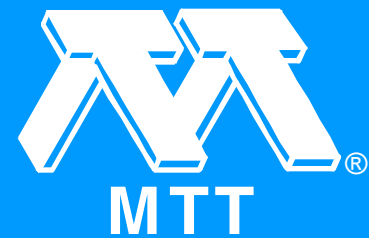
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Hairpin filters with tunable transmission zeros

Chih-Ming Tsai, Sheng-Yuan Lee and Chin-Chuan Tsai. "Hairpin filters with tunable transmission zeros." 2001 MTT-S International Microwave Symposium Digest 01.3 (2001 Vol. III [MWSYM]): 2175-2178 vol.3.

In the previous work, it was found that filter designed with 0/spl deg/ feed structure could have two extra transmission zeros in the stopband. In this paper, a method for tuning the frequencies of these two transmission zeros using impedance transformers is proposed. These zeros can be tuned to reject unwanted signals near the passband, such as image signals, This new approach has been experimentally verified with three second-order Butterworth filters.

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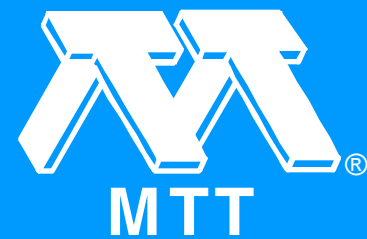
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Adjustment of a temperature compensated Ka-band ring resonator VCO using fully automated laser-trimming

M. Schallner and W. Konrath. "Adjustment of a temperature compensated Ka-band ring resonator VCO using fully automated laser-trimming." 2001 MTT-S International Microwave Symposium Digest 01.3 (2001 Vol. III [MWSYM]): 2179-2182 vol.3.

A new Ka-band voltage controlled oscillator (VCO) using a planar ring resonator (RR) and a GaAs PHEMT microwave monolithic integrated circuit (MMIC) is presented. The resonator operates at harmonic frequencies and is manufactured on a temperature stable calcium magnesium titanate substrate using photolithographic thin-film processes. An innovative fully automated active laser-trimming procedure is used to adjust the frequency of the free-running oscillator as well as the varactor tuning sensitivity. In addition, automated laser-trimming is used to equalize the electrical length between the ring resonator and the MMIC. High unloaded quality factors of more than 350 have been obtained for the harmonic ring resonator. With these high quality factors a single side-band phase noise of better than -110 dBc/Hz is achieved at an offset frequency of 1 MHz. In addition, the frequency tuning range of the laser-trimming procedure is larger than 10% without any significant change of the VCO's characteristics such as phase noise and varactor tuning sensitivity. The typical temperature drift of the oscillator frequency is less than 4 ppm/K. We use a RR-VCO with an electrical length of four wavelengths, which is phase-locked to an external reference, as a local oscillator in our latest microwave Point-to-Multipoint (PMP) transceivers.





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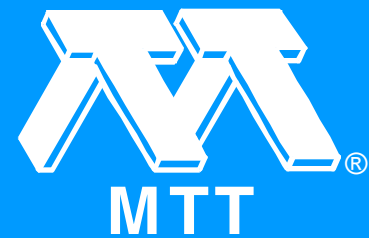
Monolithic quantum tunnel diode-based C-band oscillator and LNA

J.I. Bergman, S. Han, J. Laskar, N. El-Zein, S. Ageno, M. Deshpande and V. Nair. "Monolithic quantum tunnel diode-based C-band oscillator and LNA." 2001 MTT-S International Microwave Symposium Digest 01.3 (2001 Vol. III [MWSYM]): 2183-2186 vol.3.

We report on the design and microwave performance of a novel tunnel diode-based oscillator designed for 5 GHz in a monolithic IC technology. The fundamental output power of the oscillator is -18.8 dBm at 4.7 GHz, with second and third harmonic power levels at -43.2 dBm and -40.5 dBm, respectively. Phase noise of -87.0 dBc/Hz at 1 MHz was observed. While output power can be greatly increased by combining the tunnel diode with an integrated transistor, this design offers excellent compactness and low power consumption. In addition, an LNA design for 6 GHz in the same IC technology is presented.

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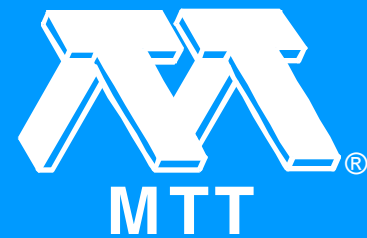
Calibrated linear and nonlinear pulsed RF measurements on an amplifier

P. Vael, Y. Rolain, C. Gaquiere and H. Gerard. "Calibrated linear and nonlinear pulsed RF measurements on an amplifier." 2001 MTT-S International Microwave Symposium Digest 01.3 (2001 Vol. III [MWSYM]): 2187-2190 vol.3.

The calibration of a nonlinear vectorial microwave network analyzer (NVNA) used for continuous wave measurements (moderate number of frequency components) is extended for pulsed RF measurements (very large number of frequency components). The new calibration is based on the combination of the regular RF calibration with a separate IF calibration. Experimental results in pulsed regime are compared with results from a pulsed RF vectorial network analyzer (VNA).

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Measurement of group velocities of various microwave transmission lines via FM reflectometry

Yong-Hyun Park, Jeong-Hae Lee, Jong-Wook Seo and Heung-SikTae. "Measurement of group velocities of various microwave transmission lines via FM reflectometry." 2001 MTT-S International Microwave Symposium Digest 01.3 (2001 Vol. III [MWSYM]): 2191-2194 vol.3.

In this paper, frequency modulated (FM) reflectometry is applied to measurement of group velocity of microwave transmission line to study its dispersion characteristics. Various microwave transmission lines such as periodically loaded conducting posts in a waveguide and nonradiative dielectric (NRD) guide are adopted to measure their group velocities using FM reflectometry. The result compared with that from network analyzer shows good agreement, indicating the validity of our measurement method.

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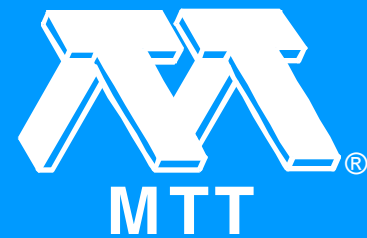
Millimeter wave measurements of temperature dependence of complex permittivity of GaAs plates by a circular waveguide method

T. Shimizu and Y. Kobayashi. "Millimeter wave measurements of temperature dependence of complex permittivity of GaAs plates by a circular waveguide method." 2001 MTT-S International Microwave Symposium Digest 01.3 (2001 Vol. III [MWSYM]): 2195-2198 vol.3.

A circular waveguide method is improved to measure the complex permittivity of low loss dielectric plates using the TE/sub 0m1/ mode with integer m of the higher order accurately in the millimeter wave range. The measurement principle is described on the basis of a rigorous analysis by the mode matching technique. A mode chart presented is effective to identify many resonance modes observed in the measurement. The temperature dependences for GaAs plates were measured at 26 GHz for the TE/sub 011/ mode and at 40 GHz for the TE/sub 021/ mode. It is verified that this method is useful to measure the temperature dependence precisely. Moreover it is expected to be able to evaluate the quantity of lattice defects of GaAs crystal.

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Infrared temperature characterization of high power RF devices

M. Mahalingam and E. Mares. "Infrared temperature characterization of high power RF devices." 2001 MTT-S International Microwave Symposium Digest 01.3 (2001 Vol. III [MWSYM]): 2199-2202 vol.3.

Infrared microscopy measurement methodology has been refined to measure high power RF device temperatures accurately at high frequencies (1 GHz, 2+ GHz). Special difficulties due to translucent nature of Si are resolved. The methodology is applied to practical Si bipolar, Si LDMOS and GaAs RF power devices. Product thermal performance characterization method is established. Methodology is also applied in product development efforts.

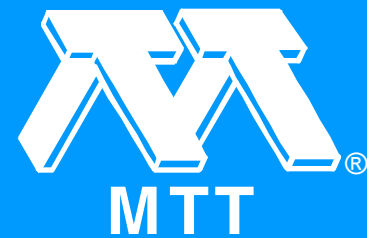


Abstracts

Near-field microwave microscopy of thin film resonators

J.A. Herbsommer, H. Safar, P.L. Gammel, B.P. Barber and M. Zierdt. "Near-field microwave microscopy of thin film resonators." 2001 MTT-S International Microwave Symposium Digest 01.3 (2001 Vol. III [MWSYM]): 2203-2206 vol.3.

We present phase-sensitive, high spatial resolution, near-field microwave microscopy images of the rf fields radiated by piezoelectric resonators operating in the vicinity of 2 GHz. Near the resonance our data show a complex distribution of fields. We fit our data to the Butterworth/Van-Dyke model that describes the behavior of these devices, and find very good qualitative agreement. In general, we show the potential of this phase-sensitive near-field imaging technique to study the behavior of complex rf devices, with potential impact on the optimization of the device's design.



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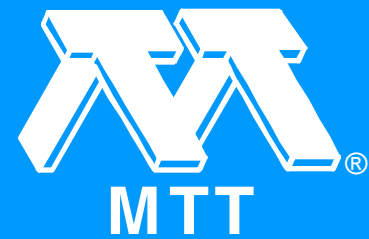
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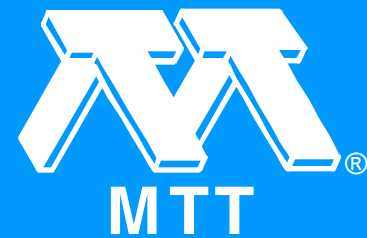
28 GHz LMDS channel measurements and modeling for parameterized urban environments

C. Briso-Rodriguez, M.A. Vazquez-Castro and J.I. Alonso-Montes. "28 GHz LMDS channel measurements and modeling for parameterized urban environments." 2001 MTT-S International Microwave Symposium Digest 01.3 (2001 Vol. III [MWSYM]): 2207-2210 vol.3.

This article presents results on LMDS channel modeling of a wide-band measurement campaign conducted in the urban environment (Madrid-Spain). The objective of this work is to classify propagation channel impairments according to simple environmental parameters rather than to specific path profiles or vague descriptions.

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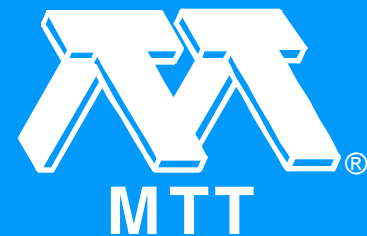
C/Ku-band pulsed transmitters for Poseidon 2 Altimeter

A. Darbandi, G. Michaud, H. Buret, J.Y. Touchais, J. Fourcroy and J. Bulgarelli. "C/Ku-band pulsed transmitters for Poseidon 2 Altimeter." 2001 MTT-S International Microwave Symposium Digest 01.3 (2001 Vol. III [MWSYM]): 2211-2214 vol.3.

Solid State Transmitters (Tx) have been used in radar applications for many years. The main advantages of the pulsed Tx are the following: (1) Low distortion of amplitude and phase during the pulse. (2) High reproducibility of identical pulses. (3) High quality of output spectrum: low harmonic content and reduced delay time. In this paper we present the design and the measured results of 30 W C-band Transmitter and 8 W Ku band Transmitter used for the Poseidon 2 Altimeter. (Jason satellite).

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The RF module design for W-CDMA/GSM dual band and dual mode handset

Xiaowei Zhu, Wei Hong, Liu Jin, Ling Tian and Jianyi Zhou. "The RF module design for W-CDMA/GSM dual band and dual mode handset." 2001 MTT-S International Microwave Symposium Digest 01.3 (2001 Vol. III [MWSYM]): 2215-2218 vol.3.

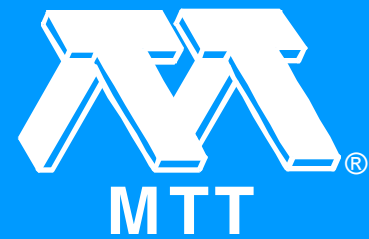
In this paper, novel RF front-ends for GSM/W-CDMA dual band and dual mode mobile terminal are described. The zero IF direct modulation transmitter and dual-superheterodyne receiver have been realized in the RF module development. The power down functions of the IC chip used to switch the RF module turn on the W-CDMA or GSM mode. Finally, the testing results are shown for both the W-CDMA and GSM modes.



Bias control technique for CDMA driver amplifier to decrease current

Jin-Su Ko, Hyun-Seok Kim, Sung-Gi Yang, Bonkee Kim and Byeong-Ha Park. "Bias control technique for CDMA driver amplifier to decrease current." 2001 MTT-S International Microwave Symposium Digest 01.3 (2001 Vol. III [MWSYM]): 2219-2222 vol.3.

The ACPR requirement is constant over wide power range. ACPR at lower output power is excessive in conventional constant bias current. A new bias control technique to decrease bias current at lower power level is proposed by implementing hyperbolic tangent function ($\tanh$) with offsets. It is verified indirectly by measurement. The measured bias current is reduced by the amount of 22% over the control range compared to the conventional one, in addition to meeting the ACPR requirement simultaneously over the entire range of output power.



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Multi-carrier microwave breakdown in air-filled components

U. Jordan, T. Olsson, V.E. Semenov, D. Anderson and M. Lisak. "Multi-carrier microwave breakdown in air-filled components." 2001 MTT-S International Microwave Symposium Digest 01.3 (2001 Vol. III [MWSYM]): 2223-2226 vol.3.

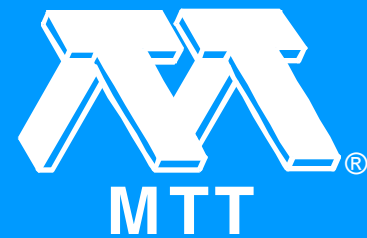
An investigation is made of the threshold for microwave breakdown in mobile telephone communication systems based on multi-carrier operation where interference between the carriers may cause occasional high power peaks in the transmission system. Thresholds are established for the worst case scenario of coherent and co-phased carriers as well as for the more realistic case of modulated carriers when the signal is considered as a stochastic signal.



Analysis of proposals to reduce SAR levels from GSM terminals

V.F. Perez, L.N. Fernandez and J.V.B. Tejedor. "Analysis of proposals to reduce SAR levels from GSM terminals." 2001 MTT-S International Microwave Symposium Digest 01.3 (2001 Vol. III [MWSYM]): 2227-2230 vol.3.

Is wireless communication dangerous? In recent years some scientists and lay people have expressed alarm at the possible harm mobile phones could cause to the user's health, even cancer. Handset terminals must meet standard limits based in SAR measurements. In this paper we present several proposals to minimize SAR values computed over a numerical user's head model using absorbent materials and new generation antennas.



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High-accuracy digital 5-bit 0.8-2 GHz MMIC RF attenuator for cellular phones

N. Kinayman, M. Bonilla, M.F. Kelcourse, J. Redus and K. Anderson. "High-accuracy digital 5-bit 0.8-2 GHz MMIC RF attenuator for cellular phones." 2001 MTT-S International Microwave Symposium Digest 01.3 (2001 Vol. III [MWSYM]): 2231-2234 vol.3.

High-accuracy digital MMIC RF attenuator for cellular phones is presented. Designing high accuracy digital MMIC RF attenuators is challenging due to the non-ideal characteristics of the transistor switches used in the attenuator and other parasitic effects. This problem can be circumvented by simultaneous optimization of the attenuator circuit at every possible input bit configuration. Without this optimization scheme, it would be extremely difficult to compensate the non-ideal transistor switch characteristics to achieve high accuracy. A design methodology is presented.

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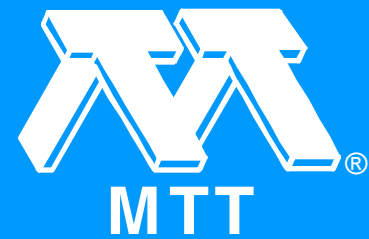
Micromachined 60 GHz GaAs power sensor with integrated receiving antenna

K. Mutamba, K. Beilenhoff, A. Megej, R. Dorner, E. Genc, A. Fleckenstein, P. Heyman, J. Dickmann, C. Woelk and H.L. Hartnagel. "Micromachined 60 GHz GaAs power sensor with integrated receiving antenna." 2001 MTT-S International Microwave Symposium Digest 01.3 (2001 Vol. III [MWSYM]): 2235-2238 vol.3.

A micromachined 60 GHz GaAs power sensor with a monolithically-integrated receiving antenna is presented. In this sensor configuration the thermoelectrical properties of AlGaAs-GaAs heterostructures are used, so that no external DC power supply is needed. First measurements with separate sensor and antenna structures on the same chip have shown a broadband sensor response as well as an excellent matching between the antenna and the sensor input.

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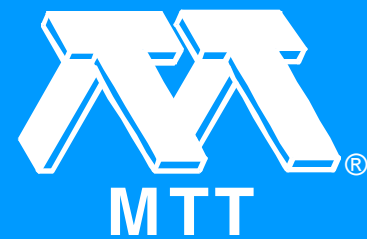
A sensor system based on SiGe MMICs for 24 GHz automotive applications

C.N. Rheinfelder, S. Lindenmeier, J.-F. Luy, C. Willner and A. Schuppen. "A sensor system based on SiGe MMICs for 24 GHz automotive applications." 2001 MTT-S International Microwave Symposium Digest 01.3 (2001 Vol. III [MWSYM]): 2239-2242 vol.3.

A near-range sensor for an electronic automotive cocoon from concept to realization is presented. Based on the commercial TEMIC SiGe technology on high and low resistivity Si substrate the DSSS- (direct sequence spread spectrum) concept allows a simplified all-round approach while maintaining high resolution below several millimeters with simultaneous compliance to ISM and cost requirements.

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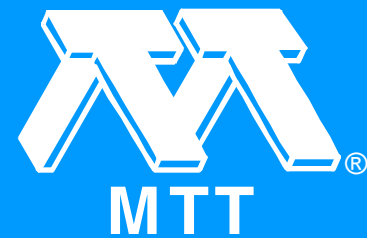
Acoustic sensing using radio frequency detection and capacitive micromachined ultrasonic transducers

S.T. Hansen, A.S. Ergun and B.T. Khuri-Yakub. "Acoustic sensing using radio frequency detection and capacitive micromachined ultrasonic transducers." 2001 MTT-S International Microwave Symposium Digest 01.3 (2001 Vol. III [MWSYM]): 2243-2246 vol.3.

Broadband acoustic sensing over several decades of frequency has traditionally been difficult to achieve. Conventional condenser and electret microphones depend on membrane and cavity resonances to achieve their maximum sensitivity. However, such resonant phenomena are inherently narrowband and limit the applicable frequency range of the acoustic sensor. New microphones using capacitive micromachined ultrasonic transducer (CMUT) technology and radio frequency (RF) detection achieve a relatively flat acoustic frequency response from frequencies below one hertz to hundreds of kilohertz. In this detection method, a high-frequency carrier signal is launched down a capacitively-loaded transmission line consisting of capacitive micromachined membranes and interconnects. The resulting phase modulation of the carrier due to impinging sound pressure can be measured. Preliminary experiments demonstrate microphone sensitivities of 50 dB/Pa/Hz/spl plusmn/3 dB over a frequency range of 0.1 Hz to 300 kHz. Calculations reveal that sensitivities on the order of 100 dB/Pa/Hz greater than the sensitivity of the human ear, may be possible with a 1 cm/sup 2/ device and a carrier frequency of several gigahertz.

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Millimeter-wave printed circuit antenna system for automotive applications

V.V. Denisenko, A.G. Shubov, A.V. Majorov, E.N. Egorov and N.K. Kashaev. "Millimeter-wave printed circuit antenna system for automotive applications." 2001 MTT-S International Microwave Symposium Digest 01.3 (2001 Vol. III [MWSYM]): 2247-2250 vol.3.

An antenna system for automotive intelligent cruise-control application contains two separate printed circuit antennas: wide beam transmit antenna and three narrow beam receive antenna. The Rotman lens beamforming network is used-to provide multibeam operation of receive antenna. The design of the antenna system is discussed and test results are presented.

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Spectrum correlation of beat signals in the FM-CW radar level meter and application for precise distance measurement

J.C. Chun, T.S. Kim, J.M. Kim, Z.S. Lim and W.S. Park. "Spectrum correlation of beat signals in the FM-CW radar level meter and application for precise distance measurement." 2001 MTT-S International Microwave Symposium Digest 01.3 (2001 Vol. III [MWSYM]): 2251-2254 vol.3.

In this paper, we analyze spectrum correlation of beat signals in the microwave level meter based on the FM-CW radar. For industrial applications, level meters must have high precision, which requires a good linearity of VCO. But, in practice, it is very complicated or very expensive to make VCO linear enough to be acceptable in the industrial field. We propose a measurement algorithm using the fact that there exists a peak in the spectrum correlation of beat signals when range difference is adequately small. This makes it possible to determine the range difference in a precise manner even using a practical VCO. We develop the background theory of correlation and show some results using this algorithm.

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K-band direct detect MMIC Si micromachined radiometer

M. Smith, T. Weller, J. Culver, B. Roeder, C. Trent and J. Naylor. "K-band direct detect MMIC Si micromachined radiometer." 2001 MTT-S International Microwave Symposium Digest 01.3 (2001 Vol. III [MWSYM]): 2255-2258 vol.3.

This paper describes the design of a K-Band direct detect MMIC radiometer using bulk micromachining techniques to create the conformal package, interconnecting structures and CPW-fed slot-coupled patch antenna array. Parylene encapsulation is used following die-attach and wire bonding. Also, a unique on-board calibration technique using an MHEMT based cold/warm noise source offers an alternative to other forms of calibration of radiometers and radar receivers. Experimental results are given for the 20.7 GHz radiometer printed on high-resistivity silicon.

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Abstracts

A rugged active sensor for microwave aquametry

G. Avitabile, G.B. Gentili and N. Sottani. "A rugged active sensor for microwave aquametry." 2001 MTT-S International Microwave Symposium Digest 01.3 (2001 Vol. III [MWSYM]): 2259-2262 vol.3.

The paper introduces a compact active sensor of the resonant type for microwave aquametry. The proposed sensor is very simple yet accurate. The design procedure is described and experimental results are reported validating the sensor performance.



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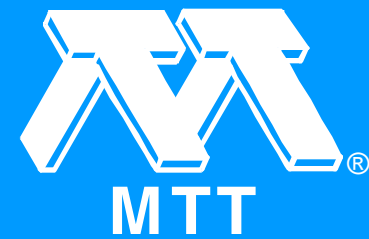
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Index of Authors (2001 Vol. III [MWSYM])

"Index of Authors (2001 Vol. III [MWSYM])." 2001 MTT-S International Microwave Symposium Digest 01.3 (2001 Vol. III [MWSYM]): xxxi-xxxviii.



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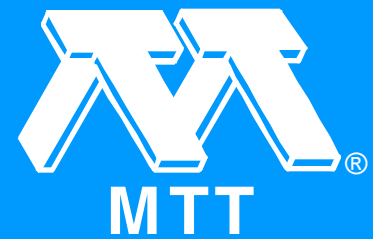
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Front Cover (2001 [RFIC])

"Front Cover (2001 [RFIC])." 2001 Radio Frequency Integrated Circuits (RFIC) Symposium 01. (2001 [RFIC]): 0_1-0_2.

The following topics were covered: wireless LAN, advances in RF CMOS; W-CDMA transceivers; power amplifiers; frequency generation; next generation front end design; GPS and Bluetooth system design; integrated Bluetooth transceivers; RFIC packaging and passive components; active device modeling for RFIC applications; high frequency devices and IC techniques; RF transceivers; control circuits for receivers and transmitters; low-noise amplifiers; and building block front ends.

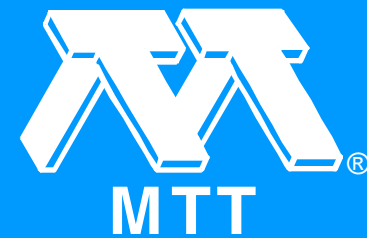
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"Table of Contents (2001 [RFIC])." 2001 Radio Frequency Integrated Circuits (RFIC) Symposium 01. (2001 [RFIC]): xiii-xxv.



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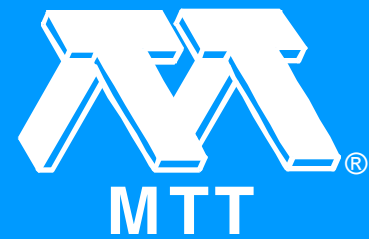
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Wireless LAN revolution: from silicon to systems

T.H. Meng and B. McFarland. "Wireless LAN revolution: from silicon to systems." 2001 Radio Frequency Integrated Circuits (RFIC) Symposium 01. (2001 [RFIC]): 3-6.

Advances in silicon technology have brought forth the tremendous success of the modern-day wireless industry, demonstrating a 40% yearly growth in the cellphone industry. The wireless local area network (wireless LAN) has also expanded its deployment in recent years. To increase the performance and to serve various usage models, the wireless LAN industry has proposed a few standards. These approaches, however, are only a small step forward in comparison to what is achievable with current-day CMOS technology, not to mention what will be possible with next-generation processes. The new era of wireless LAN will be built on a combination of breakthroughs in wireless signal processing and the ever more powerful CMOS processes to deliver a ubiquitous wireless fabric, allowing connectivity of a multitude of computation and consumer devices incorporating a variety of data rates and quality of service.

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A W-CDMA zero-IF front-end for UMTS in a 75 GHz SiGe BiCMOS technology

H. Pretl, W. Schelmbauer, L. Maurer, H. Westermayr, R. Weigel, B.-U. Klepser, B. Adler and J. Fenk. "A W-CDMA zero-IF front-end for UMTS in a 75 GHz SiGe BiCMOS technology." 2001 Radio Frequency Integrated Circuits (RFIC) Symposium 01. (2001 [RFIC]): 9-12.

A zero-IF front-end consisting of an I/Q down-conversion mixer, broadband I/Q-generation, fully-integrated VCO, dual-modulus prescaler, low-noise baseband buffer and blocking filter is presented. Integrated in a 75 GHz f/sub t/ BiCMOS technology with 0.35 /spl mu/m CMOS it draws 33 mA from a 2.7 V supply. Extremely low local-oscillator leakage of -95 dBm together with a high IIP2 of 55 dBm results in very low DC offset values of less than 20 mV at the baseband output of the IC. The presented circuit is intended for application in a highly-integrated UMTS receiver.



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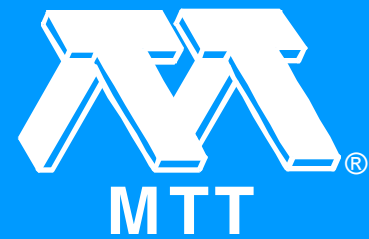
Dual-band/tri-mode receiver IC for N- and W-CDMA systems using 6"-PHEMT technology

B. McNamara, S. Zhang, M. Murphy, H.M. Banzer, H. Kapusta, E. Rohrer, T. Grave and L. Verweyen. "Dual-band/tri-mode receiver IC for N- and W-CDMA systems using 6"-PHEMT technology." 2001 Radio Frequency Integrated Circuits (RFIC) Symposium 01. (2001 [RFIC]): 13-16.

A dual-band/tri-mode receiver IC for CDMA based mobile systems has been fabricated using our 6"-PHEMT production line, comprising the complete RF front end and one IF stage. The first LNA stage exhibits an input IP3 of +8 dBm and a noise figure of 1.0 dB, the overall gain of the complete receiver is 26.0 dB. The current consumption only is 17 mA, for a minimum LO power demand of -7 dBm.

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High-performance quadrature modulators for broadband wireless communication

B. Sam and P. Halford. "High-performance quadrature modulators for broadband wireless communication." 2001 Radio Frequency Integrated Circuits (RFIC) Symposium 01. (2001 [RFIC]): 17-20.

A quadrature modulator operating from 250-1000 MHz, having a maximum output level of +3 dBm into a 50-ohm load and a noise floor of -155 dBm/Hz has been developed. The device draws 65 mA from a single 2.7 to 5.5 V supply when active, and 70 uA during standby. The high dynamic range achieved by this device is attributable to the design of its baseband interface, as well as its complementary bipolar process with insulated substrate. A high frequency version of this chip provides similar performance from 800-2700 MHz.

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A versatile receiver IC supporting WCDMA, CDMA and AMPS cellular handset applications

K. Rampmeier, B. Agarwal, P. Mudge, D. Yates and T. Robinson. "A versatile receiver IC supporting WCDMA, CDMA and AMPS cellular handset applications." 2001 Radio Frequency Integrated Circuits (RFIC) Symposium 01. (2001 [RFIC]): 21-24.

This paper presents a single chip, superhetrodyne receiver IC capable of supporting dual-band, tri-mode handsets. Supported standards include W-CDMA, CDMA (IS-98-C) and AMPS. The receiver consists of multistep gain LNAs, high performance RF mixers with adjustable linearity, a variable gain amplifier, on chip VCO cores, and an IQ downconverter. The IC is fabricated in a 35 GHz f/sub t/ Si BiCMOS process and packaged into a 48 pin 7 mm/spl times/7 mm land grid array (RF-LGA/sup TM/) chipscale package.

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Fully integrated W-CDMA IF chip-set for UMTS mobiles

W. Thomann, J. Fenk, R. Hagelauer and R. Weigel. "Fully integrated W-CDMA IF chip-set for UMTS mobiles." 2001 Radio Frequency Integrated Circuits (RFIC) Symposium 01. (2001 [RFIC]): 25-28.

A fully integrated Si bipolar IF-receiver and IF-transmitter with on-chip synthesizer for use in third-generation variable duplex W-CDMA mobiles is introduced. Both devices incorporate an IF-synthesizer with on-chip VCO tuning and tank as well as 5th order baseband filters and comply with ARIB W-CDMA and UMTS standards. The devices are mounted in a small outline, 32 pin, leadless surface mount package.

A 50% efficiency InGaP/GaAs HBT power amplifier module for 1.95 GHz wide-band CDMA handsets

T.B. Nishimura, M. Tanomura, K. Azuma, K. Nakai, Y. Hasegawa and H. Shimawaki. "A 50% efficiency InGaP/GaAs HBT power amplifier module for 1.95 GHz wide-band CDMA handsets." 2001 Radio Frequency Integrated Circuits (RFIC) Symposium 01. (2001 [RFIC]): 31-34.

A 0.1 cc high-efficiency power amplifier multi-chip module (MCM) has been developed using InGaP/GaAs heterojunction bipolar transistors (HBTs) for 1.95 GHz wide-band CDMA handsets. Under 3.5 V operation, the MCM achieved an output power P_{out} of 26.3 dBm, an excellent power-added efficiency (PAE) of 50.5%, and a high associated gain G_a of 28.5 dB with an adjacent channel leakage power ratio (ACPR) of -35 dBc at a 5 MHz off-center frequency band. The MCM also exhibited excellent PAEs of more than 40% even at a low supply voltage of 1.5 V.



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SiGe-power amplifiers in flipchip and packaged technology

*W. Bischof, M. Alles, S. Gerlach, A. Kruck, A. Schuppen, J. Sinderhauf and H.-J. Wassener.
"SiGe-power amplifiers in flipchip and packaged technology." 2001 Radio Frequency Integrated Circuits (RFIC) Symposium 01. (2001 [RFIC]): 35-38.*

A SiGe HBT with 22 GHz ft was optimized for power applications. A driver stage measured on wafer achieves $P_{sat}=23$ dBm at 1.8 GHz with PAE up to 68%. A family of SiGe power amplifiers was developed for assembly in standard PSSOP packages and in flipchip technology. There are single and dualband PAs for 900 MHz and 1800 MHz GSM bands. The PAs are fully integrated three stage devices and feature high gain, output power and power added efficiency. The ICs incorporate power control circuits and operate from one positive supply voltage which can be as low as 2.5 V. At a nominal operating voltage of 3.5 V the 900 MHz packaged amplifier delivers up to 35 dBm output power at 58% PAE. The 1800 MHz amplifier produces up to 33 dBm power at 48% PAE. The devices can survive 5 V supply voltage under full power. An optimized application design gives similar results for packaged and flipchip devices.

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A nonlinear capacitance cancellation technique and its application to a CMOS class AB power amplifier

Chengzhou Wang, L.E. Larson and P.M. Asbeck. "A nonlinear capacitance cancellation technique and its application to a CMOS class AB power amplifier." 2001 Radio Frequency Integrated Circuits (RFIC) Symposium 01. (2001 [RFIC]): 39-42.

A nonlinear cancellation technique is developed specifically for MOS class AB power amplifiers. This technique utilizes a PMOS transistor at the amplifier input to cancel the variation of the input capacitance, thus improving the overall amplifier linearity. A monolithic CMOS RF power amplifier with this technique is designed and fabricated in a standard 0.6 μm CMOS technology. The prototype single-stage amplifier has a measured drain efficiency of 40% and a power gain of 7 dB at 1.9 GHz. Linearity measurements show that the new amplifier has over 10 dB of IM/sub 3/ improvement and 6 dB of ACPR improvement compared with the traditional NMOS class AB power amplifier.



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RF power performance of LDMOSFETs on SOI: an experimental comparison with bulk Si LDMOSFETs

J.G. Fiorenza and J.A. del Alamo. "RF power performance of LDMOSFETs on SOI: an experimental comparison with bulk Si LDMOSFETs." 2001 Radio Frequency Integrated Circuits (RFIC) Symposium 01. (2001 [RFIC]): 43-46.

We have simultaneously fabricated RF power LDMOSFETs on SOI and bulk-silicon wafers using an identical process. This paper directly compares their RF power performance at 1.9 GHz. We use this comparison to assess the suitability of SOI for RF power applications. The gain and linearity of the SOI LDMOSFETs match those of the bulk-silicon devices. The SOI devices exhibit substantially improved power efficiency, up to 8 percentage points. This improvement in PAE is shown to be related to reduced parasitic substrate loss in the SOI LDMOSFETs.

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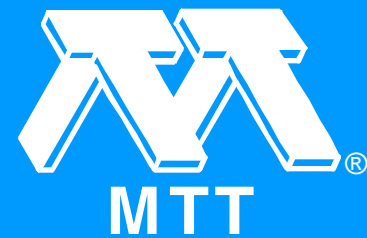


Abstracts

A 0.35 μm CMOS 2.5 GHz complementary -G/sub M/ VCO using PMOS inversion mode varactors

R. Bunch and S. Raman. "A 0.35 μm CMOS 2.5 GHz complementary -G/sub M/ VCO using PMOS inversion mode varactors." 2001 Radio Frequency Integrated Circuits (RFIC) Symposium 01. (2001 [RFIC]): 49-52.

A fully integrated VCO has been fabricated in a standard single poly 4-metal 0.35 μm 3.3 volt digital CMOS process, using a complementary negative G/sub M/ topology. PMOS inversion-mode varactors are used for frequency tuning. A phase noise of -97 dBc/Hz at 100 kHz offset has been measured using a single-ended test setup. The measured tuning range is 16 percent. Unbuffered and buffered versions of the oscillator were fabricated on the same die. The buffered version has an output power of nearly 0 dBm. The unbuffered core of the oscillator has a power dissipation of 35 mW.



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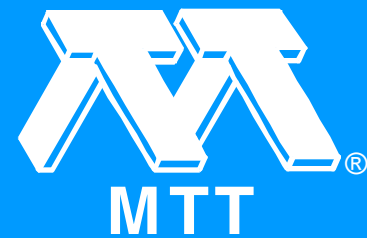
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HiperLAN 5.4 GHz low power CMOS synchronous oscillator (2001 [RFIC])

Y. Deval, J.-B. Begueret, A. Spataro, P. Fouillat, D. Belot and F. Badets. "HiperLAN 5.4 GHz low power CMOS synchronous oscillator (2001 [RFIC])." 2001 Radio Frequency Integrated Circuits (RFIC) Symposium 01. (2001 [RFIC]): 53-56.

A 5.4 GHz 0.25 μm VLSI CMOS synchronous oscillator is proposed, which is designed to act as a local oscillator for HiperLAN systems. The design strategy is described, including the synchronization range optimization approach. A chip is presented, which provides a 150 MHz synchronization range and a -97 dBc/Hz phase noise at 10 kHz offset from the carrier, while only consuming 5 mA from a 2.5 V supply.



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High performance flip-chip multi-mode, multi-band VCO IC using a standard low cost BiCMOS process

D. Lovelace and R. Disilvestro. "High performance flip-chip multi-mode, multi-band VCO IC using a standard low cost BiCMOS process." 2001 Radio Frequency Integrated Circuits (RFIC) Symposium 01. (2001 [RFIC]): 57-60.

A low cost, high performance flip-chip multi-mode, multi-band voltage controlled oscillator (VCO) IC is presented. This IC is suitable for high performance VCO circuits over a wide range of frequencies. A novel noise reduction circuit technique is used to obtain improved phase noise performance without the use of a higher cost SiGe BiCMOS processes. This IC has a measured phase noise of -162 dBc/Hz at a 20 MHz offset operating at an oscillation frequency of 900 MHz with an output power of +10 dBm.

Click on title for a complete paper.



A 5.7 GHz Hiperlan SiGe BiCMOS voltage-controlled oscillator and phase-locked-loop frequency synthesizer

B.-U.H. Klepser, M. Scholz and J.J. Kucera. "A 5.7 GHz Hiperlan SiGe BiCMOS voltage-controlled oscillator and phase-locked-loop frequency synthesizer." 2001 Radio Frequency Integrated Circuits (RFIC) Symposium 01. (2001 [RFIC]): 61-64.

A SiGe BiCMOS 5.5-6.4 GHz frequency synthesizer is presented. The synthesizer consists of an oscillator with a phase noise of -110 dBc/Hz at 1 MHz offset, and a 10 GHz phase-lock-loop circuit with an in-band phase noise of -79 dBc/Hz. The power consumption of the ICs was 9 mW and 17 mW, respectively.

A fully integrated PLL frequency synthesizer LSI for mobile communication system

T. Yasunaga, S. Hirano, R. Maeda, Y. Hiraoka, T. Andou and Y. Miyahara. "A fully integrated PLL frequency synthesizer LSI for mobile communication system." 2001 Radio Frequency Integrated Circuits (RFIC) Symposium 01. (2001 [RFIC]): 65-68.

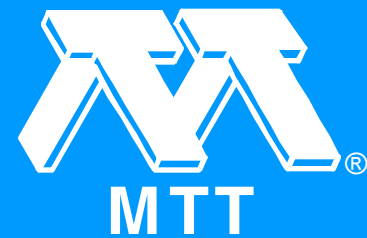
A fully integrated phase locked loop (PLL) frequency synthesizer LSI has been developed. This newly developed fractional-N type PLL LSI consists of an on-chip loop filter and a voltage controlled oscillator (VCO) with an on-chip resonator circuit. This VCO has a band-switching tuning circuit using MOS capacitors and an analog tuning circuit using PN varactor diodes. Both these tuning circuits are controlled automatically without external adjustment. The phase noise of the VCO at 2.2 GHz is -92.5 dBc/Hz at 50 kHz offset, while the frequency switching time is 170 /spl mu/s.

Abstracts

A flexible 10-300 MHz receiver IC employing a bandpass sigma-delta ADC

R. Schreier, J. Lloyd, L. Singer, F. Weiss, B. Sam, D. Paterson, C. Jacobs, J. Steinheider, M. Timko, J. Zhou and W. Martin. "A flexible 10-300 MHz receiver IC employing a bandpass sigma-delta ADC." 2001 Radio Frequency Integrated Circuits (RFIC) Symposium 01. (2001 [RFIC]): 71-74.

This 0.6 μm BiCMOS IC mixes a 10-300 MHz first IF down to a 1.5-3 MHz second IF and digitizes the result with a bandpass sigma-delta ADC. The ADC achieves 88 dB SNR in a 10 kHz bandwidth, 75 dB SNR in a 200 kHz bandwidth and >90 dB of image rejection while consuming only 8 mA from a 2.7 V supply. The complete IC, which incorporates an LNA, mixer, active anti-alias filter, VGA, ADC, decimation filter and two synthesizers, achieves a noise figure of 11 dB and an IIP3 of -1 dBm with a power consumption of 120 mW.



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A completely integrated 1.8 volt 5 GHz tunable image reject notch filter

J.W.M. Rogers and C. Plett. "A completely integrated 1.8 volt 5 GHz tunable image reject notch filter." 2001 Radio Frequency Integrated Circuits (RFIC) Symposium 01. (2001 [RFIC]): 75-78.

This paper presents a topology for an integrated image reject notch filter. The filter circuitry is combined with a standard LNA topology thus minimizing the additional current required to perform this function on-chip. In applications where NF is not the dominant consideration, the filter could do double duty as an LNA stage. A prototype circuit exhibited the following performance: 70 dB of image rejection, a NF of 4.2 dB, 14 dB of gain in the pass band, and an IIP3 of -6 dBm.

A monolithic 2-V 950-MHz CMOS bandpass amplifier with a notch filter for wireless receivers

Chunbing Guo, A.N.L. Chan and H.C. Luong. "A monolithic 2-V 950-MHz CMOS bandpass amplifier with a notch filter for wireless receivers." 2001 Radio Frequency Integrated Circuits (RFIC) Symposium 01. (2001 [RFIC]): 79-82.

A fully-integrated 950-MHz bandpass amplifier for use in a wireless receiver is designed in a standard 0.5- μm CMOS process. A Q-compensation circuit is embedded to achieve a desired bandwidth of 25 MHz. Unbalanced g/sub m/-cells are used to maximize the linearity. A notch filter is adopted to achieve an image rejection of 50 dB. A switchable-capacitor array is used to tune the center frequency over 100 MHz range. The amplifier measures a gain of 22 dB with an IIP3 of -17 dBm, a noise figure of 10 dB and draws a current of 25 mA from a 2-V supply.

Tuned LNA for RFICs using boot-strapped inductor

F. Albertoni, L. Fanucci, B. Neri and E. Sentieri. "Tuned LNA for RFICs using boot-strapped inductor." 2001 Radio Frequency Integrated Circuits (RFIC) Symposium 01. (2001 [RFIC]): 83-86.

In this paper, the principle of operation of a new type of active inductor and its application to a tuned LNA are described. The design is optimized at 1.8 GHz. An integrated transformer in connection with a current amplifier realizes a "boot-strapped" inductor with a $L/spl \times Q$ factor never obtained before at this frequency. This way a selective LNA with a 60 MHz bandwidth, corresponding to a Q of 30, was designed. The circuit exhibits a matched noise figure of 1.8 dB with 25.5 dB transducer power gain while dissipating 20.7 mW from a 3 V power supply.

A 2.4 GHz CMOS transceiver for Bluetooth

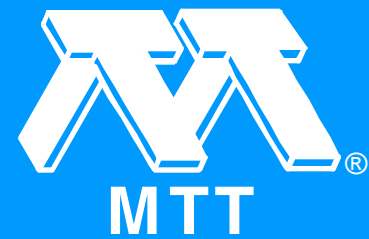
H. Darabi, S. Khorram, E. Chien, M. Pan, S. Wu, S. Moloudi, J.C. Leete, J.J. Rael, M. Syed, R. Lee, B. Ibrahim, M. Rofougaran and A. Rofougaran. "A 2.4 GHz CMOS transceiver for Bluetooth." 2001 Radio Frequency Integrated Circuits (RFIC) Symposium 01. (2001 [RFIC]): 89-91.

A fully integrated CMOS transceiver tuned to 2.1 GHz consumes 46 mA in receive-mode and 47 mA in transmit-mode from a 2.7 V supply. The receiver achieves a sensitivity of -80 dBm at 0.1% BER, and an IIP3 of -7 dBm. The transmitter delivers a GFSK modulated spectrum at an output power of 5 dBm.

A highly integrated GPS receiver for cellular handset

F. Dantoni, A. Holden, S.T. Fu, D. Sahu, S. Venkatraman and S.H.K. Embabi. "A highly integrated GPS receiver for cellular handset." 2001 Radio Frequency Integrated Circuits (RFIC) Symposium 01. (2001 [RFIC]): 93-96.

A highly integrated dual conversion heterodyne GPS receiver is reported. The receiver chip includes a 2.9 dB NF LNA, an image-reject mixer with 32 dB image rejection. The on-chip IF chain, which consists of a VGA, a 2nd mixer and filtering, has a maximum gain of 83 dB, a gain range of 45 dB and a 7 dB NF. A 4-bit ADC is integrated on chip for enhanced SNR. The PLL with its VCO are also integrated. The total NF is 3 dB with a total 121 dB voltage gain. The chip consumes 132 mW at 2.7 V.



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The first very low-IF RX, 2-point modulation TX CMOS system on chip Bluetooth solution

C. Durdodt, M. Friedrich, C. Grewing, M. Hammes, A. Hanke, S. Heinen, J. Oehm, D. Pham-Stabner, D. Seippel, D. Theil, S. van Waasen and E. Wagner. "The first very low-IF RX, 2-point modulation TX CMOS system on chip Bluetooth solution." 2001 Radio Frequency Integrated Circuits (RFIC) Symposium 01. (2001 [RFIC]): 99-102.

The proposed low cost Bluetooth single-chip solution is implemented in a 0.25 μm CMOS technology. The "System On Chip (SOC)" includes all necessary baseband- and RF-parts to achieve full Bluetooth functionality, by occupying 18.5 mm² chip area in total. The maximum current consumption of the analog part is 60 mA. The internal regulated supply voltages of the analog and digital parts are 2.65 V. First measurement results of basic functionalities are discussed in this paper.

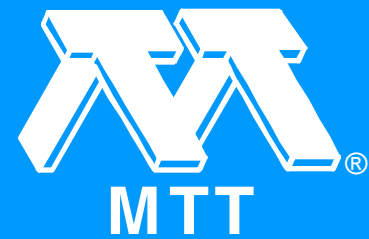
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A fully integrated CMOS frequency synthesizer for Bluetooth

D. Theil, C. Durdodt, A. Hanke, S. Heinen, S. van Waasen, D. Seippel, D. Pham-Stabner and K. Schumacher. "A fully integrated CMOS frequency synthesizer for Bluetooth." 2001 Radio Frequency Integrated Circuits (RFIC) Symposium 01. (2001 [RFIC]): 103-106.

A low power, fully integrated 2.4 GHz fractional-N frequency synthesizer for Bluetooth in a 0.25 μm CMOS technology is presented. The complete synthesizer, including a fully integrated VCO, consumes 22 mA from a 2.5 V supply. The integrated VCO reaches a phase noise of -133 dBc/Hz at 3 MHz. The synthesizer is designed for a direct $\Sigma\Delta$ -modulation of the PLL.



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Student-designed Bluetooth radio in silicon-on-sapphire

W.B. Kuhn. "Student-designed Bluetooth radio in silicon-on-sapphire." 2001 Radio Frequency Integrated Circuits (RFIC) Symposium 01. (2001 [RFIC]): 107-110.

The core of a fully-integrated Bluetooth receiver has been designed in a 0.5 μm Silicon-on-Sapphire (SOS) process by a team of 11 students during the Spring 2000 semester. Unlike previously reported RFIC development work done by graduate students in the course of their research, this design was completed in the context of a classroom setting in a single semester. The receiver incorporates a number of research efforts underway at the authors' institution, providing a wide range of students with exposure to state-of-the-art design methods. Details of both the class structure and of the Bluetooth architecture being studied are discussed. Measurements taken from an early prototype circuit in SOS are also reported.

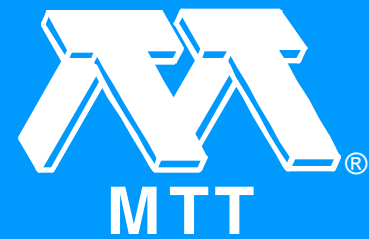
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A 2.5 V CMOS switched-capacitor channel-select filter with image rejection and automatic gain control

Yi-Huei Chen, Jenn-Chyou Bor and Po-Chiun Huang. "A 2.5 V CMOS switched-capacitor channel-select filter with image rejection and automatic gain control." 2001 Radio Frequency Integrated Circuits (RFIC) Symposium 01. (2001 [RFIC]): 111-114.

This paper presents a channel-select filter for 2.4 GHz, low-IF Bluetooth transceiver application. Besides of channel selection, image signal rejection, automatic gain control (AGC) and signal strength indication functions are all integrated. High frequency accuracy and large signal dynamic range is given as the switched-capacitor (SC) structure. Circuit techniques like multiple clock rate, filter capacitance scaling, and simplified op-amp structure are employed for power minimization. Measurement results indicate that the image rejection and the adjacent channel selectivity are better than 40 dB and 60 dB respectively. With a 0.25 μm 1P5M CMOS technology the proposed filter dissipates 11.8 mA from a single 2.5 V supply voltage.



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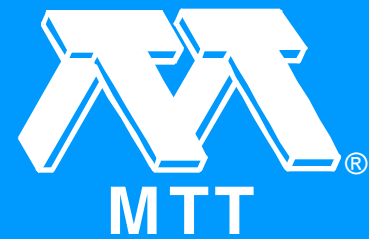
Design and modeling of compact on-chip transformer/balun using multi-level metal windings for RF integrated circuits

Tao Liang, J. Gillis, D. Wang and P. Cooper. "Design and modeling of compact on-chip transformer/balun using multi-level metal windings for RF integrated circuits." 2001 Radio Frequency Integrated Circuits (RFIC) Symposium 01. (2001 [RFIC]): 117-120.

A compact integrated balun transformer is analyzed that meets the size demand of highly integrated RFICs for the wireless industry. The design of a balun transformer with 4:1 impedance ratio using multi-level windings significantly reduces the silicon area compared to that occupied by an equivalent planar design. Its application is demonstrated in a highly efficient, linear amplifier design which achieved first pass design success.

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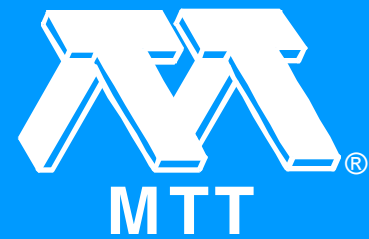
A complete physical frequency dependent lumped model for RF integrated inductors

J. Sieiro, J.M. Lopez-Villegas, J. Cabanillas, J.A. Osorio and J. Samitier. "A complete physical frequency dependent lumped model for RF integrated inductors." 2001 Radio Frequency Integrated Circuits (RFIC) Symposium 01. (2001 [RFIC]): 121-124.

A new development in the modeling of planar inductors is presented. The inductance is evaluated by means of analytical expressions, taking into account a full geometry description and the frequency dependence. Moreover, the model predicts the behavior of the ohmic losses and the magnetically induced losses. Finally, a new electric model interpretation of the self-resonant frequency based on physical assumptions is given.

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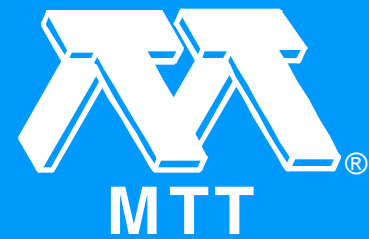
Microwave filters on a low resistivity Si substrate with a polyimide interface layer for wireless circuits

J. Papapolymerou and G.E. Ponchak. "Microwave filters on a low resistivity Si substrate with a polyimide interface layer for wireless circuits." 2001 Radio Frequency Integrated Circuits (RFIC) Symposium 01. (2001 [RFIC]): 125-128.

Novel low-pass and band-pass filter designs on low resistivity silicon substrate (1 /spl Omega/cm) with a polyimide interface layer are presented for the first time. The filters utilize the finite ground coplanar (FGC) line technology, and operate from 10-30 GHz with very good insertion loss. The latter is possible by using a 20 /spl mu/m thick polyimide on top of the silicon wafer, and a line geometry that minimizes field interaction with the lossy Si substrate. The attenuation of the FGC lines is comparable with that of thin film microstrip lines on similar substrates. Experimental and full-wave analysis results are provided. These filters can be used as part of a wireless microwave interconnect system.

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On-board probing of broadband RF amplifiers using CPW interconnects

K. Naishadham. "On-board probing of broadband RF amplifiers using CPW interconnects." 2001 Radio Frequency Integrated Circuits (RFIC) Symposium 01. (2001 [RFIC]): 129-132.

Printed circuit boards with edge-connectors for insertion into appropriate sockets on a motherboard are used in the RF industry as functional circuit blocks. For example, RF amplifiers in high-speed data transmission, video communication and broadband cable television systems employ modular interconnect circuit boards for attenuation, matching, etc. This paper presents a novel method for the on-board (in-situ) characterization of interstage functional blocks in broadband RF amplifiers, utilizing CPW plug-in connectors. We discuss an on-board calibration technique to compensate for the connector mismatch, and present measured data useful in modeling broadband high-power RF circuitry.

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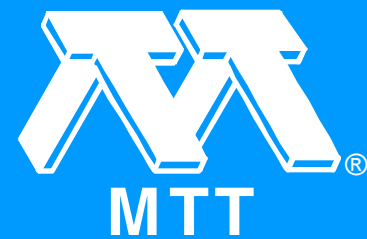
Modeling of lead-frame plastic CSPs for accurate prediction of their low-pass filter effects on RFICs (2001 [RFIC])

T.S. Horng, S.M. Wu, H.H. Huang, C.T. Chiu and C.P. Hung. "Modeling of lead-frame plastic CSPs for accurate prediction of their low-pass filter effects on RFICs (2001 [RFIC])." 2001 Radio Frequency Integrated Circuits (RFIC) Symposium 01. (2001 [RFIC]): 133-136.

This paper presents a direct extraction method to construct the electrical models of lead-frame plastic CSPs (Chip Scale Packages) for RFICs from the measured S-parameters. To evaluate the package effects on the reciprocal passive components, the insertion loss for an on-chip 50-ohm microstrip line housed in a 32-pin BCC (Bump Chip Carrier) package was calculated based on the established package model. Excellent agreement with measurement has been found up to 15 GHz. When applied to the non-reciprocal active components, the variation of gain for an HBT (Heterojunction Bipolar Transistor) array housed in an 8-pin BCC package has been also predicted up to 22 GHz successfully. Both cases have demonstrated that the package acts as a low-pass filter to cause a sharp cut off for the RFIC components above a certain frequency.

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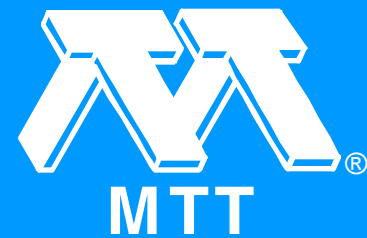
RF circuit performance degradation due to soft breakdown and hot carrier effect in 0.18 μm CMOS technology

Qiang Li, Jinlong Zhang, Wei Li, J.S. Yuan, Yuan Chen and A.S. Oates. "RF circuit performance degradation due to soft breakdown and hot carrier effect in 0.18 μm CMOS technology." 2001 Radio Frequency Integrated Circuits (RFIC) Symposium 01. (2001 [RFIC]): 139-142.

A systematic study of RF circuit performance degradation subject to soft oxide breakdown (SBD) and hot carrier (HC) stress is demonstrated. Device parameters before and after stress are extracted from the experimental data of 0.18 μm CMOS technology. The effects of SBD and HC degradations on $f_{\text{sub T}}$, $f_{\text{sub max}}$, third-order interception point and the four noise parameters (F_{min} , R_{n} , G_{opt} and B_{opt}) of an RF device have been studied. Since the figures of merit for the RF circuit characterization are gain, noise figure, linearity and input matching, the RF low noise amplifier (LNA) performance drift is evaluated for these features. The predicted the degradation trend from our experimental and simulation results can help design reliable CMOS RFICs.

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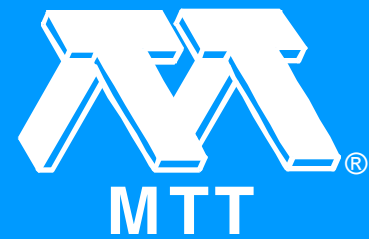
Reduced intermodulation distortion of AlGaAs/InGaAs doped-channel FETs by air-bridge gate process

Hsien-Chin Chiu, Feng-Tso Chien, Shih-Cheng Yang and Yi-Jen Chan. "Reduced intermodulation distortion of AlGaAs/InGaAs doped-channel FETs by air-bridge gate process." 2001 Radio Frequency Integrated Circuits (RFIC) Symposium 01. (2001 [RFIC]): 143-146.

The conventional mesa isolation process in AlGaAs/InGaAs doped-channel FETs (DCFETs) results in the gate contacting the exposed highly n-type doped channel at the mesa sidewall, forming a parasitic gate leakage path. In this work, we suppress the gate leakage from the mesa sidewall to increase the gate-to-drain breakdown voltage (BV/sub gd/) and the microwave power performance by using the air-bridge gate structure. The device gate leakage characteristics under high input power swing are particularly investigated in terms of the 3rd-order intermodulation distortion, which are sensitive to the sidewall gate leakage. The air-bridge gate DCFETs provide not only a lower power gain at higher input powers but also a lower IM3 power than those characteristics in conventional DCFETs.

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Systematic analysis of RF distortion in SiGe HBT's

Guofu Niu, Qingqing Liang, J.D. Cressler, C.S. Webster and D.L. Harnme. "Systematic analysis of RF distortion in SiGe HBT's." 2001 Radio Frequency Integrated Circuits (RFIC) Symposium 01. (2001 [RFIC]): 147-150.

A systematic analysis of the RF intermodulation in SiGe HBT's is performed using a new Volterra series-based approach. The relative dominance of individual nonlinearities and their interaction were shown to vary with source/load, bias current, and CB feedback. The C/sub CB/ and avalanche multiplication nonlinearities are the dominant factors in determining the overall linearity, and are responsible for the load dependence. A cancellation mechanism between the avalanche current I/sub CB/ nonlinearity and the CB capacitance C/sub CB/ nonlinearity is identified. The current dependence of avalanche multiplication was shown to be beneficial to linearity. The results suggest that there is a fundamental limit to achieving high f/sub T/ and high linearity and multiple collector profiles need to be used for leverage in RF circuit design.

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Field-modulating plate (FP) InGaP MESFET with high breakdown voltage and low distortion

A. Wakejima, K. Ota, K. Matsunaga, W. Contrata and M. Kuzuhara. "Field-modulating plate (FP) InGaP MESFET with high breakdown voltage and low distortion." 2001 Radio Frequency Integrated Circuits (RFIC) Symposium 01. (2001 [RFIC]): 151-154.

This paper describes a successfully developed field-modulating plate (FP) InGaP MESFET with an extremely high breakdown voltage of 100 V. The FP-FET, consisting of a 2.62 mm gate width, delivered an output power of 4.3 W and an output power density of 1.6 W/mm at 1.95 GHz operated at a drain bias (V_d) of 55 V. A low 3rd-order intermodulation distortion (IM3) of -31 dBc was also achieved at 8 dB back-off from saturation power. These results show the developed FET is suited for applications in the next generation cellular base station.

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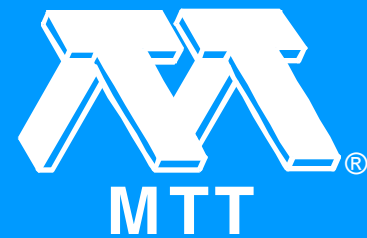
Large signal bias-dependent modeling of PHEMTs by pulsed measurements

B.L. Ooi, K. Lan, M.S. Leong and K.S. Kooi. "Large signal bias-dependent modeling of PHEMTs by pulsed measurements." 2001 Radio Frequency Integrated Circuits (RFIC) Symposium 01. (2001 [RFIC]): 155-157.

A bias-dependent large signal model and corresponding parameter extraction procedures are presented to characterize PHEMT devices by pulsed measurements. Two nonlinear current sources and few additional parameters are used to model bias-dependence of the drain current. Results show that the method discussed in this paper can be applied to model the large signal behavior of PHEMTs from DC to RF at any bias points.

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20-GHz InP-HBT voltage-controlled oscillator with wide tuning range

H. Djahanshahi, N. Saniei, S.P. Voinigescu, M.C. Maliepaard and C.A.T. Salama. "20-GHz InP-HBT voltage-controlled oscillator with wide tuning range." 2001 Radio Frequency Integrated Circuits (RFIC) Symposium 01. (2001 [RFIC]): 161-164.

This paper presents the design and implementation of a 20-GHz-band differential VCO using InP HBT process technology. Aimed at 20- or 40-Gb/s fiber optic applications, the design is based on a single-stage feedback amplifier with no intentional L or C. The salient features of the proposed VCO are wide frequency tuning range compared to LC oscillators, and low power consumption and transistor count compared to ring-oscillator counterparts. The implemented VCO has an adjustable frequency range from 13.75 GHz to 21.5 GHz and provides two complementary outputs. Total power consumption at 18.6 GHz is 130 mW, while the phase noise is -87.6 dBc/Hz measured at 1 MHz offset.

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The design of CMOS transimpedance amplifier based on BSIM large-signal model

Chin-Wei Kuo, Chao-Chih Hsiao, Shih-Cheng Yang and Yi-Jen Chan. "The design of CMOS transimpedance amplifier based on BSIM large-signal model." 2001 Radio Frequency Integrated Circuits (RFIC) Symposium 01. (2001 [RFIC]): 165-168.

A modified BSIM CMOS RF large-signal model is presented for RF circuit design. The high-frequency CMOS model is based on BSIM3v3, by adding some passive components to describe the microwave behavior. Integrated CMOS transimpedance (TZ) amplifier circuits were designed and fabricated based on this model. A 0.35 μm CMOS technology was used for circuit realization, and a capacitive-peaking [1-3] design to improve the bandwidth of TZ amplifier was also proposed and investigated.

Monolithic Ka-band even-harmonic quadrature resistive mixer for direct conversion receivers

K.S. Ang, M. Chongcheawchamnan, D. Kpogla, P.R. Young, I.D. Robertson, Dong-sik Kim, Moon-chuel Ju and Hwa-Chang Seo. "Monolithic Ka-band even-harmonic quadrature resistive mixer for direct conversion receivers." 2001 Radio Frequency Integrated Circuits (RFIC) Symposium 01. (2001 [RFIC]): 169-172.

This paper describes the design and measured performance of a Ka-band even-harmonic quadrature mixer which employs PHEMT resistive mixer elements. By employing the even-harmonic technique, with local oscillator at half the RF input frequency, the mixer is better suited for direct conversion receiver application. The chip operates in the 30 to 40 GHz range and has been used to successfully demodulate a 4 Mb/s 16-QAM signal at 38 GHz.

Compensation of MMIC spread in 60 GHz telecommunication module by automatic output power control

M. Fillebock and J. Schroth. "Compensation of MMIC spread in 60 GHz telecommunication module by automatic output power control." 2001 Radio Frequency Integrated Circuits (RFIC) Symposium 01. (2001 [RFIC]): 173-176.

Cost effective measures for compensation of component spread are required in mass production of mm-wave telecommunication modules. We present the development and implementation of an automatic output power control in a 60 GHz transceiver module in production at the MicroWave Factory of EADS. Without using any additional MMIC module production yield is increased significantly.

A 23-GHz low-noise amplifier in SiGe heterojunction bipolar technology

G. Schuppener, T. Harada and Yinggang Li. "A 23-GHz low-noise amplifier in SiGe heterojunction bipolar technology." 2001 Radio Frequency Integrated Circuits (RFIC) Symposium 01. (2001 [RFIC]): 177-180.

A monolithic low-noise amplifier for operation in the 23-GHz band is presented. The circuit has been designed utilizing an advanced 0.2-micron SiGe heterojunction bipolar technology, featuring npn transistors with $f_{sub T}$ and $f_{sub max}$ of about 90- and 100-GHz, respectively. Measurements show a gain of 21-dB and noise figure of 4.1-dB at 23-GHz, which compare reasonably well with simulated results. The circuit consumes 20-mA from a 2.5-V single supply. To our knowledge, 23 GHz band is the highest operation frequency reported so far for LNA in SiGe technology.



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A single chip FSK/ASK 900 MHz transceiver in a standard 0.25 um CMOS technology

W. Schuchter, G. Krasser, V. Schultheiss and G. Hofer. "A single chip FSK/ASK 900 MHz transceiver in a standard 0.25 um CMOS technology." 2001 Radio Frequency Integrated Circuits (RFIC) Symposium 01. (2001 [RFIC]): 183-186.

This paper presents a low power consumption single chip FSK/ASK transceiver for half-duplex low data rate communication in the 868-870 MHz band. The IC was processed in a standard 0.25 um CMOS technology, offers a very high level of integration and needs only few external components. The transmit/receive RF front end contains a high efficiency power amplifier, a low noise amplifier (LNA), a double balanced RF mixer and an I/Q mixer for down conversion to an intermediate frequency (IF) of 289 MHz and further to zero IF. The transmit/receive frequency synthesis of 868/1157 MHz is done by a fully integrated switchable frequency range voltage controlled oscillator (VCO), a phase locked loop synthesizer (PLL) and a tunable crystal oscillator used as reference frequency generator as well as FSK modulator. A bandwidth configurable I/Q channel select filter, an I/Q limiter with RSSI generation used also for AM demodulation, a FSK demodulator, a bandwidth configurable data filter and a dataslicer are implemented for further zero IF and baseband analog signal processing. The transceiver can be configured by a 2/3-wire bus interface. Low-drop voltage regulators are implemented to allow supply voltages up to 3.6 V because the maximum allowed voltages for the standard MOS transistors are 2.8 V. The overall current consumption of the transceiver in the receive and transmit mode is 11 mA and 20 mA, respectively. Additionally, a standby mode and idle mode is realized to increase battery lifetime.

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A highly integrated UHF data receiver for vehicle applications

D. Jobling, C. Landez, D. Frund and A. Huot. "A highly integrated UHF data receiver for vehicle applications." 2001 Radio Frequency Integrated Circuits (RFIC) Symposium 01. (2001 [RFIC]): 187-190.

This paper describes a UHF data receiver designed for short range data transfer for automotive applications: keyless entry and tyre pressure monitoring systems in the 315, 434 and 868 MHz bands. Received signals may be OOK or FSK modulated and may come from transmitters which are PLL-tuned (i.e. precise) or SAW-tuned (less precise, requiring a wide bandwidth receiver). The design target may be summarised as: a very high level of integration and autonomy combined with best possible performance (for example, -107 dBm sensitivity), consuming from 5 mA at 434 MHz to 7 mA at 868 MHz. This has been achieved by a superheterodyne architecture which has an image cancelling mixer, a fully integrated IF filter and a fully integrated local oscillator and PLL. A digital control block permits configuration of the circuit and some signal processing. The wake-up time is short so the average current consumption may be user-defined by an awake/sleep cycle.



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1W 900 MHz direct conversion CMOS transmitter for paging applications

D. Gerna, A. Giry, D. Manstretta, D. Belot and D. Pache. "1W 900 MHz direct conversion CMOS transmitter for paging applications." 2001 Radio Frequency Integrated Circuits (RFIC) Symposium 01. (2001 [RFIC]): 191-194.

This paper presents a 900 MHz transmitter for FSK applications. A power amplifier, an upconverter mixer and a phase shifter have been integrated together on the same substrate in 0.35 μm RF 3 V CMOS technology. The power amplifier has been designed to transmit more than 30dBm@900MHz with an associated efficiency of more than 50% at the maximum power.

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A 1-chip RF transceiver MMIC for ETC with surface via-hole isolation technique

S. Yamamoto, A. Suwa, T. Tanbo, T. Kitazawa, K. Tara and M. Hagio. "A 1-chip RF transceiver MMIC for ETC with surface via-hole isolation technique." 2001 Radio Frequency Integrated Circuits (RFIC) Symposium 01. (2001 [RFIC]): 195-198.

An RF Transmitter Receiver MMIC (TX-RX MMIC) with 16-pin plastic package has been developed for 5.8 GHz Japanese Electronic Toll Collection system (ETC). The MMIC contains following RF blocks; local buffer amplifier, variable attenuator, ASK modulator, power amplifier, low-noise amplifier, down-converter, local switch and antenna switch. We have developed the new Surface Via-Hole (SVH) isolation technique to integrate all RF circuits into single chip. The double hetero-junction modulation doped FETs (MODFETs) and SrTiO/sub 3/ (STO) MIM capacitors are also developed to realize a single voltage operation and small chip size. By using SVH isolation technique, low carrier leakage of -43 dBm, high on/off ratio of 39.6 dB at 5.84 GHz and low total current of 150 mA are achieved, and the practical small chip size (2.25/spl times/1.25 mm/sup 2/) is realized.

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A 1-5 GHz low-power single-chip receiver IC for optical video distribution system

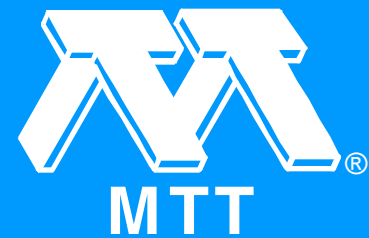
T. Oka, T. Ikedo, K. Nojima and K. Fujimoto. "A 1-5 GHz low-power single-chip receiver IC for optical video distribution system." 2001 Radio Frequency Integrated Circuits (RFIC) Symposium 01. (2001 [RFIC]): 199-202.

A 1-5 GHz low-power single-chip receiver IC has been developed for an optical video signal distribution system. A preamplifier and delay-line type FM demodulator are integrated on to a single-chip using 0.5 μm Si-bipolar technology. Using this IC, 80 carriers of 64-QAM digital video signals can be successfully transmitted with bit error rates less than 10^{-10} . This IC operates with low power consumption of 0.7 W, which is one of the lowest power consumption figures ever reported for such a device.

Power controller for dual band TDMA power amplifiers

S. Weber. "Power controller for dual band TDMA power amplifiers." 2001 Radio Frequency Integrated Circuits (RFIC) Symposium 01. (2001 [RFIC]): 205-208.

An Si IC for the analog power control of a TDMA dual-band power amplifier featuring a low-pass filter, internal RF detectors and a loop amplifier is presented. The key design constraints are identified and an optimized system topology with a new gain-shaping block is developed.



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A 450 MHz CMOS RF power detector

S. Ho. "A 450 MHz CMOS RF power detector." 2001 Radio Frequency Integrated Circuits (RFIC) Symposium 01. (2001 [RFIC]): 209-212.

An RF power detector based on a CMOS logarithmic/limiting amplifier achieves 50 dB dynamic range at 450 MHz. The logarithmic accuracy is +/- 1dB over the temperature range 0 to 85 degC. The chip is fabricated in 0.35 um double-poly triple-metal CMOS and consumes 10 mA with a 3 V supply.

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Design of an LTCC switch diplexer front-end module for GSM/DCS/PCS applications

R. Lucero, W. Qutteneh, A. Pavio, D. Meyers and J. Estes. "Design of an LTCC switch diplexer front-end module for GSM/DCS/PCS applications." 2001 Radio Frequency Integrated Circuits (RFIC) Symposium 01. (2001 [RFIC]): 213-216.

This paper presents the results of an antenna switch/filter module integrating GSM/DCS/PCS diplexer functions and Rx/Tx antenna switching on a low temperature co-fired ceramic (LTCC) substrate. Although the RF front-end module (FEM) was configured for dual-band (GSM/DCS) applications, the high pass filter function was designed to operate in the PCS band as well. Harmonic filtering was included in the diplexer design, which reduced the filtering requirements for the power amplifier. The 50-ohm in/out FEM utilized GaAs PHEMT switches and associated bias passives surface mounted on the LTCC substrate. S-parameter characterization of the FEM demonstrated excellent insertion and return loss characteristics. For GSM, the return and insertion losses measured at 912 MHz were better than 28 dB and less than 1.7 dB, respectively. Similarly, for DCS applications, the return and insertion losses at 1.77 GHz were better than 19 dB and less than 1.5 dB, respectively. In both cases, the design approach yielded excellent agreement between measured and simulated results.

Click on title for a complete paper.



A monolithic Si PCS-CDMA power amplifier with an impedance-controllable biasing scheme

Sifen Luo and T. Sowlati. "A monolithic Si PCS-CDMA power amplifier with an impedance-controllable biasing scheme." 2001 Radio Frequency Integrated Circuits (RFIC) Symposium 01. (2001 [RFIC]): 217-220.

This paper for the first time presents a monolithic Si PCS-CDMA power amplifier (PA) capable of delivering 28.2 dBm output power with 30% power-added efficiency (PAE) and -45 dBc adjacent-channel-power ratio (ACPR) at 1.9 GHz and 3.6 V supply voltage. The PA implemented in a 30 GHz BiCMOS process incorporates a novel impedance-controllable biasing scheme to control class of operation and bias impedance of the output stage.

A wide dynamic range switched-LNA in SiGe BiCMOS (2001 [RFIC])

T. Nakatani, J. Itoh, I. Imanishi and O. Ishikawa. "A wide dynamic range switched-LNA in SiGe BiCMOS (2001 [RFIC])." 2001 Radio Frequency Integrated Circuits (RFIC) Symposium 01. (2001 [RFIC]): 223-226.

A wide dynamic range, high current efficient switched-LNA has been developed by using SiGe BiCMOS technology. The low loss RF MOSFET reduced silicon substrate effect at high frequency is used as a bypass switch of LNA. The 800-900 MHz LNA is demonstrated in this work in high gain/low distortion mode for transmitting and receiving simultaneously, the amplifier achieves 15.3 dB gain, 1.4 dB noise figure and +1.6 dBm IIP3 with 5.9 mA DC current. In high gain/low current mode for receiving only, 13.3 dB gain, 1.6 dB noise figure and -0.6 dBm IIP3 are achieved with 3.0 mA. In low gain mode, 1.5 dB insertion loss and +16.1 dBm IIP3 with <10 uA are realized by the bypass switch. The switched-LNA is housed in a very small and low cost SON12 plastic package with a Down-Mixer.

Dual bias feed SiGe HBT low noise linear amplifier (2001 [RFIC])

E. Taniguchi, K. Maeda, T. Ikushima, K. Sadahiro, K. Itoh, N. Suematsu and T. Takagi. "Dual bias feed SiGe HBT low noise linear amplifier (2001 [RFIC])." 2001 Radio Frequency Integrated Circuits (RFIC) Symposium 01. (2001 [RFIC]): 227-230.

A 2 GHz-band SiGe HBT low noise amplifier (LNA) achieving high saturation power and low distortion performance is described. It has a novel diode/resistor dual bias feed circuit for the base of the HBT to extend its P1dB. In small signal region, the conventional resistor feed circuit is a dominant base current source, but in large signal region, the diode turns on and the diode feed circuit can supply base current like a voltage source which allows higher output power and linearity. The fabricated dual feed type LNA shows the P1dB improvement of 5 dB compared with the conventional resistor feed LNA.



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A 1.4-dB-NF variable-gain LNA with continuous control for 2-GHz-band mobile phones using InGaP emitter HBTs (2001 [RFIC])

Y. Aoki, M. Fujii, S. Ohkubo, S. Yoshida, T. Niwa, Y. Miyoshi, H. Dodo, N. Goto and H. Hida. "A 1.4-dB-NF variable-gain LNA with continuous control for 2-GHz-band mobile phones using InGaP emitter HBTs (2001 [RFIC])." 2001 Radio Frequency Integrated Circuits (RFIC) Symposium 01. (2001 [RFIC]): 231-234.

We designed a continuously variable-gain low-noise-amplifier (VG-LNA) circuit with a noise figure (NF) of 1.4 dB. This VG-LNA has a diode-loaded emitter follower and a variable-current source. The diode-loaded emitter follower enables gain control without NF degradation at the maximum gain; the variable-current source improves the linearity and widens the range of gain control. It was fabricated by using InGaP-emitter hetero bipolar transistors (HBTs) and has an NF of 1.4 dB at maximum gain, 1.95 GHz, and a 3-V supply voltage. Its maximum gain is 15 dB, its input 3rd-order-intercept-point (IIP3) at the maximum gain is 3.4 dBm, and the gain-control range is 40 dB. The obtained NF of 1.4 dB is the lowest so far reported for a continuously controlled VG-LNA.

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A 1.7 mA low noise amplifier with integrated bypass switch for wireless 0.05-6 GHz portable applications (2001 [RFIC])

H. Morkner, M. Frank and S. Yajima. "A 1.7 mA low noise amplifier with integrated bypass switch for wireless 0.05-6 GHz portable applications (2001 [RFIC])." 2001 Radio Frequency Integrated Circuits (RFIC) Symposium 01. (2001 [RFIC]): 235-238.

An ultra low current low noise amplifier with an integrated bypass switch has been developed using PHEMT technology. The LNA/Sw uses only 1.7 mA when powered and less than 1 uA when bypassed. It is usable from 50 MHz to 6 GHz. This enables portable systems such as Bluetooth, Home RF, PDAs, wireless LANs. The LNA provides 15 dB gain, 1.8 dB noise figure with 50 Ω load at the output and Γ_{opt} at the input. Bypass mode provides 5 dB insertion loss into the same I/O match. The LNA and bypass switch with associated control circuitry are integrated into a single RFIC and housed in the miniature SOT package. This LNA/Sw provides lower current and easier usage with comparable NF, Gain, and bandwidth than previously reported products.

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1.8 V RF AGC and mixer implemented with a novel four-terminal HBT (FHBT)

Sining Zhou, Pingxi Ma, Liyang Zhang, P. Zampardi, Jiang Li, Y.S. Chang and M.F. Chang. "1.8 V RF AGC and mixer implemented with a novel four-terminal HBT (FHBT)." 2001 Radio Frequency Integrated Circuits (RFIC) Symposium 01. (2001 [RFIC]): 241-244.

A recent discovery indicates that the current gain of AlGaAs/GaAs HBTs can be externally modulated by biasing an extra Schottky electrode that contacts the emitter passivation ledge directly. This discovery leads to the possibility of implementing complex RF AGC (automatic-gain-control) and signal mixing functions within a 4-terminal HBT (FHBT) at relatively low power supply voltages (down to $V_{sub} \approx 1.8$ V). This low voltage operation has been extremely difficult for the conventional Gilbert-cell mixer design based on regular 3-terminal HBTs. The demonstrated FHBT AGC has 24 dB gain control up to 6 GHz and the mixer has 7 dB conversion gain and -12.5 dBm IIP3 without emitter or base degeneration.



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Design and performance of a highly integrated wideband active downconverter MMIC

C.F. Campbell and J.M. Beall. "Design and performance of a highly integrated wideband active downconverter MMIC." 2001 Radio Frequency Integrated Circuits (RFIC) Symposium 01. (2001 [RFIC]): 245-248.

The design and performance of a highly integrated wideband downconverter MMIC is described. The circuit utilizes 0.25 μm pHEMT technology and a high density interconnect (HDI) process to yield a single ended, double balanced active downconverter with a 1 mm² die area. The circuit is self biased and draws 17-24 mA from a single 3-5 V positive supply. Diode level shifting is employed to achieve a direct coupled IF output. Measured performance of the MMIC demonstrates 10 GHz 3 dB-RF bandwidth and positive conversion gain through 18 GHz.

Click on title for a complete paper.



A 2.5 GHz low noise high linearity LNA/mixer IC in SiGe BiCMOS technology

D. Wang, K. Krishnamurthi, S. Gibson and J. Brunt. "A 2.5 GHz low noise high linearity LNA/mixer IC in SiGe BiCMOS technology." 2001 Radio Frequency Integrated Circuits (RFIC) Symposium 01. (2001 [RFIC]): 249-252.

A monolithic low noise high linearity LNA/mixer circuit for 2.5 GHz applications has been fabricated in IBM 47 GHz SiGe production process. The measured performance is 8 dBm input IP3, 1.6 dB NF and 12 dB Gain for a low noise amplifier (LNA), and 2.5 dBm input IP3, 7.5 dB NF and 14 dB gain for a downconversion mixer with a total current consumption of 26 mA for a 2.75 V supply. LNA matching, mixer RF and LO matching and two baluns are all integrated on chip, requiring no critical RF tuning components.

A 1.9 GHz double-balanced subharmonic mixer for direct conversion receivers

K. Nimmagadda and G.M. Rebeiz. "A 1.9 GHz double-balanced subharmonic mixer for direct conversion receivers." 2001 Radio Frequency Integrated Circuits (RFIC) Symposium 01. (2001 [RFIC]): 253-256.

This paper presents a 1.9 GHz double-balanced subharmonic mixer for wireless communications applications. The mixer is fabricated in a 0.35 μm BiCMOS process. The conversion gain of the subharmonic mixer at an RF input of 1.6-1.9 GHz with an LO input at 750-900 MHz is 9.5-7.5 dB. The mixer has a measured IIP3 of -3 dBm and an input 1 dB compression point of -10 dBm at 1.9 GHz. The measured SSB noise figure is 9.5-10.5 dB at 1.9 GHz. The mixer core consumes 8 mA of current and the LO buffers consume 7 mA of current from a 3 V power supply. The application areas are in direct conversion transceivers for wireless systems.

A 1 GHz-band low distortion up-converter with a linear in dB control VGA for digital TV tuner

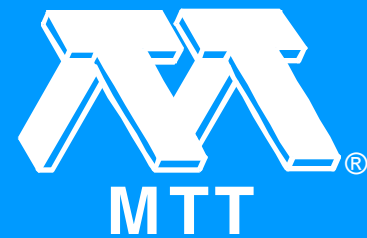
Yong-Sik Youn, Cheon-Soo Kim, Nam-Soo Kim and Hyun-Kyu Yu. "A 1 GHz-band low distortion up-converter with a linear in dB control VGA for digital TV tuner." 2001 Radio Frequency Integrated Circuits (RFIC) Symposium 01. (2001 [RFIC]): 257-260.

A new exponential controlled variable gain amplifier (VGA) and an up-mixer have been integrated in a single chip using 0.35 μm CMOS process. The gain of the VGA is controlled analog-linear in dB by using proposed a multi-stage multi-control R-r ladder structure to cover the wide gain control range. Up-converter shows a low distorted IF output signal over the wide RF input signal range of 50 MHz/spl sim/810 MHz for digital TV tuner. Measurements show that the gain control range of VGA is -48/spl sim/0 dB and the IIP3 of the overall up-converter is 27/spl sim/1 dBm, respectively. In addition, -3 dB frequency is measured to 1 GHz. The chip consumes 10 mA with a single 3.3 V power supply.

A low-power direct conversion receiver module for C-band wireless applications (2001 [RFIC])

B. Matinpour, A. Sutono and J. Laskar. "A low-power direct conversion receiver module for C-band wireless applications (2001 [RFIC])." 2001 Radio Frequency Integrated Circuits (RFIC) Symposium 01. (2001 [RFIC]): 263-266.

In this paper, we present the first low-power direct conversion receiver module for broadband wireless applications at C-band. This module is composed of a highly-integrated receiver MMIC fabricated in a 0.6 μm commercial GaAs MESFET process mounted on a LTCC substrate with an integrated multi-layer three-dimensional front-end filter. With only 25 mW of dc power consumption, this receiver module demonstrates a conversion gain of 9 dB, NF of 4.7 dB, dc offset below -70 dBm, IIP2 of +30 dBm, and IIP3 of -10 dBm at 5.8 GHz.



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A GaAs HBT 5.8 GHz OFDM transmitter MMIC chip set (2001 [RFIC])

A. Raghavan, E. Gebara, C.-H. Lee, S. Chakraborty, D. Mukherjee, J. Bhattacharjee, D. Heo and J. Laskar. "A GaAs HBT 5.8 GHz OFDM transmitter MMIC chip set (2001 [RFIC])." 2001 Radio Frequency Integrated Circuits (RFIC) Symposium 01. (2001 [RFIC]): 267-270.

This paper presents a GaAs/AlGaAs HBT transmitter MMIC chip set consisting of a power amplifier, a mixer and a voltage-controlled oscillator (VCO) for 5.8 GHz OFDM applications. The performance of the transmitter in an OFDM system is investigated by means of envelope co-simulation of the circuit in an OFDM transmitter simulation platform that conforms to the IEEE 802.11a wireless LAN standard. To the best of our knowledge, this research represents the first reported implementation of an OFDM transmitter in GaAs HBT technology.

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A 2.5 V CMOS differential active inductor with tunable L and Q for frequencies up to 5 GHz (2001 [RFIC])

M. Grozing, A. Pascht and M. Berroth. "A 2.5 V CMOS differential active inductor with tunable L and Q for frequencies up to 5 GHz (2001 [RFIC])." 2001 Radio Frequency Integrated Circuits (RFIC) Symposium 01. (2001 [RFIC]): 271-274.

A differential active inductor in CMOS-technology with a supply voltage of 2.5 V is presented. A self-resonant frequency of 5.6 GHz is achieved. The value of the inductance L can be controlled in the range from 10 nH up to 100 nH. The quality factor Q can be tuned independently of L to values as large as 600. The active inductor is realized with a differential gyrator. The gyrator transforms intrinsic capacitances of the MOSFETs to the emulated inductance.

Temperature dependence of intermodulation and linearity in GaN based devices (2001 [RFIC])

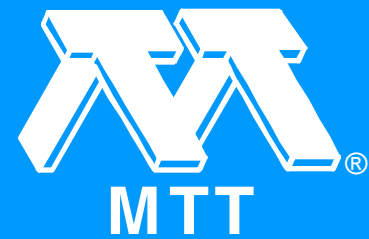
A. Ahmed, S.S. Islam and A.F.M. Anwar. "Temperature dependence of intermodulation and linearity in GaN based devices (2001 [RFIC])." 2001 Radio Frequency Integrated Circuits (RFIC) Symposium 01. (2001 [RFIC]): 275-278.

Gain, intermodulation distortion of an AlGaN/GaN device operating at RF, have been analyzed using a general Volterra series representation. The circuit model to represent the GaN FET is obtained from a physics based analysis. Theoretical current-voltage characteristics are in excellent agreement with the experimental data. For a $1 \text{ /spl mu/m/spl times/500 /spl mu/m}$ Al/sub 0.15/Ga/sub 0.85/N/GaN FET, the calculated output power, power added efficiency and gain are 25 dBm, 13% and 10.1 dB, respectively at 15 dBm input power and are in excellent agreement with the experimental data. The output referred third order intercept point IP3 is 39.9 dBm at 350 K and 33 dBm at 650 K. These are in agreement with the simulated results from Cadence which are 39.34 dBm and 35.7 dBm, respectively. At 10 GHz, third order intermodulation distortion IM3 for 10 dBm output power is -88 dB at 350 K and -82 dB at 650 K. At 350 K IM3 is -97 dB at 5 GHz and -88 dB at 10 GHz. For the same frequencies IM3 increased to -90 dB and -82 dB, respectively, at 650 K.

A new 'T' circuit topology for the broadband modelling of symmetric inductors fabricated in CMOS technology (2001 [RFIC])

W. Tatinian, P. Pannier and R. Gillon. "A new 'T' circuit topology for the broadband modelling of symmetric inductors fabricated in CMOS technology (2001 [RFIC])." 2001 Radio Frequency Integrated Circuits (RFIC) Symposium 01. (2001 [RFIC]): 279-282.

This paper shows that the conventional /spl Pi/-type model is not suitable for the broadband modelling of symmetrical inductors. A T-shaped model topology is introduced and a suitable extraction procedure is proposed for its parameters. The new model allows one to reproduce the measured behaviour of symmetric inductors up to twice the self-resonance frequency.



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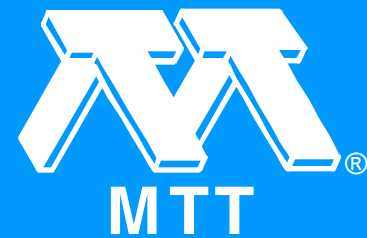
Modeling of inductors and transformers (2001 [RFIC])

S.R. Kythakypuzha and W.B. Kuhn. "Modeling of inductors and transformers (2001 [RFIC])." 2001 Radio Frequency Integrated Circuits (RFIC) Symposium 01. (2001 [RFIC]): 283-286.

This paper deals with modeling of spiral inductors and transformers. A lumped element approach is used to represent the spirals on a turn-by-turn basis. A previously reported approach for modeling of substrate eddy currents is employed and a new approach for modeling of current crowding effects is introduced. Both are modeled using inductor and resistance loops with coupling to the turn inductances. The program is written to generate a Spice sub-circuit for a wide variety of inductors and transformers. The results are validated against measured values of spirals implemented in a six-layer-copper bulk CMOS process and an SOI process.

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15 GHz wideband amplifier with 2.8 dB noise figure in SiGe bipolar technology (2001 [RFIC])

H. Knapp, D. Zoschg, T. Meister, K. Aufinger, S. Boguth and L. Treitinger. "15 GHz wideband amplifier with 2.8 dB noise figure in SiGe bipolar technology (2001 [RFIC])." 2001 Radio Frequency Integrated Circuits (RFIC) Symposium 01. (2001 [RFIC]): 287-290.

We present a wideband amplifier with 12 dB gain and a 3-dB bandwidth of 15 GHz. The noise figure is 2.8 dB for frequencies up to 10 GHz and 4 dB at 15 GHz. The circuit is manufactured in an advanced SiGe bipolar technology and consumes 7.2 mA from a 3.3 V supply.

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40-Gbit/s D-type flip-flop and multiplexer circuits using InP HEMT (2001 [RFIC])

T. Suzuki, H. Kano, Y. Nakasha, T. Takahashi, K. Imanishi, H. Ohnishi and Y. Watanabe. "40-Gbit/s D-type flip-flop and multiplexer circuits using InP HEMT (2001 [RFIC])." 2001 Radio Frequency Integrated Circuits (RFIC) Symposium 01. (2001 [RFIC]): 291-294.

We developed a novel design technique for a D-type flip-flop (D-FF) circuit that is based on a small-signal-equivalent circuit approach. This technique provides the best condition to operate the D-FF at a high frequency. Using this technique, we fabricated a master-slave D-FF using a 0.15- μm InP HEMT technology. We achieved 40-Gbit/s operation with clear-eye-waveform patterns and reduced jitter.



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A direct Ku-band linear subharmonically pumped BPSK and I/Q vector modulator in multi-layer thin-film MCM-D (2001 [RFIC])

G. Carchon, D. Schreurs, W. De Raedt, P. Van Loock and B. Nauwelaers. "A direct Ku-band linear subharmonically pumped BPSK and I/Q vector modulator in multi-layer thin-film MCM-D (2001 [RFIC])." 2001 Radio Frequency Integrated Circuits (RFIC) Symposium 01. (2001 [RFIC]): 295-298.

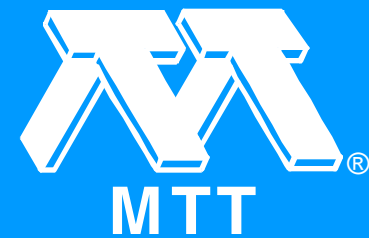
A direct Ku-band linear subharmonically pumped BPSK and I/Q vector modulator has been developed using multi-layer thin-film MCM-D technology. All passives are integrated in the low cost MCM-D substrate. The subharmonic mixing is performed using a beam-lead anti-parallel diode pair, mounted onto the MCM using thermocompression. No tuning has been performed on the circuits. The BPSK modulator has a very flat mixer conversion due to an optimal harmonic loading of the third harmonic of the LO: measurements show a ± 0.25 dB variation on the conversion loss for an LO-frequency varying between 6.8-7.6 GHz. The LO and RF return loss are below -14 dB and -12.5 dB respectively. The I/Q vector modulator consists of a Wilkinson power divider, a CPW Lange coupler and 2 BPSK modulators. The LO and RF return loss are better than -13 dB and -18 dB respectively. The QPSK-modulator has a measured image rejection better than -27 dB over the RF-range of 13.4-15.2 GHz band (corresponding to a vector phase and amplitude error lower than 2/spl deg/ and 1%). The image rejection is even better than -32 dB over the VSAT band (RF: 14-14.5 GHz).



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"Index of Authors (2001 [RFIC])." 2001 Radio Frequency Integrated Circuits (RFIC) Symposium 01. (2001 [RFIC]): 299-300.



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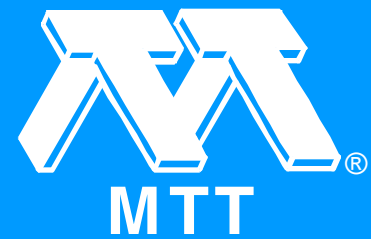
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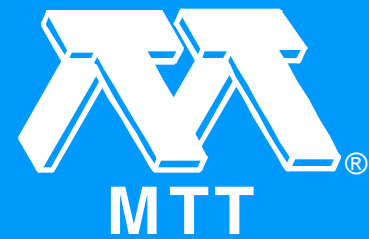
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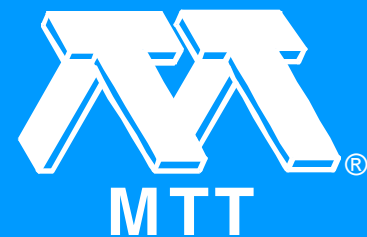
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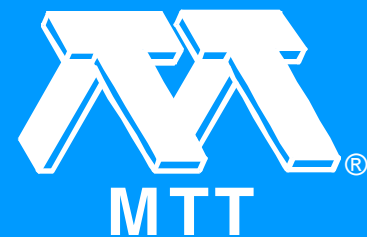
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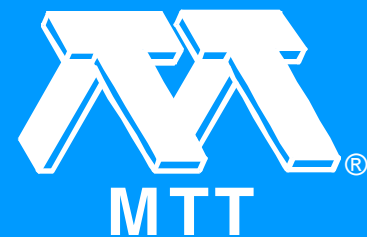
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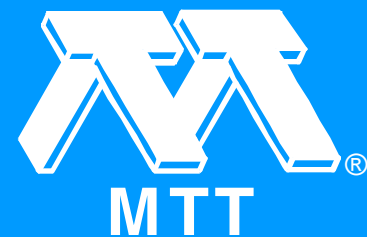
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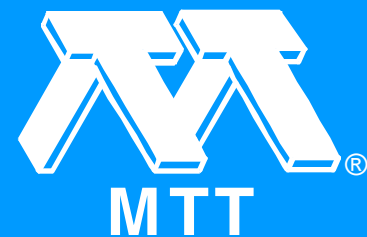
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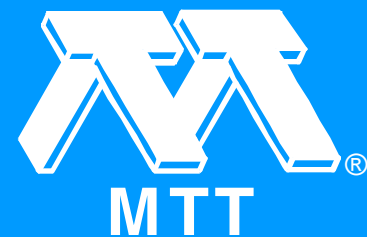
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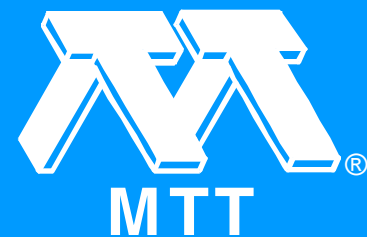
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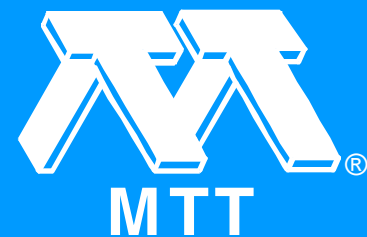
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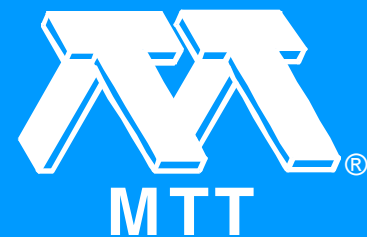
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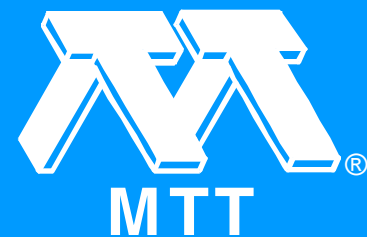
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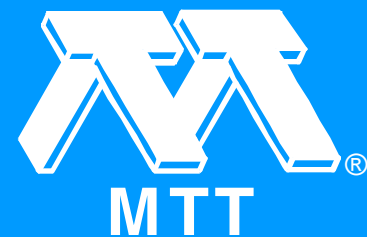
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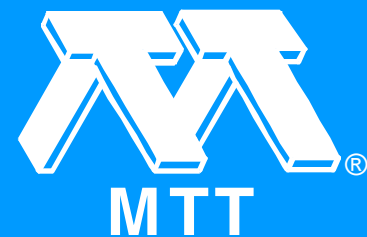
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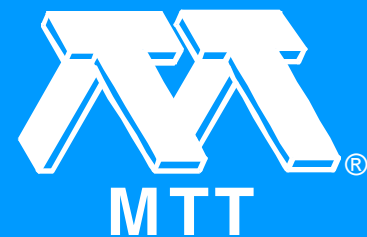
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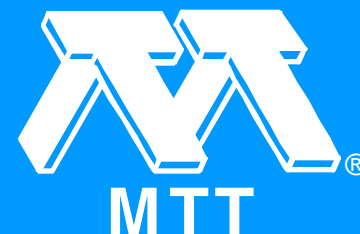
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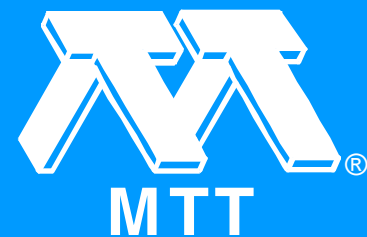
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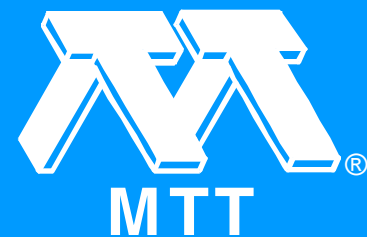
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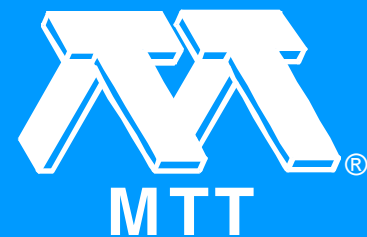
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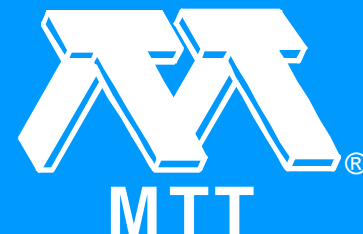
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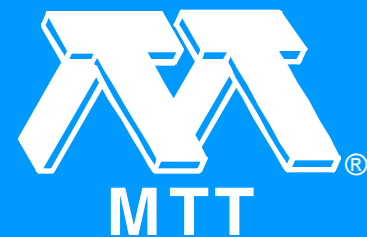
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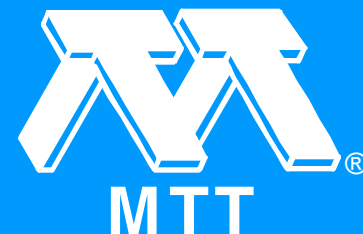
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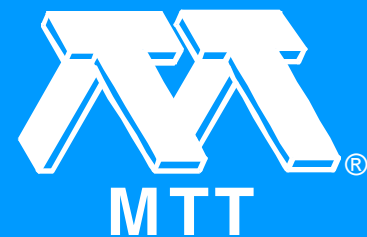
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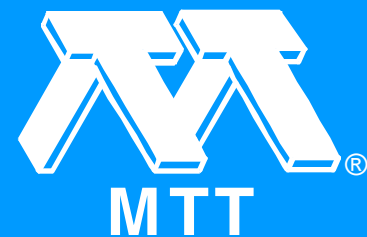
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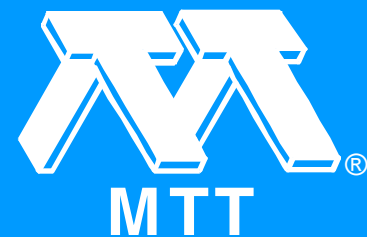
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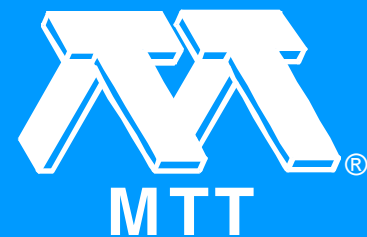
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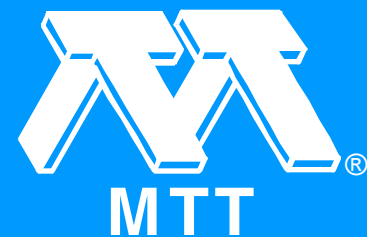
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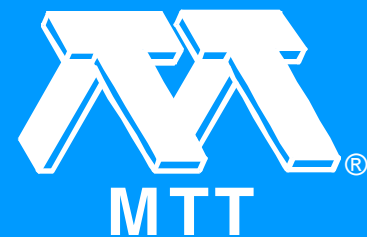
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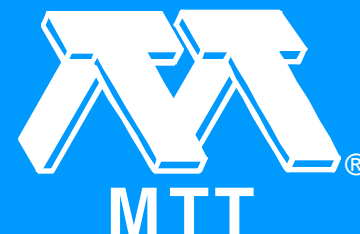
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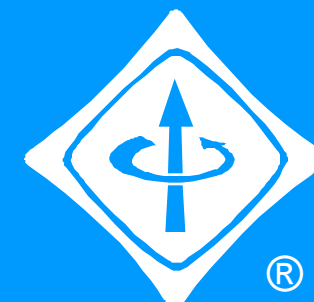
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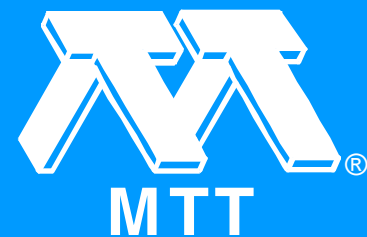
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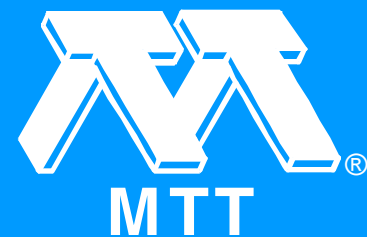
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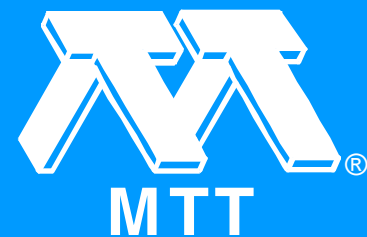
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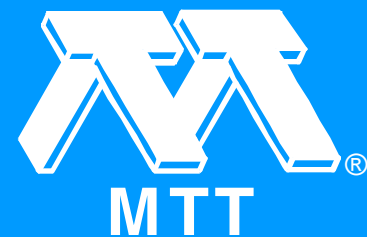
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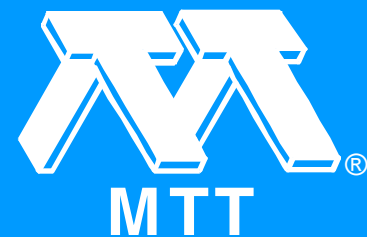
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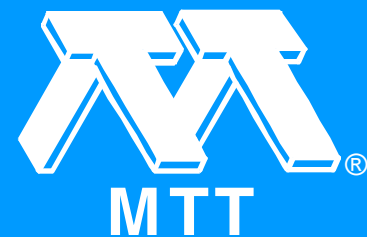
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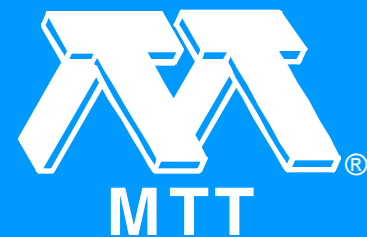
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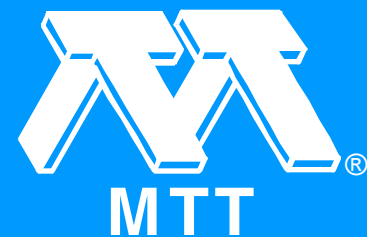
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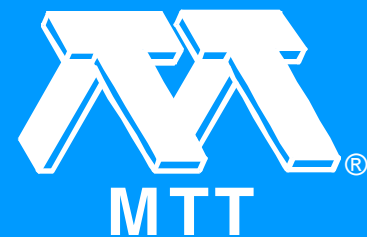
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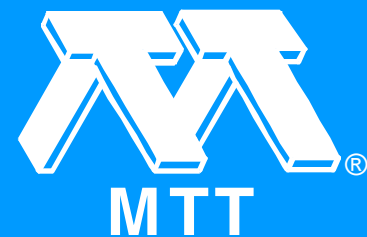
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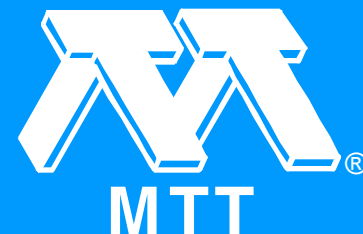
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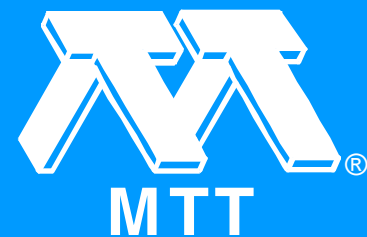
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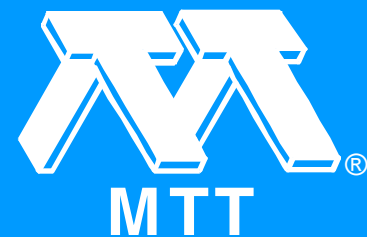
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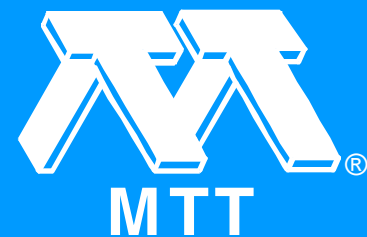
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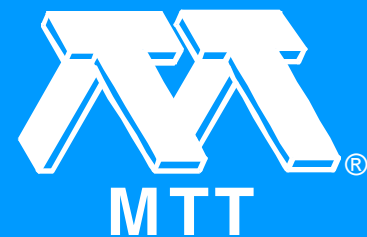
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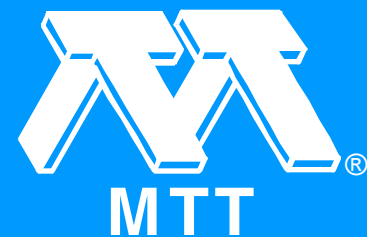
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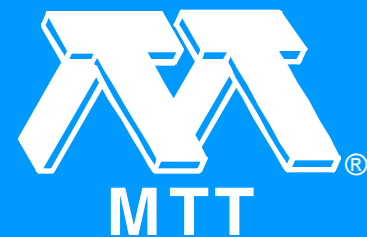
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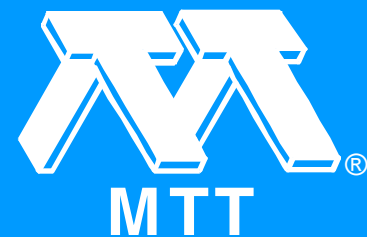
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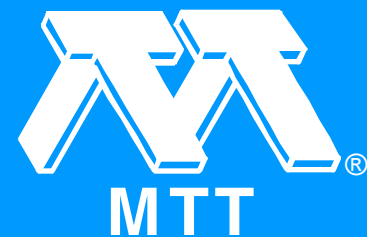
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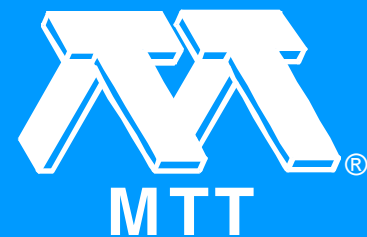
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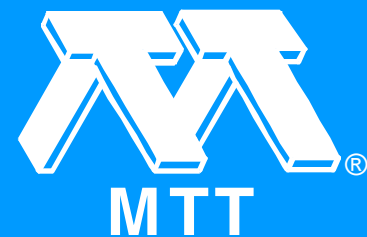
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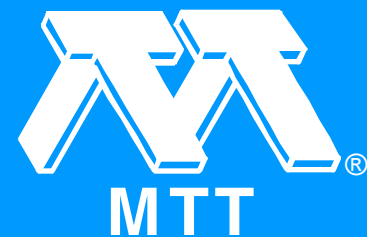
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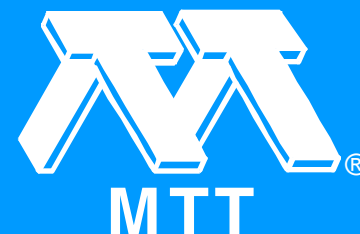
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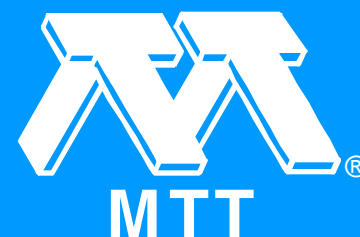
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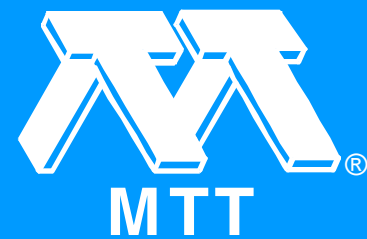
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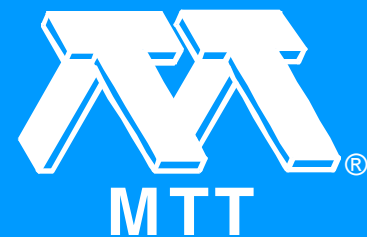
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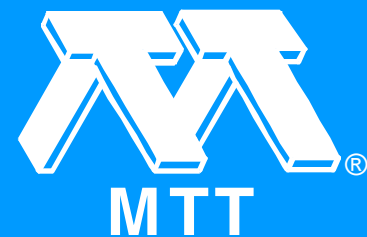
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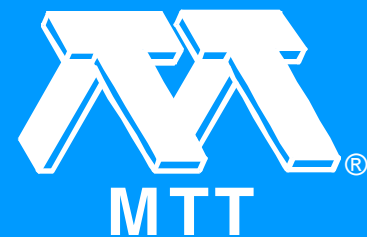
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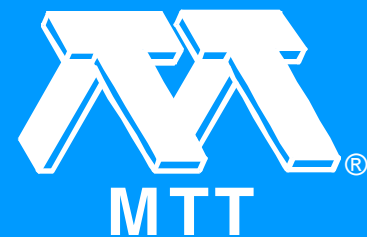
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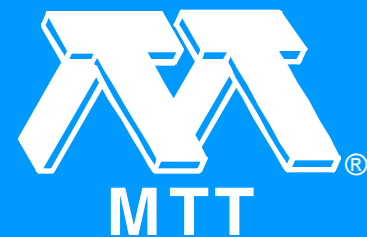
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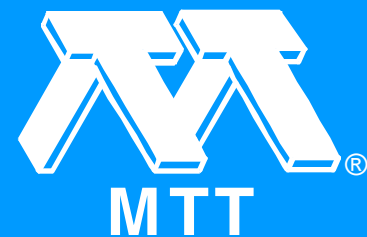
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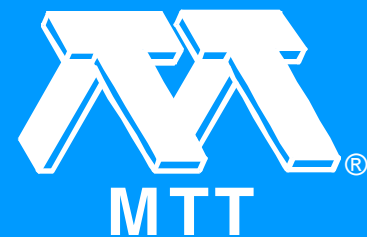
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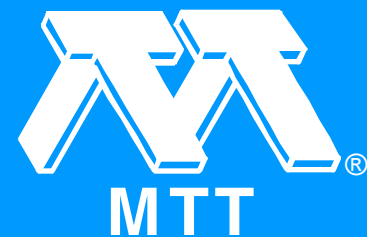
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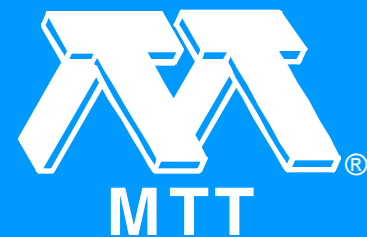
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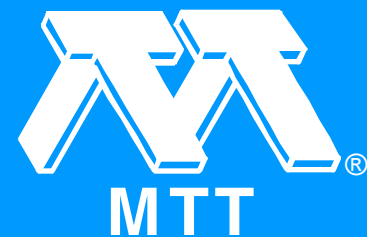
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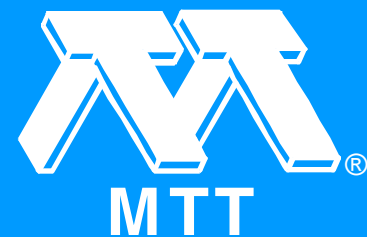
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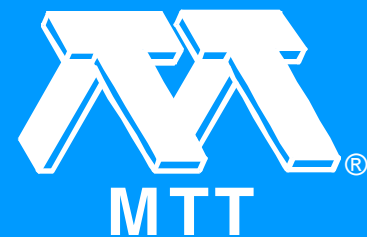
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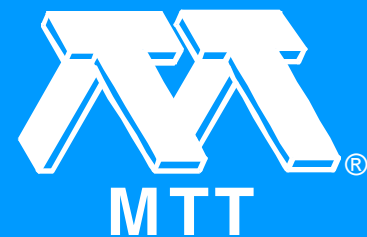
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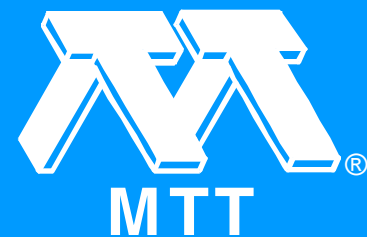
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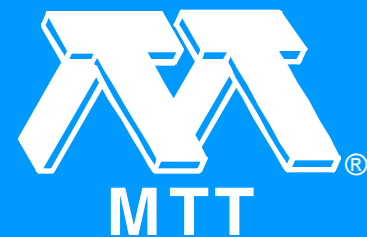
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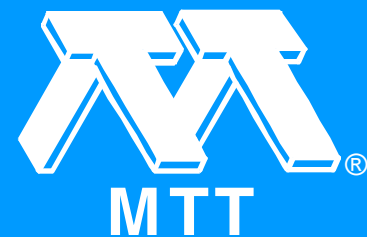
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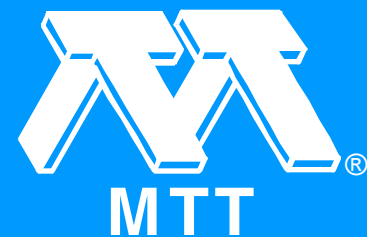
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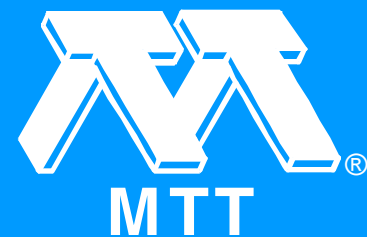
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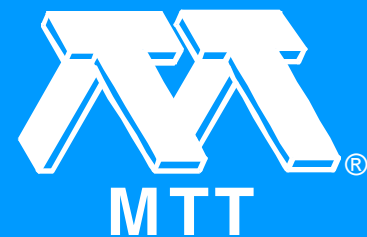
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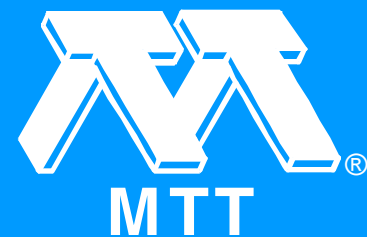
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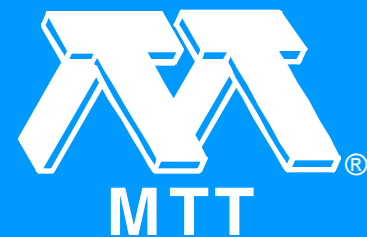
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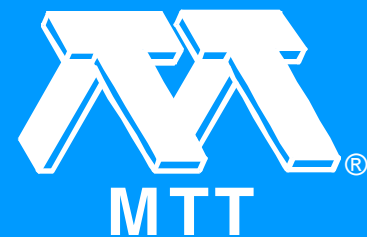
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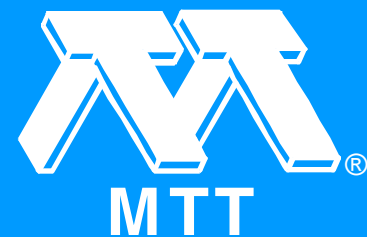
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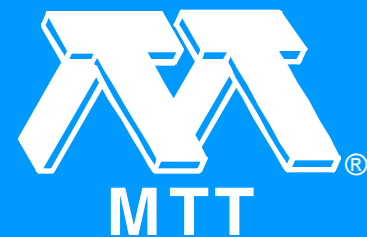
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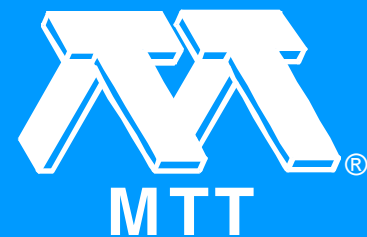
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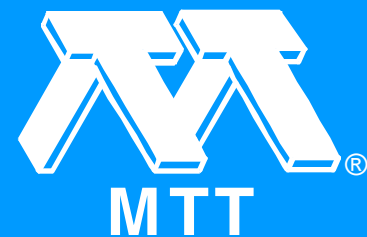
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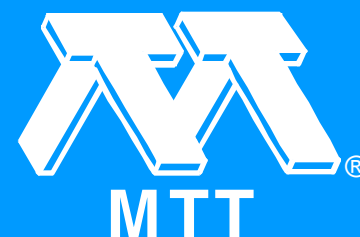
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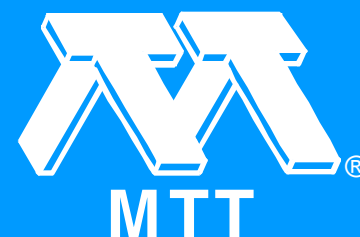
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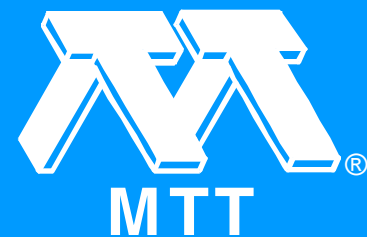
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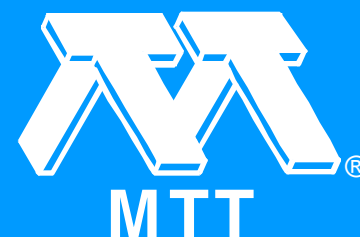
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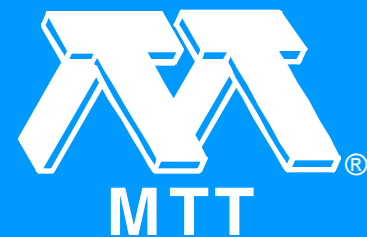
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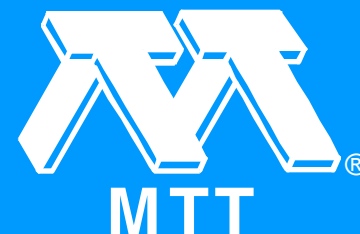
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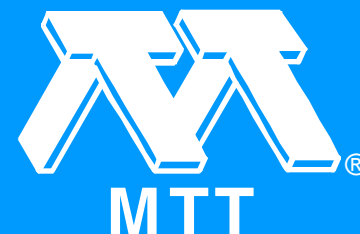
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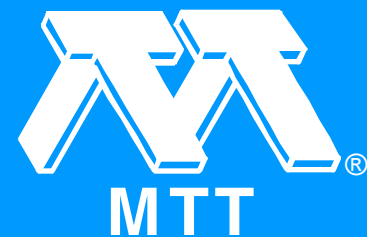
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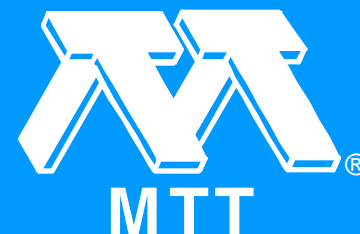
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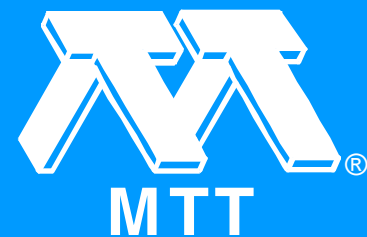
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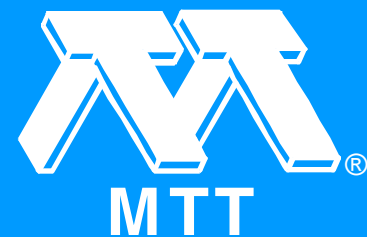
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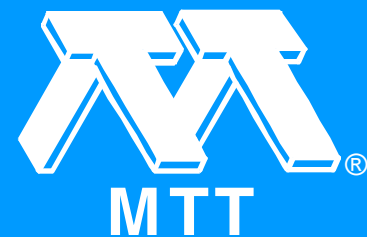
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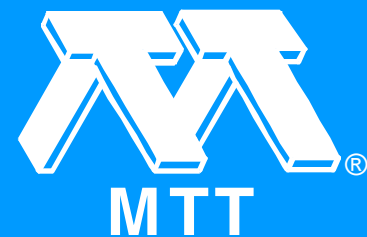
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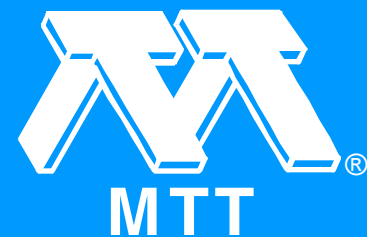
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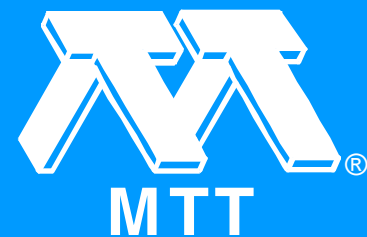
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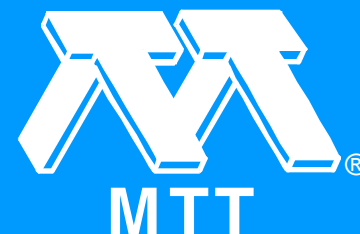
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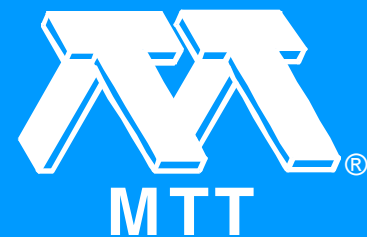
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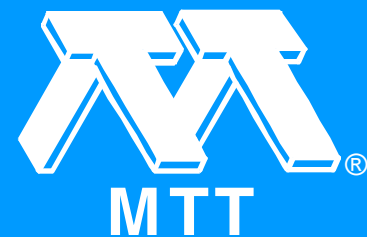
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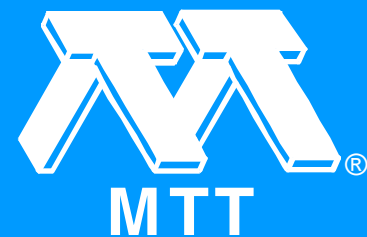
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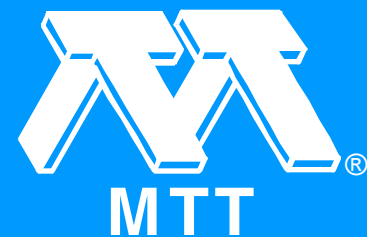
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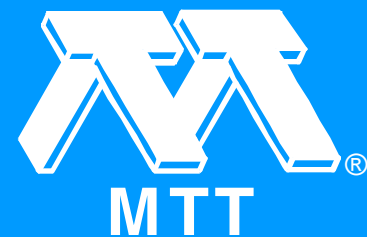
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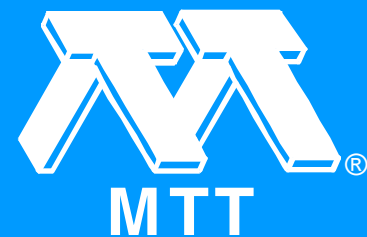
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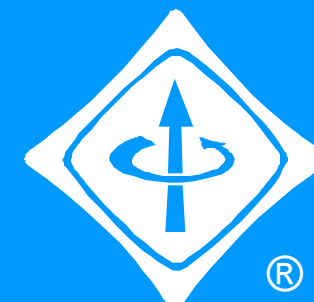
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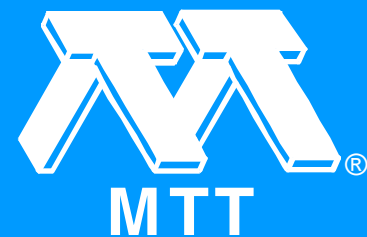
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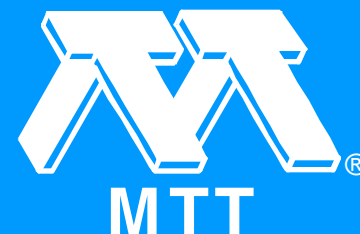


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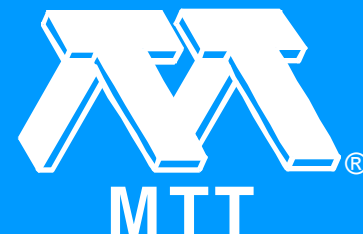
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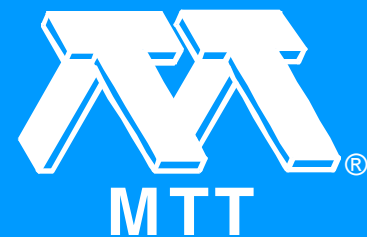
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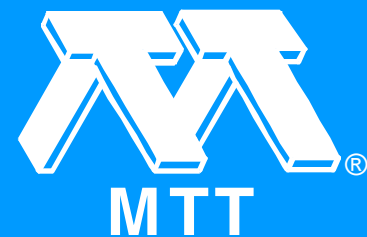
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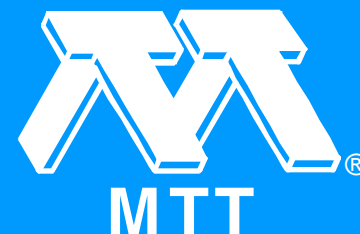
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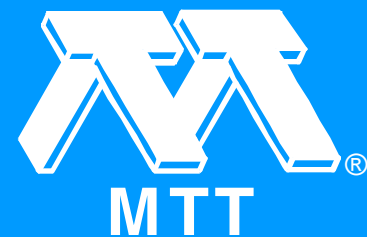
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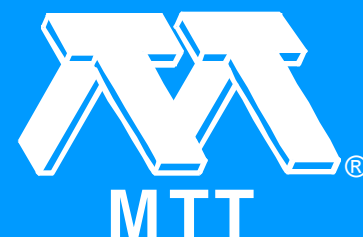
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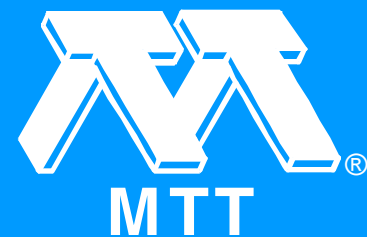
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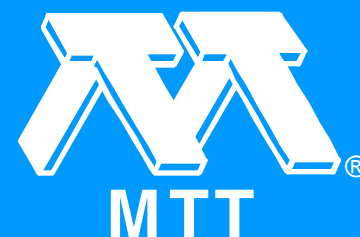
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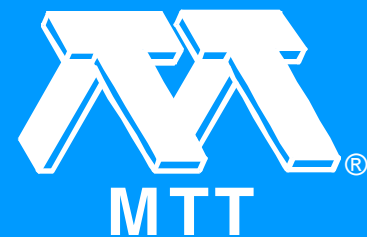
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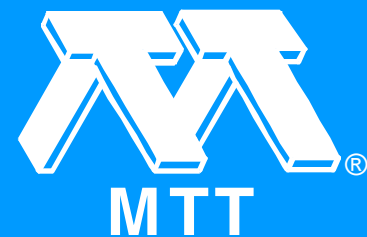
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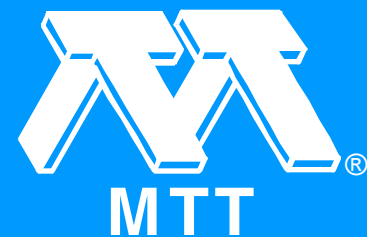
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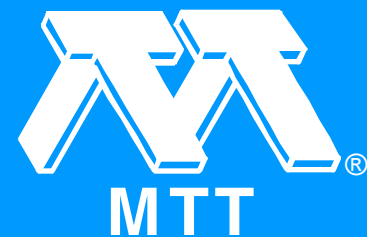
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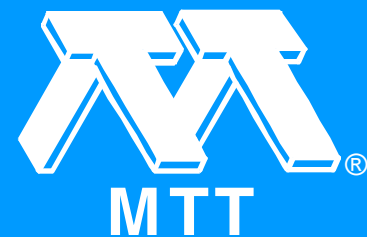
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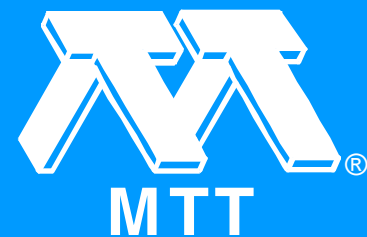
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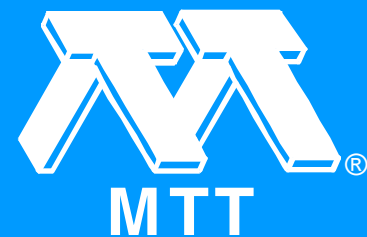
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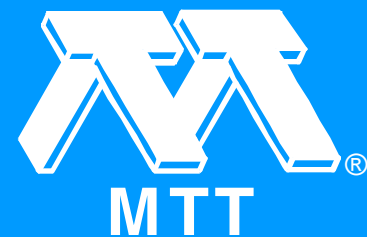
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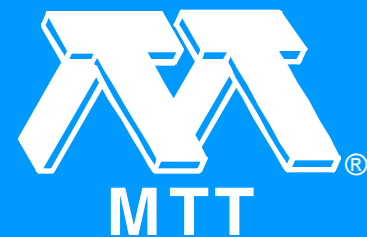
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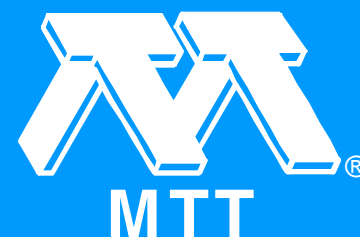
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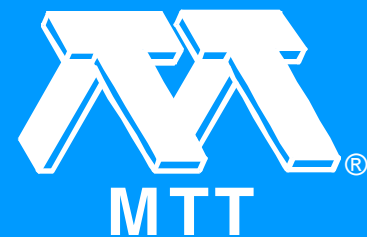
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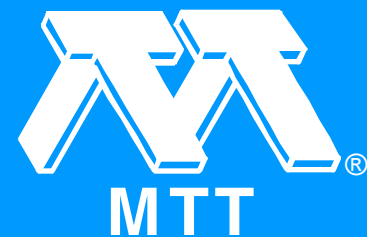
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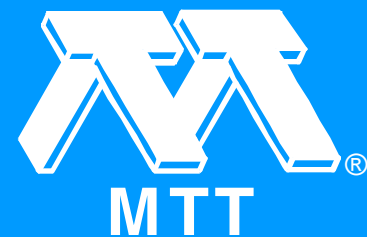
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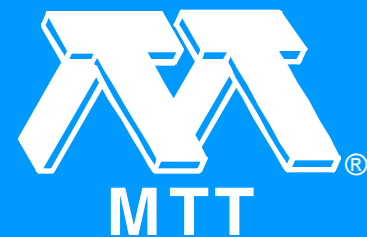
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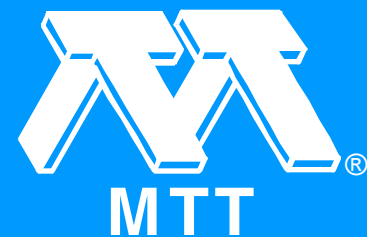
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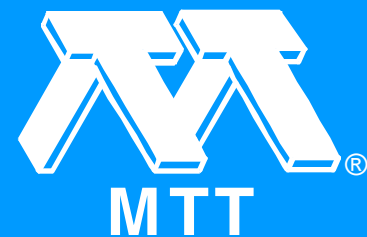
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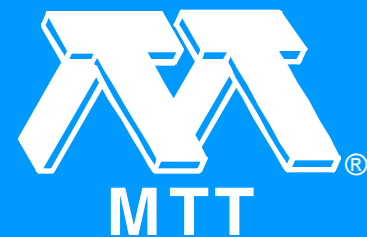
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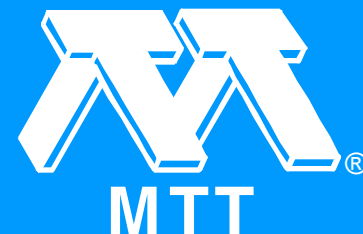
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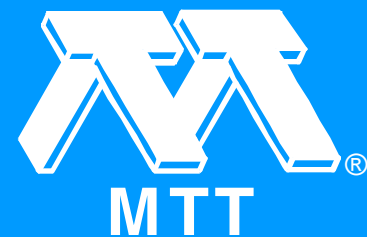
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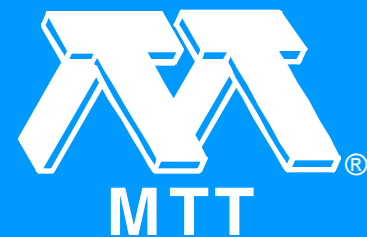
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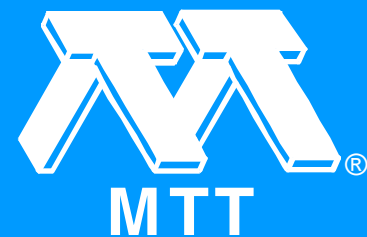
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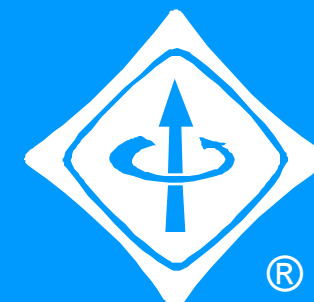
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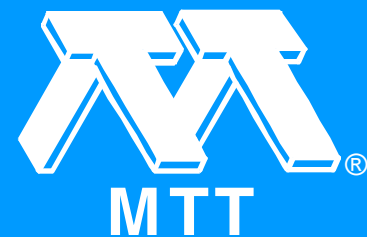
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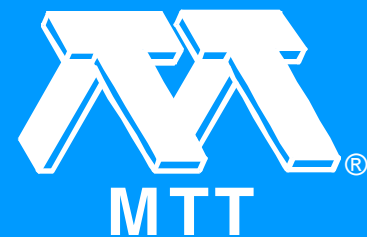
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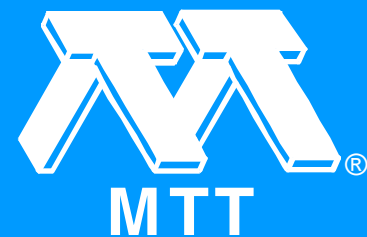
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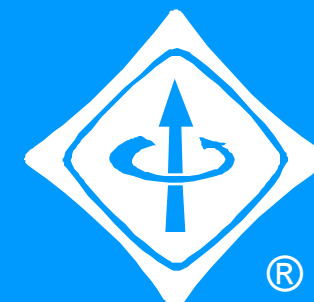
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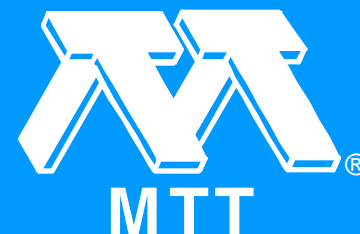
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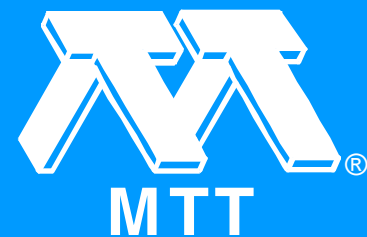
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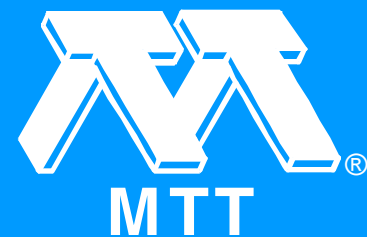
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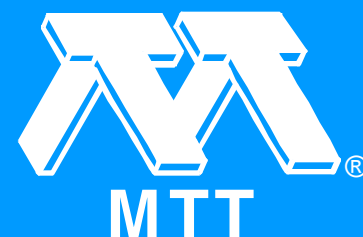
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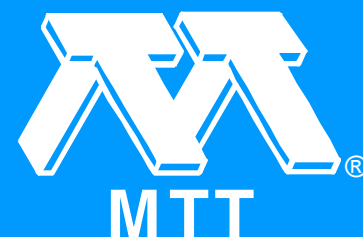
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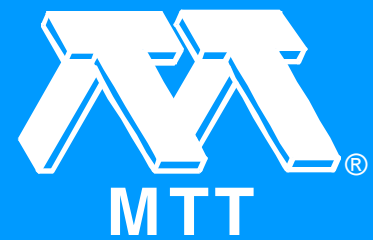
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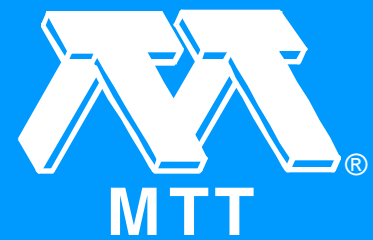
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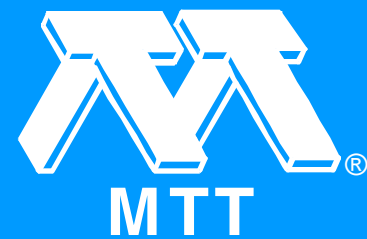
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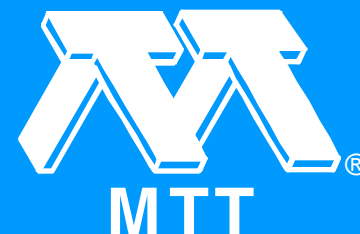
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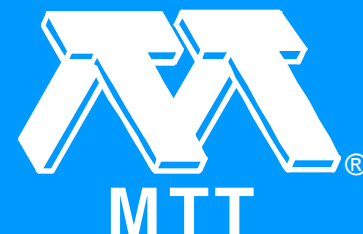
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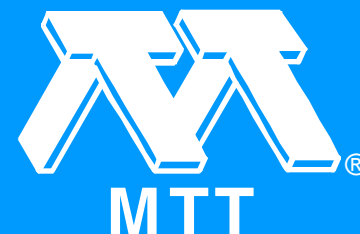
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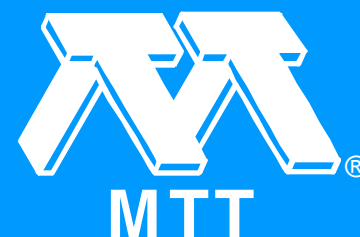
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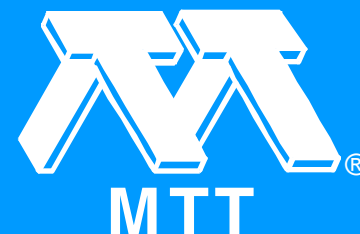
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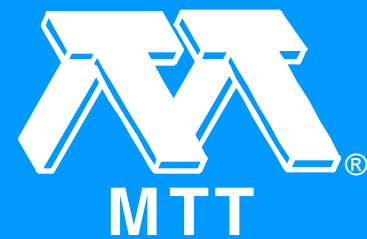
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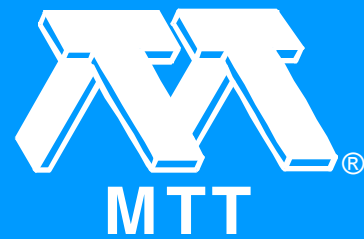
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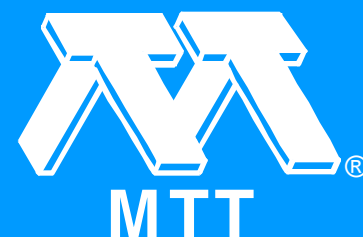
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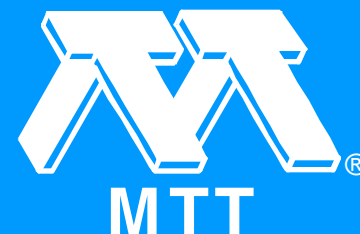


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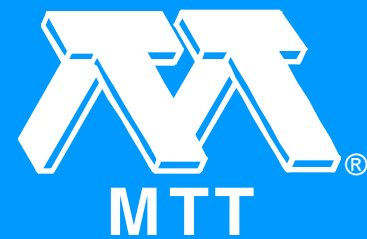
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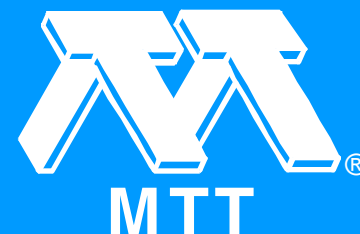
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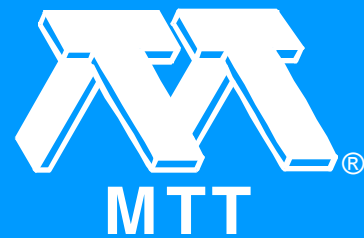
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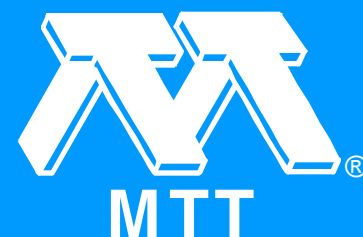
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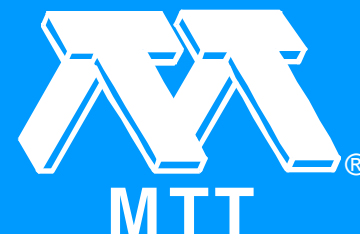
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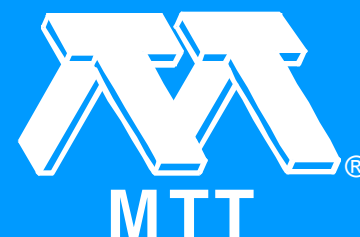


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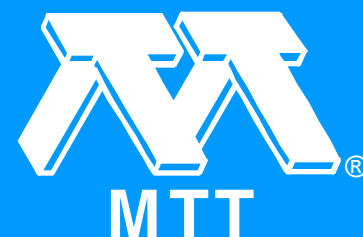
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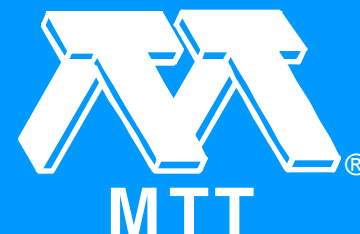
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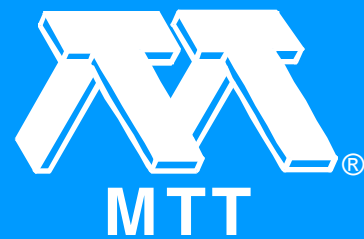


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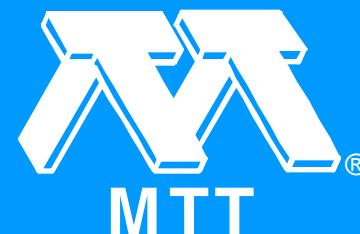


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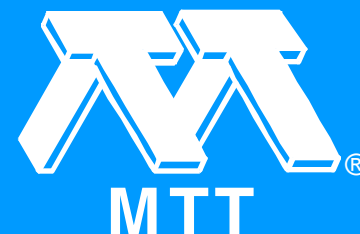
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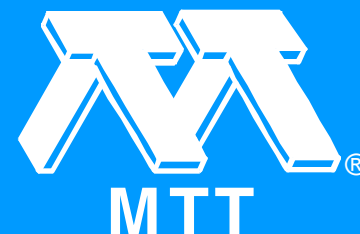
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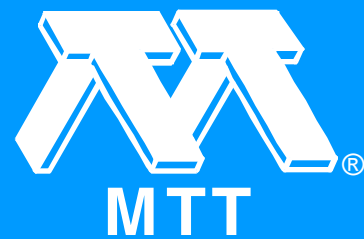
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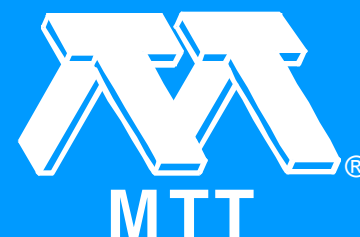
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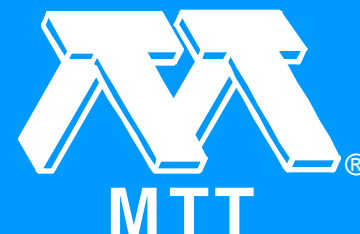
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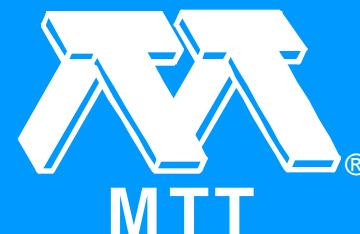
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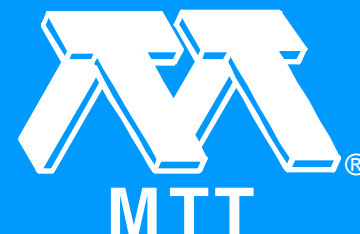


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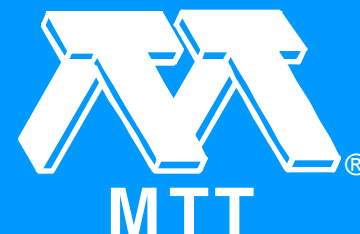
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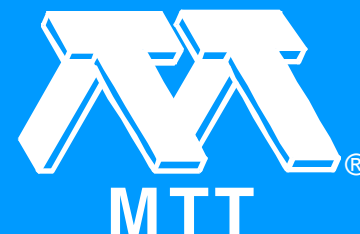


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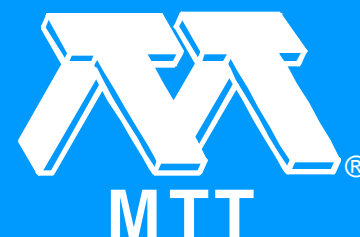
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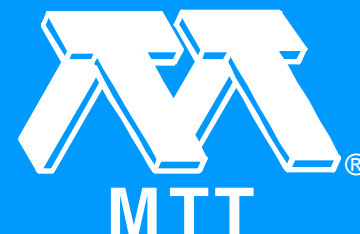


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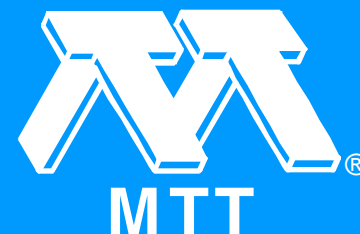
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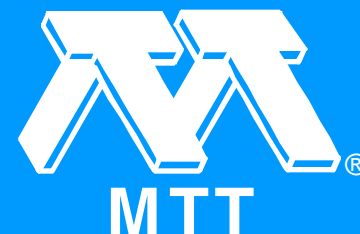
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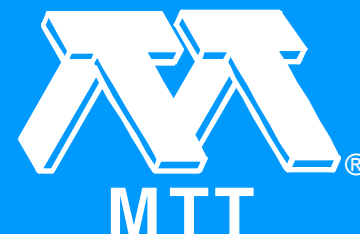
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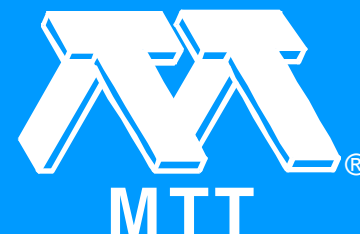
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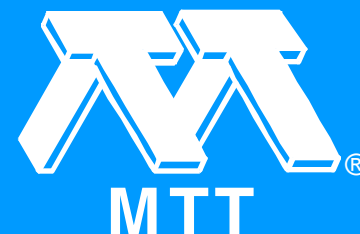
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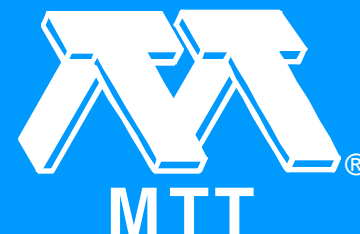
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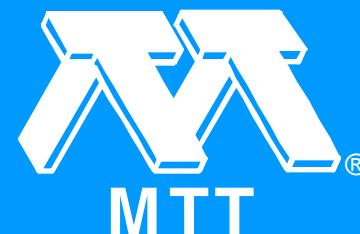


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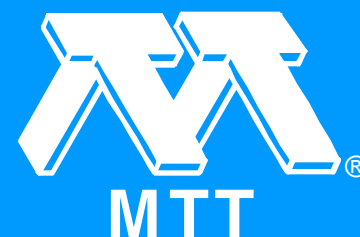
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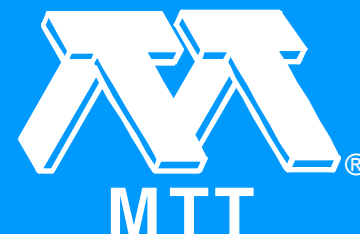
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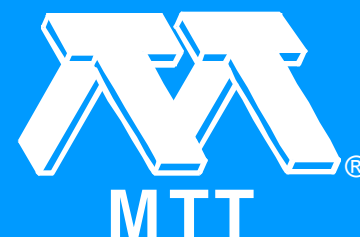


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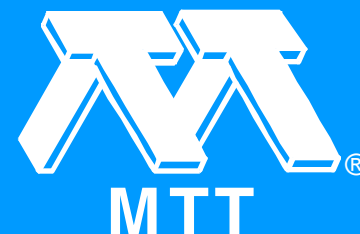
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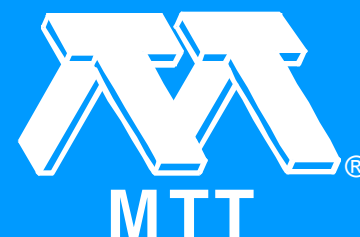
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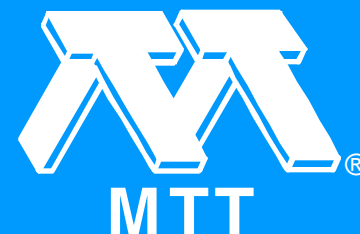


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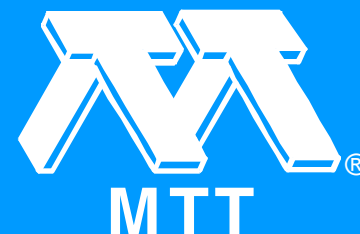
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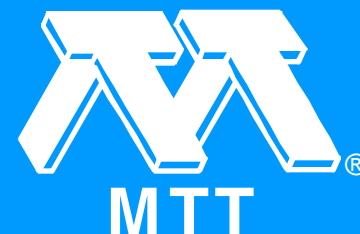


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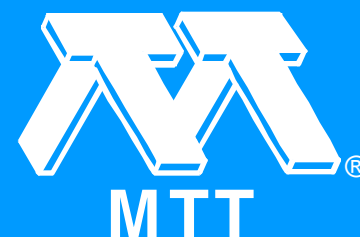
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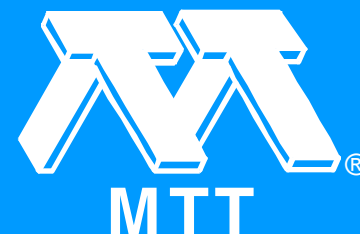
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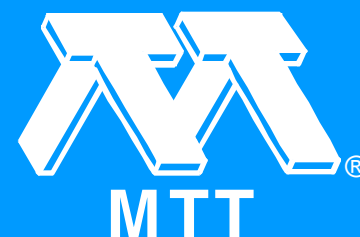
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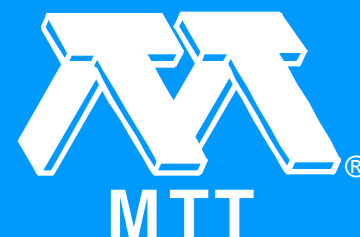


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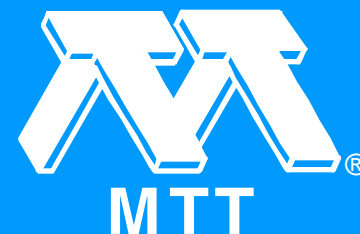
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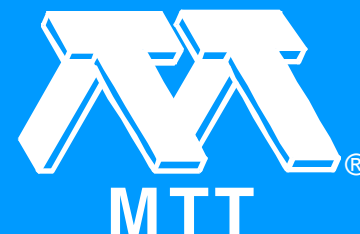


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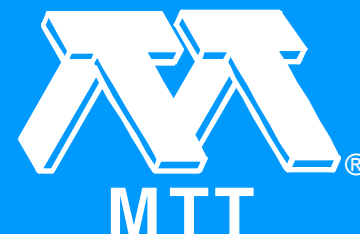
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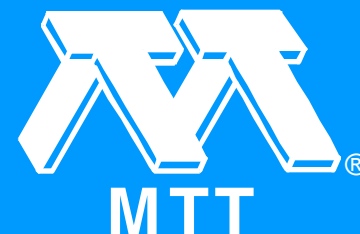
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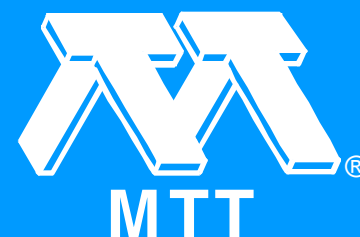
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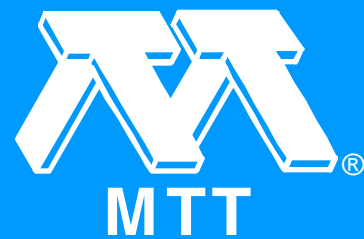


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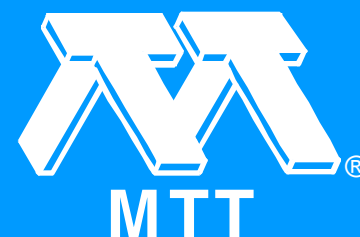


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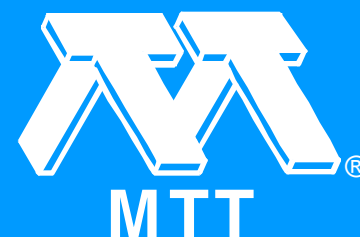
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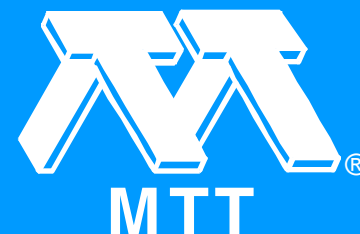
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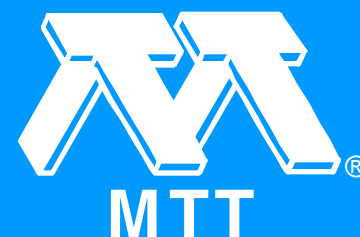
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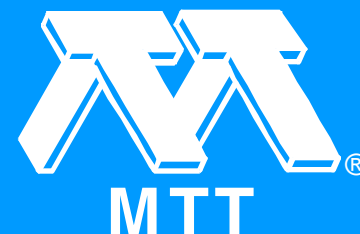
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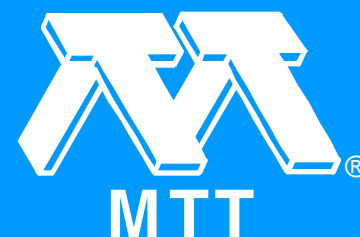
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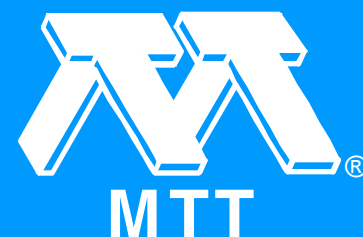
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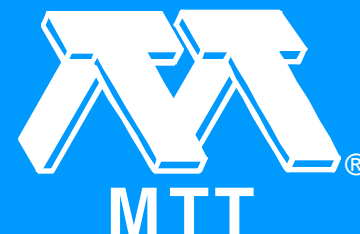
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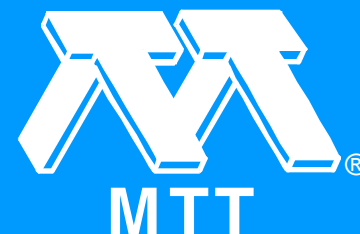
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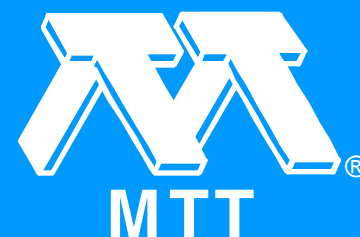
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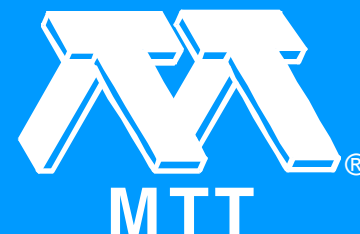


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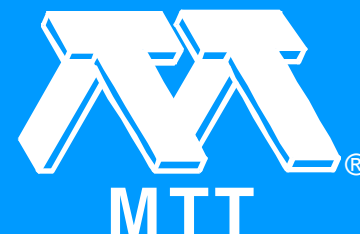
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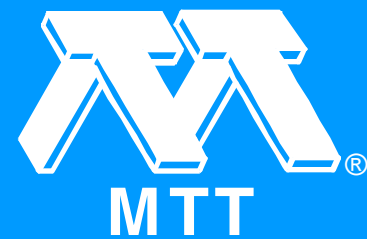


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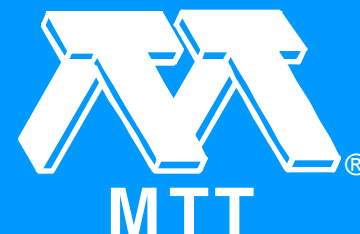
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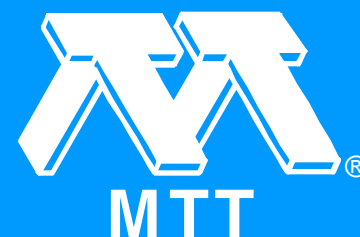
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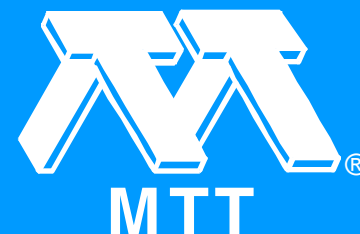
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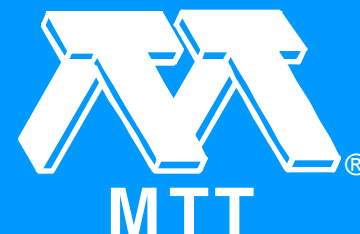
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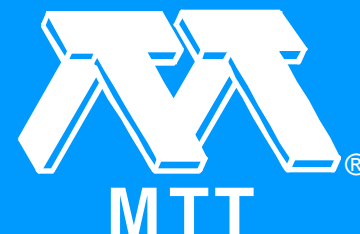
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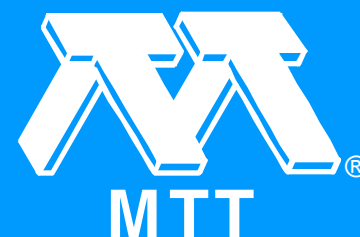
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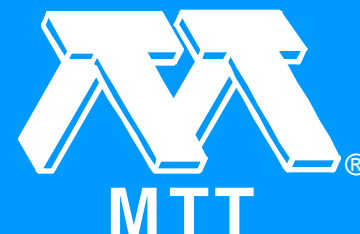
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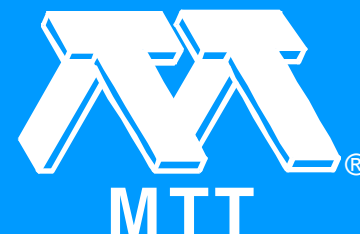
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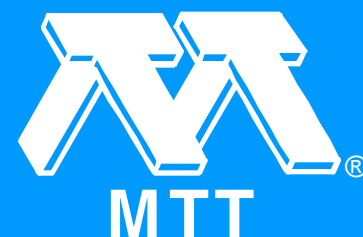
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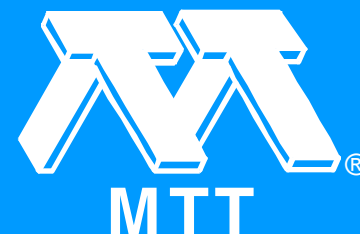
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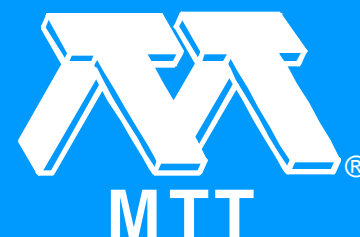
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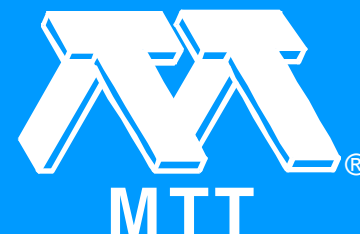
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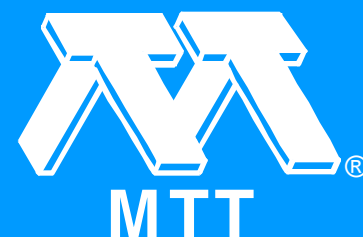
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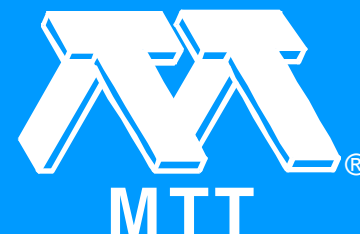
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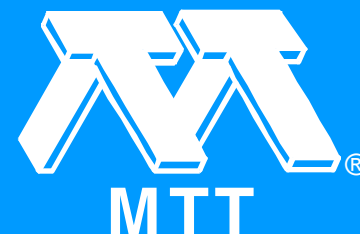
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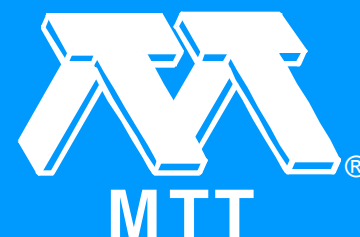
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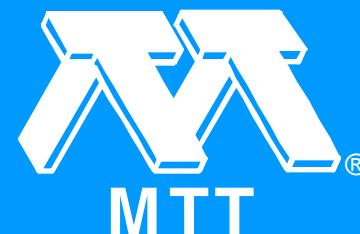


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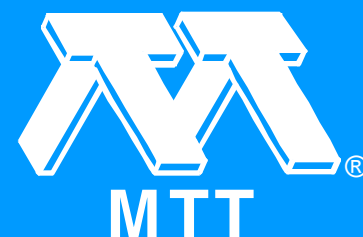
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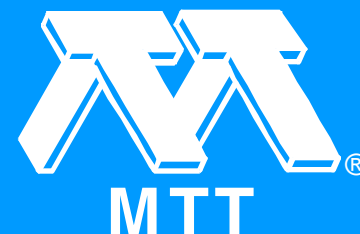
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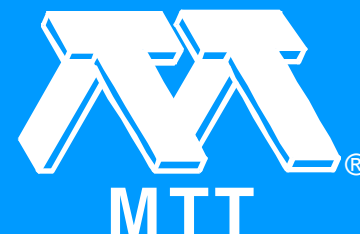
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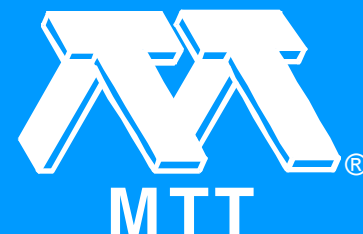
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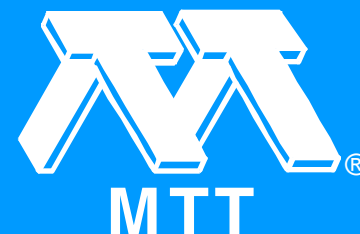
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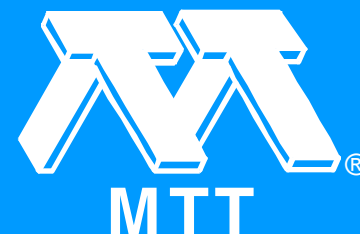
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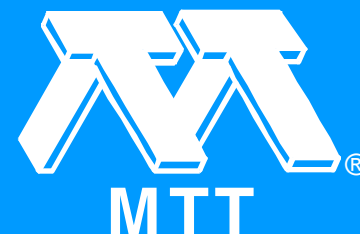
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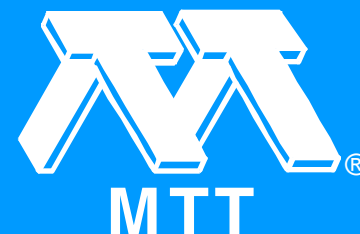
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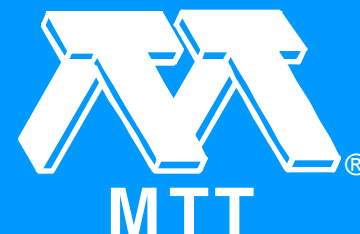
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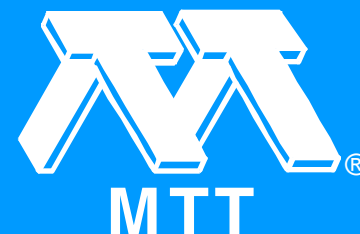
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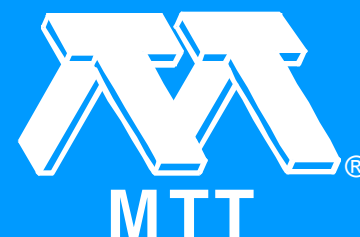


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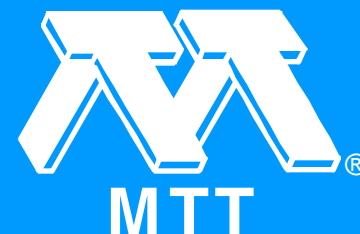


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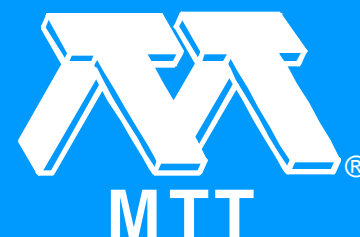
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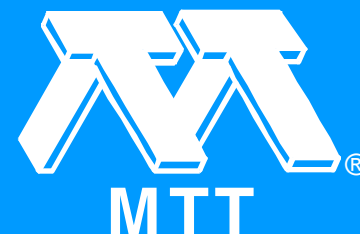
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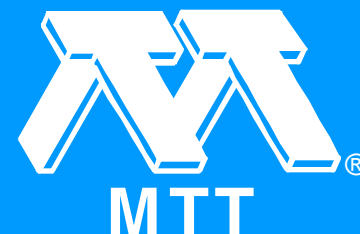
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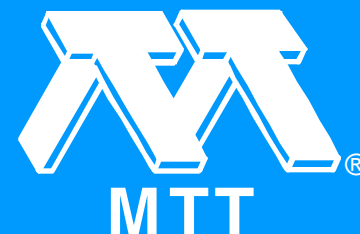


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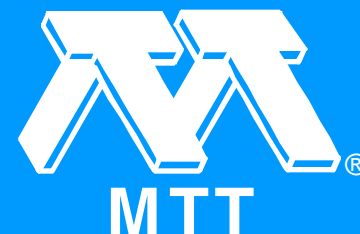
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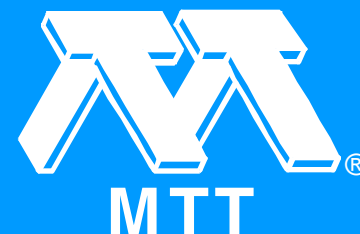
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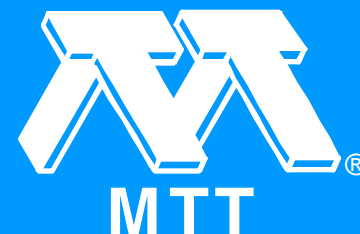
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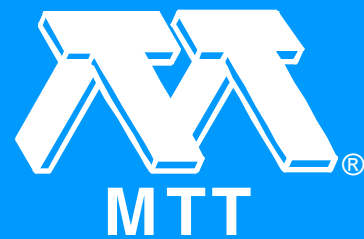


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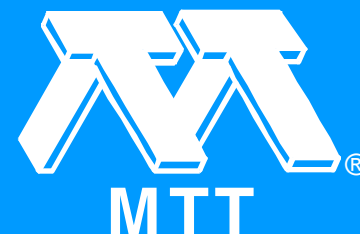
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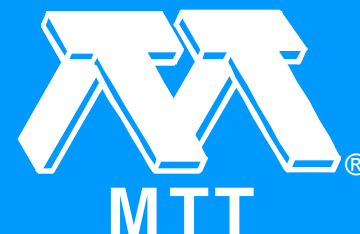
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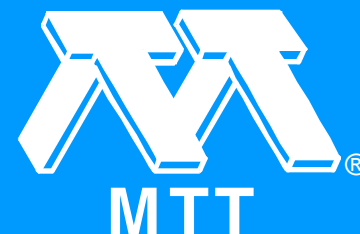
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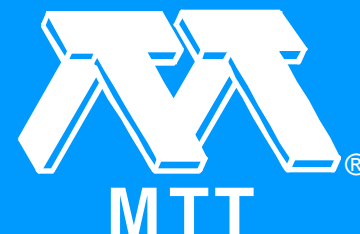
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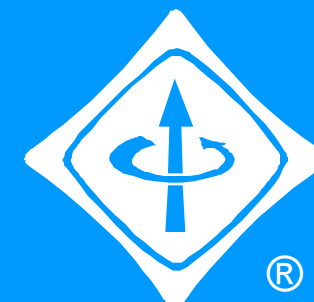
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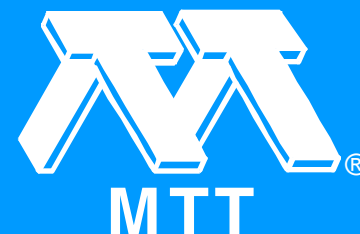
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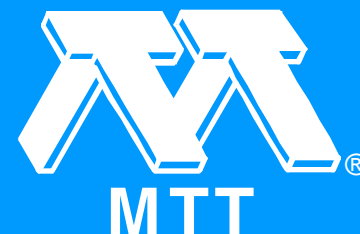
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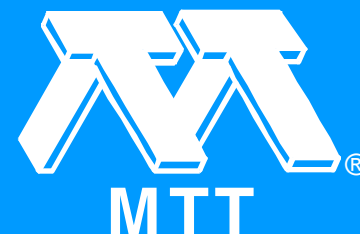
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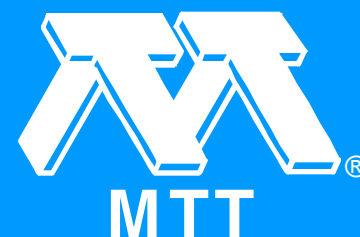
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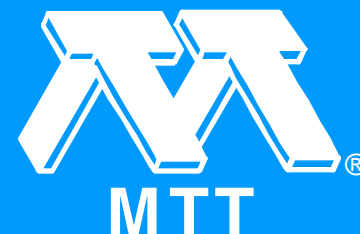
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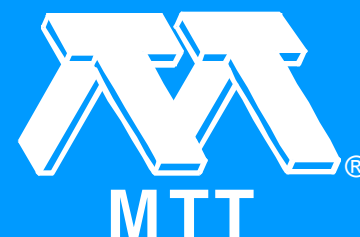
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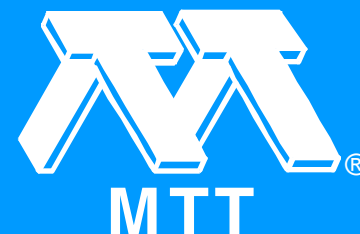


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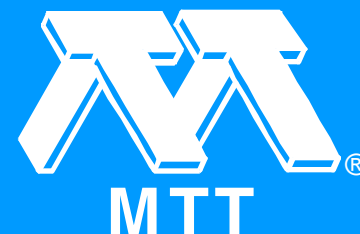


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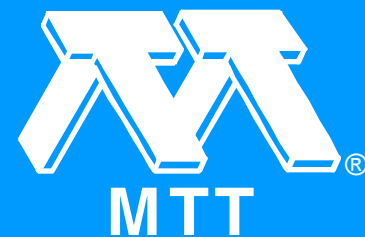
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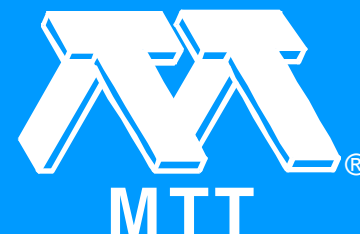
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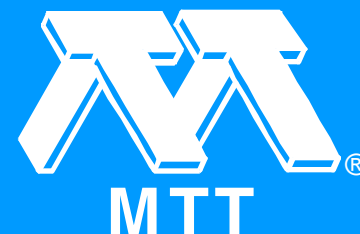


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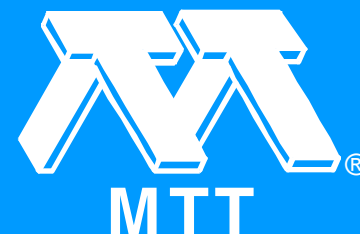
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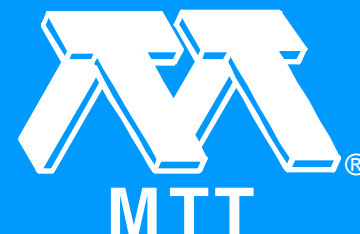


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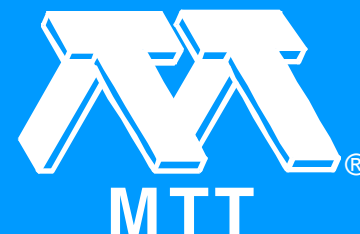


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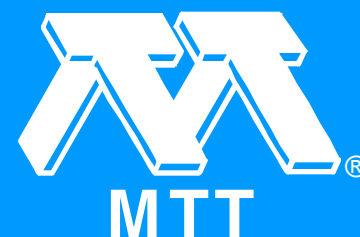
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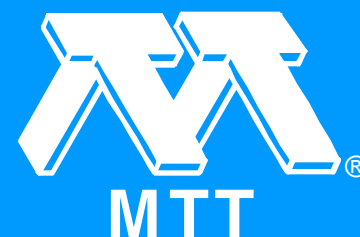
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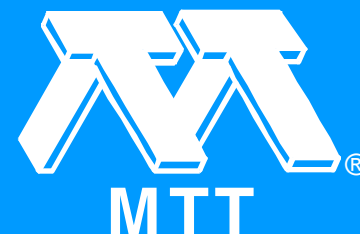
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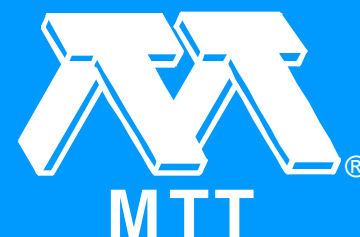


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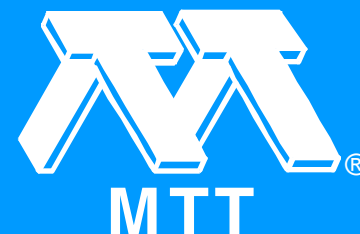


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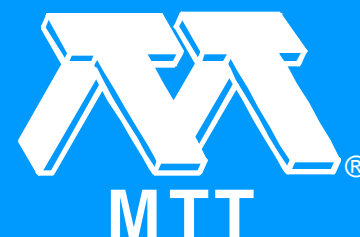
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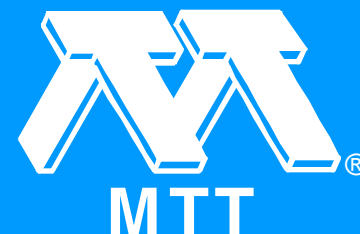
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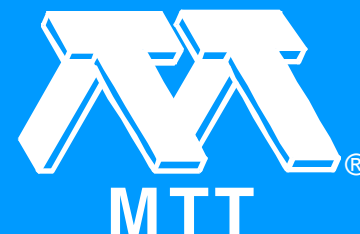


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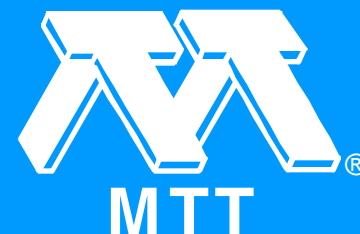


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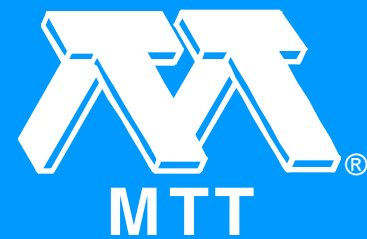
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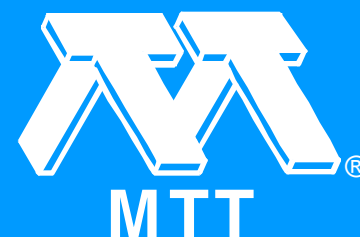
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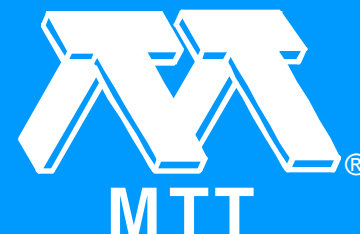
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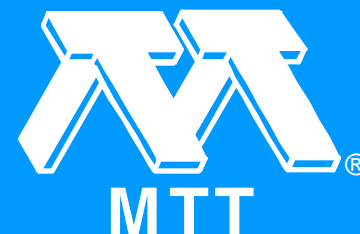
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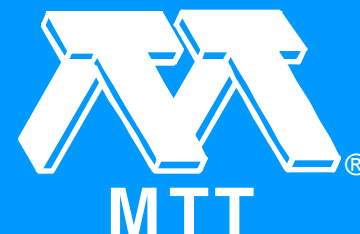
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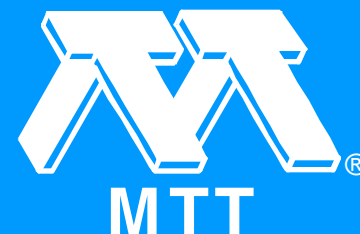


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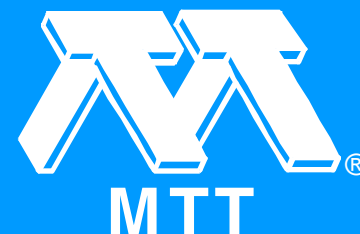


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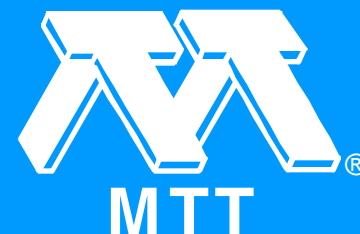


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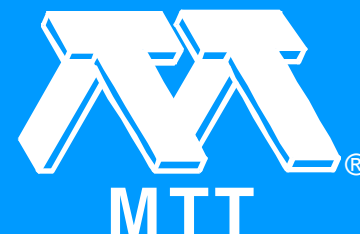
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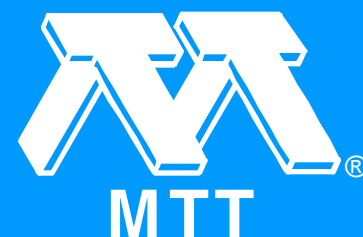
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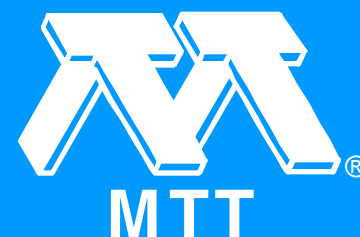
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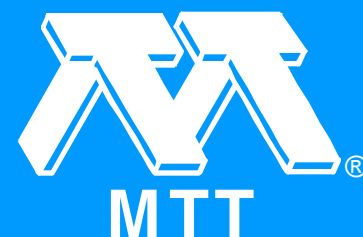
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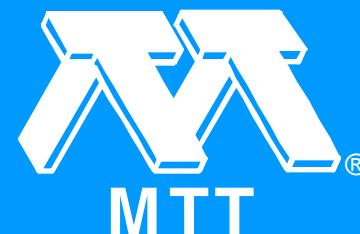


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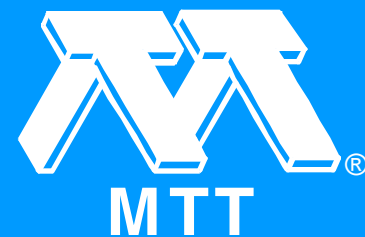
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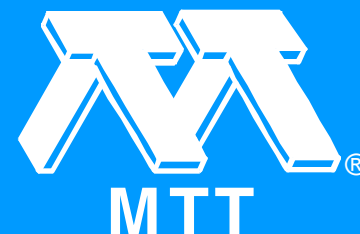
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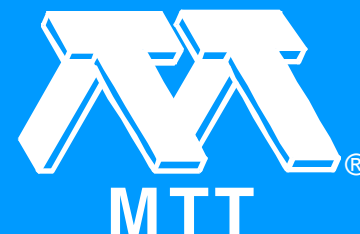


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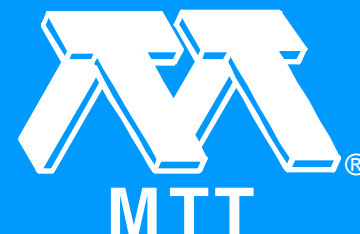


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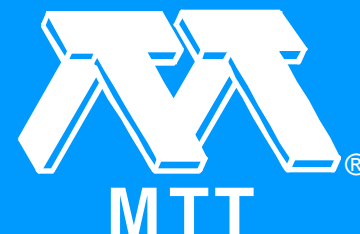
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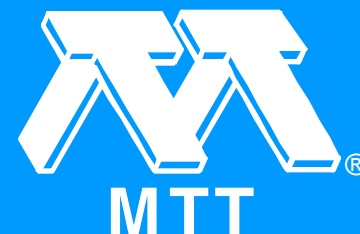
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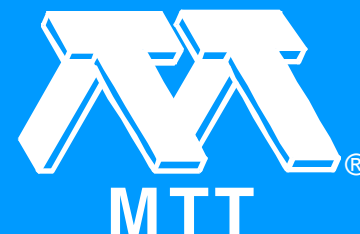


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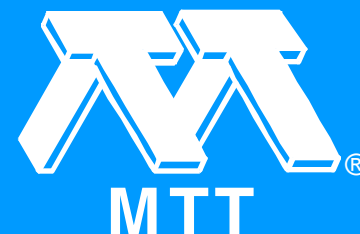
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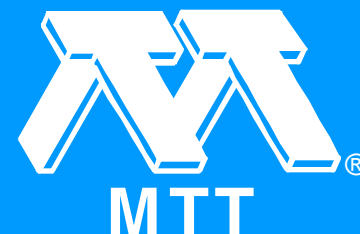
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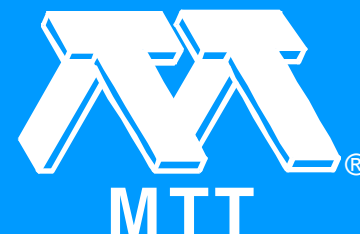
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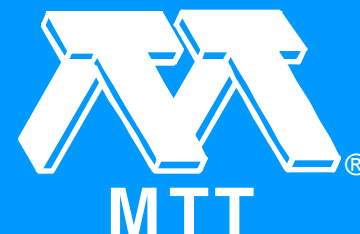
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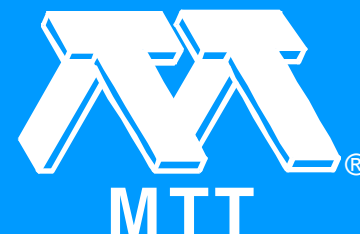
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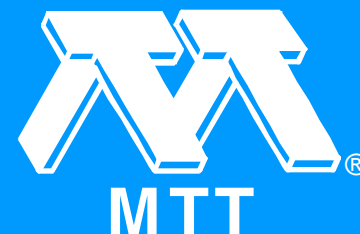
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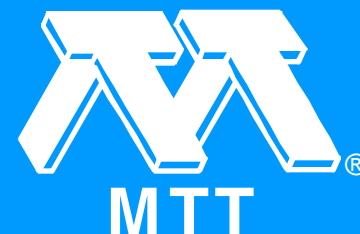


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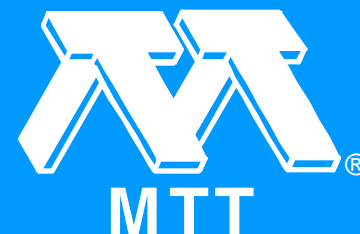
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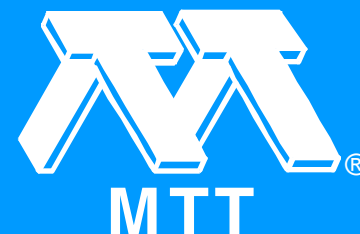


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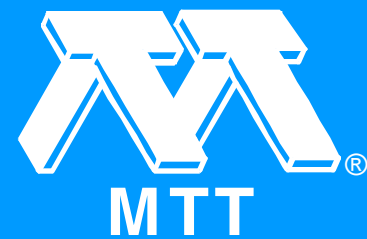
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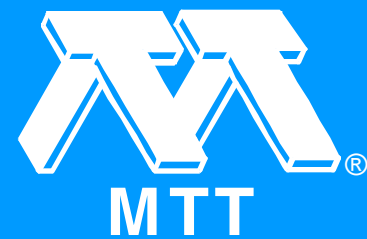
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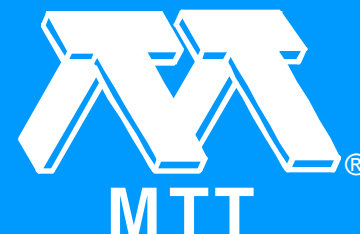
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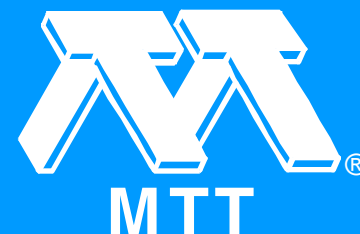


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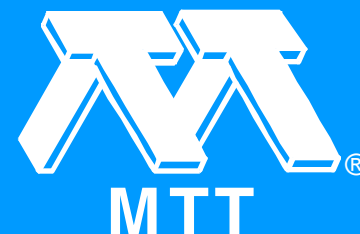
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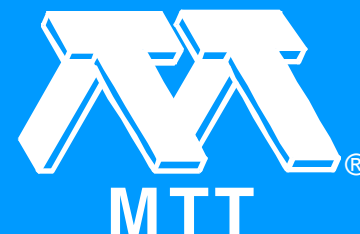
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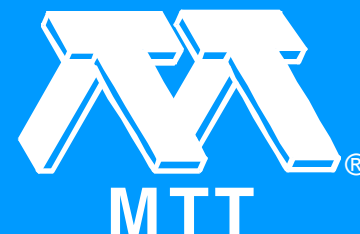
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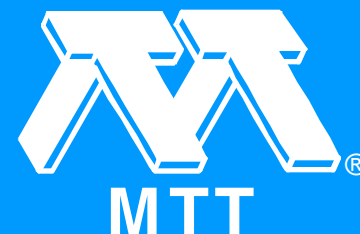


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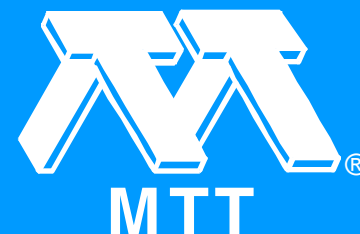
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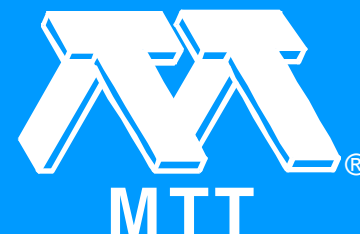
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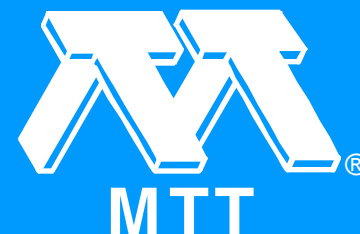
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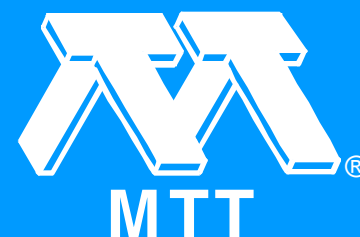
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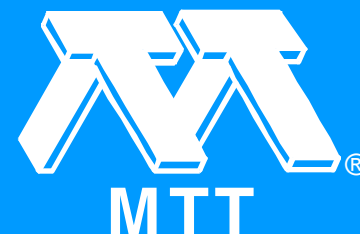
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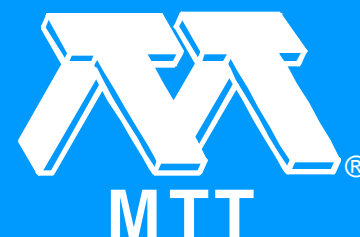
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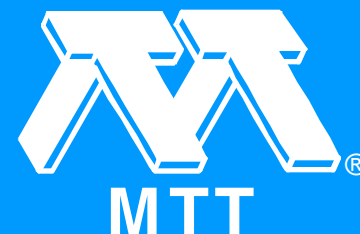


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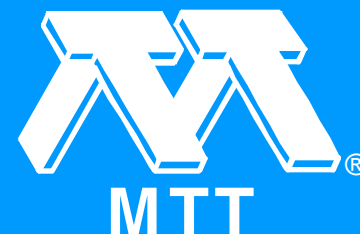
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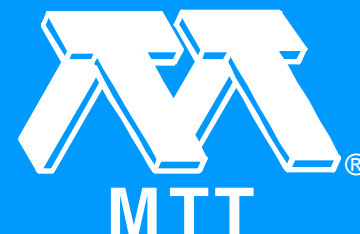


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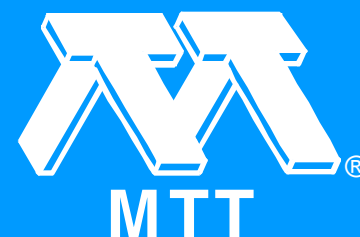
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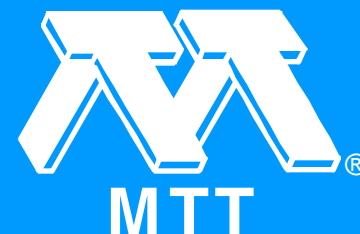


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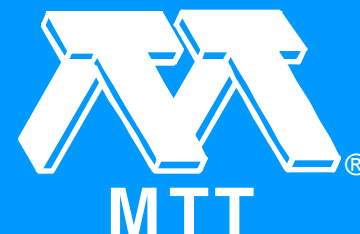
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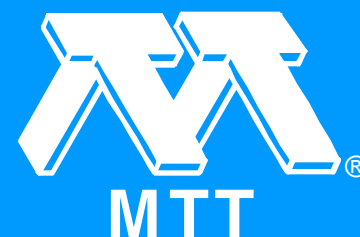
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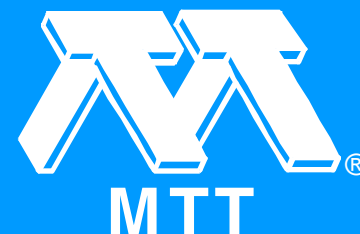


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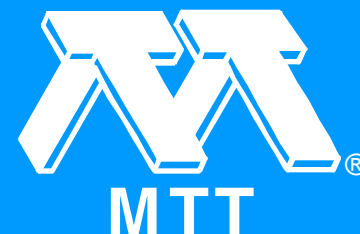
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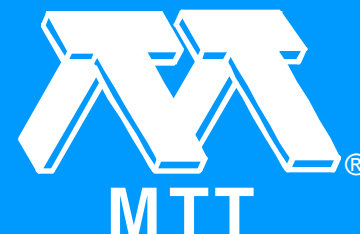
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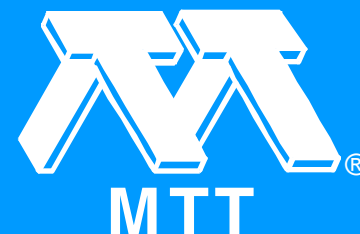
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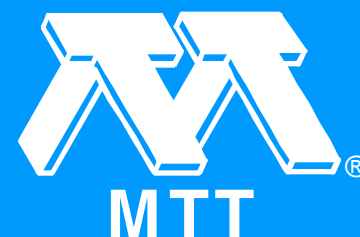
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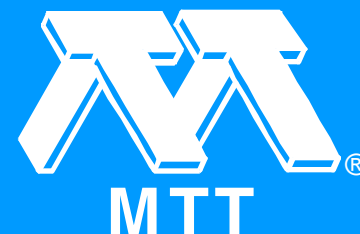


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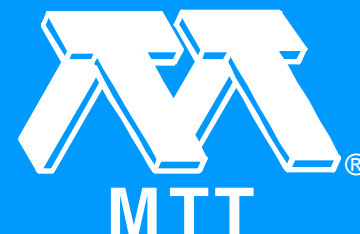


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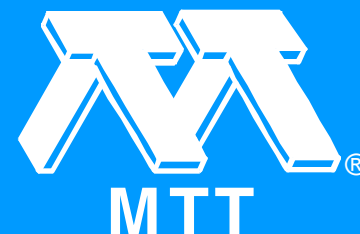
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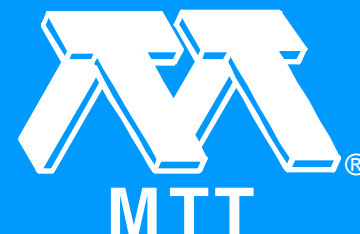


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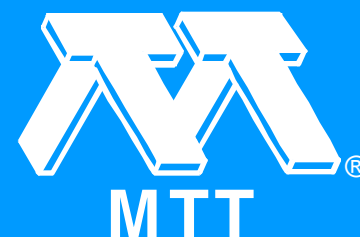
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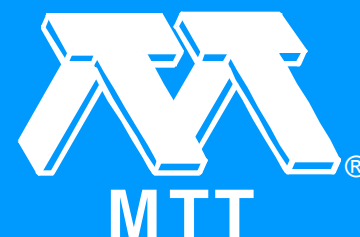
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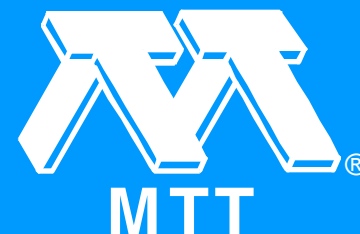
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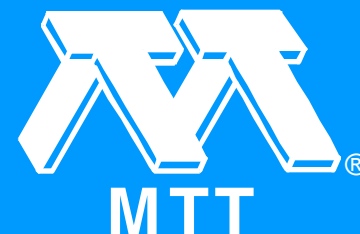
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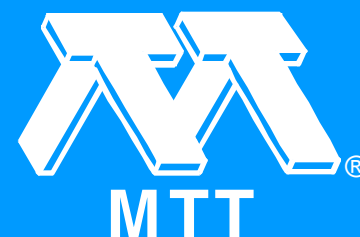
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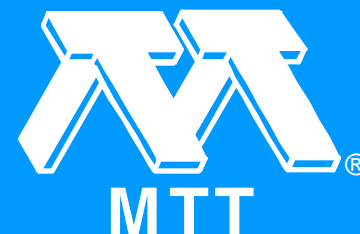
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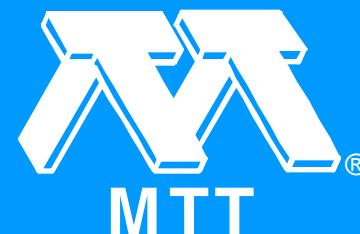


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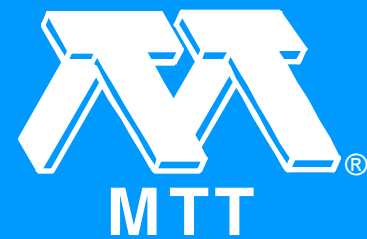
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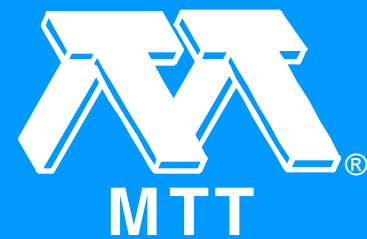
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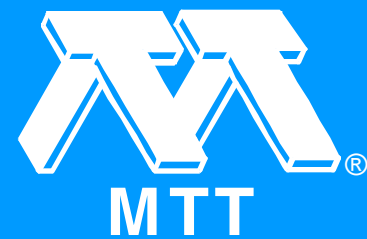
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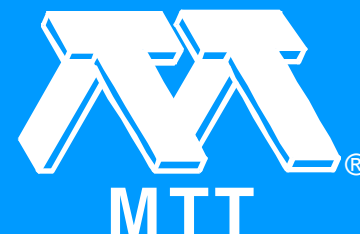
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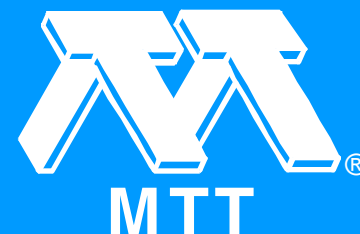
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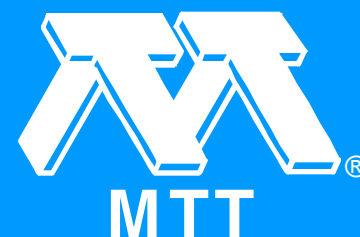
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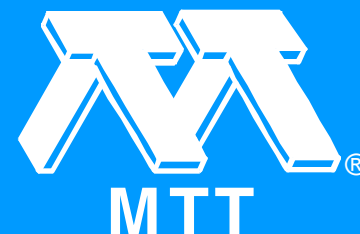
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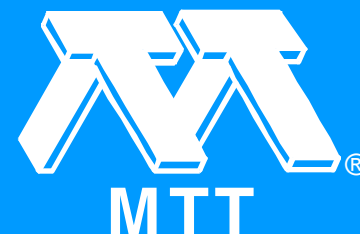
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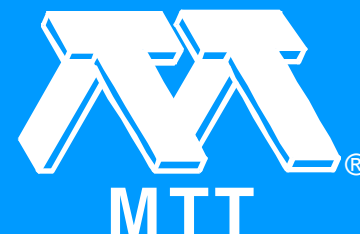
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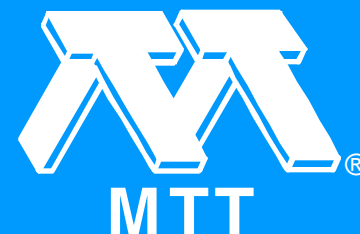


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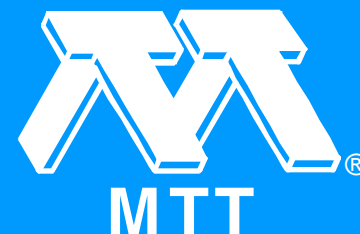
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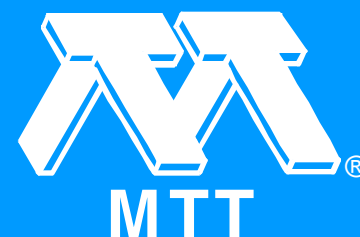
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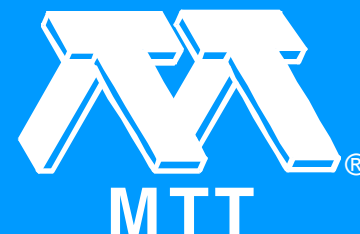
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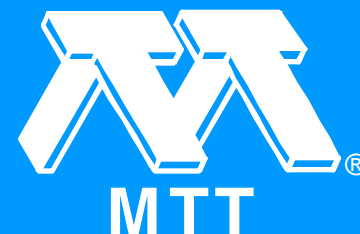
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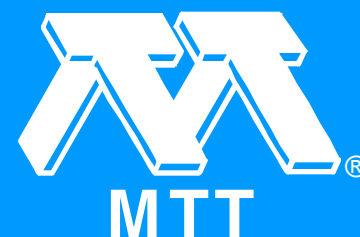
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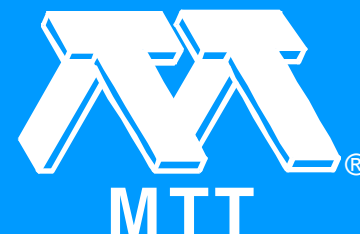
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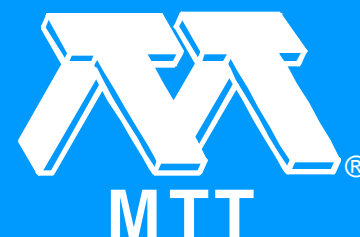
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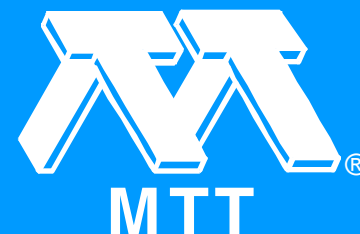
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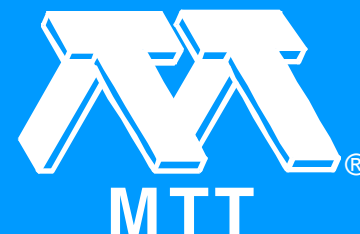


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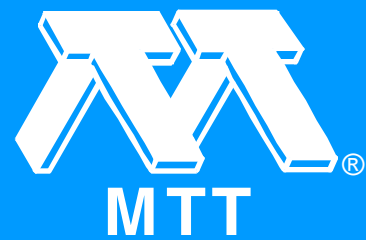
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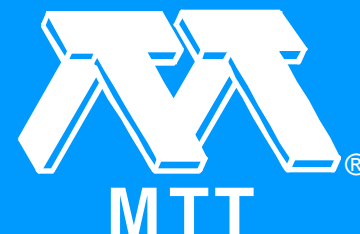
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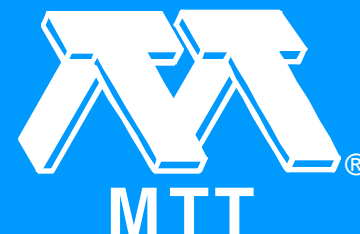
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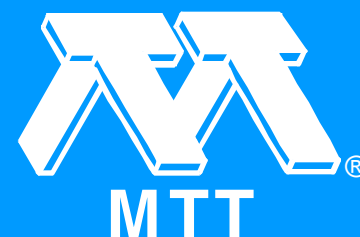
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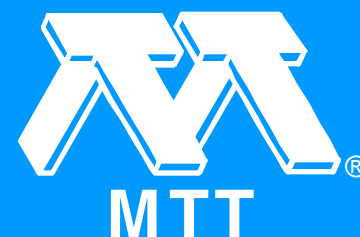
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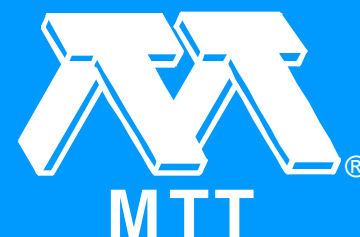


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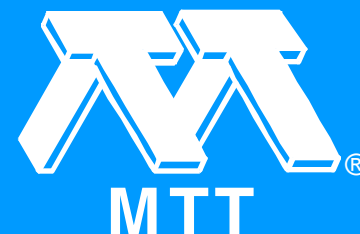
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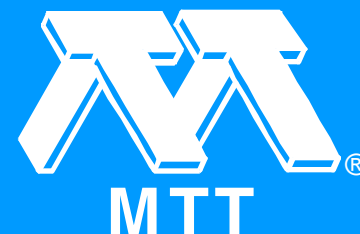


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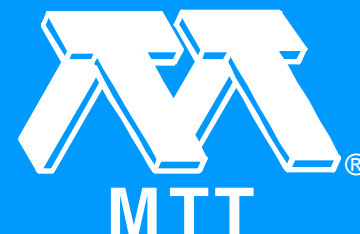


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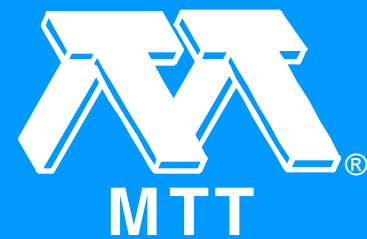
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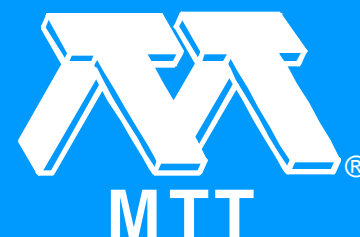
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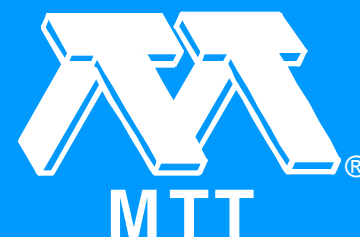
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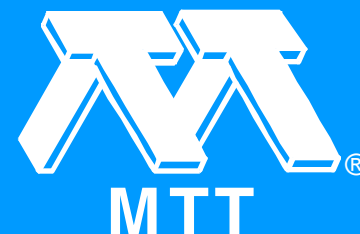
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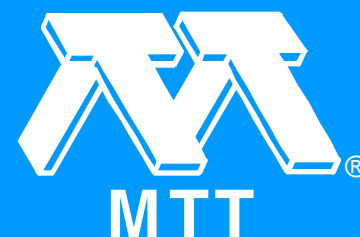
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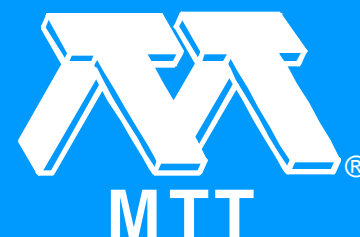
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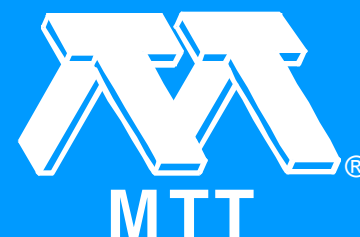


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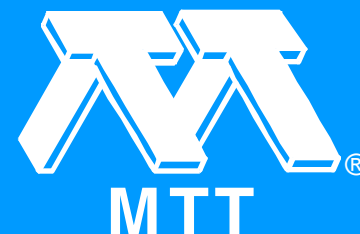


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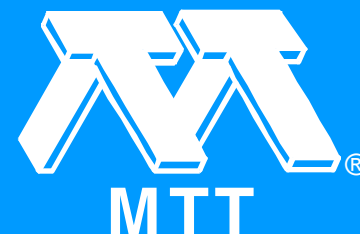
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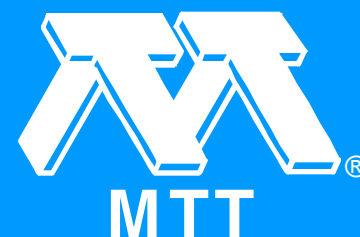
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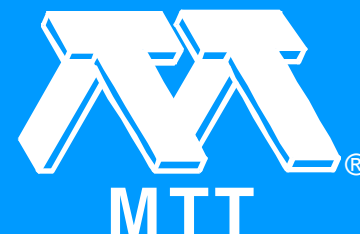
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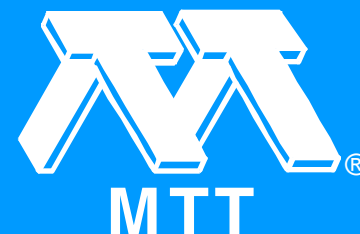
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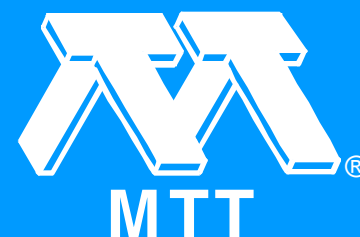
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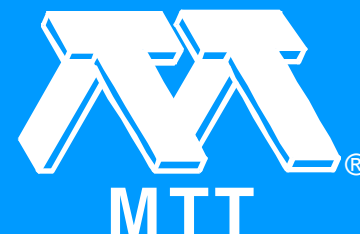
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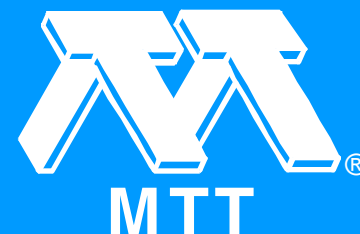
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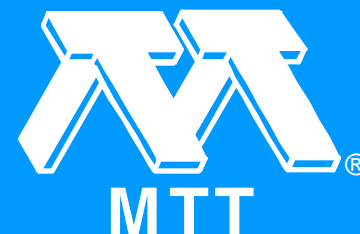
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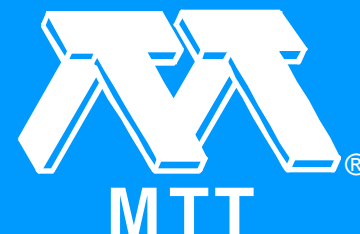
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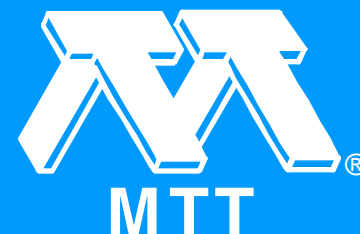
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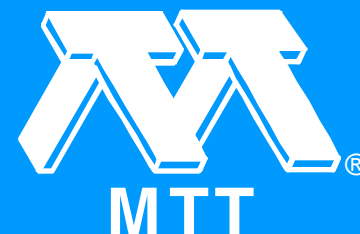
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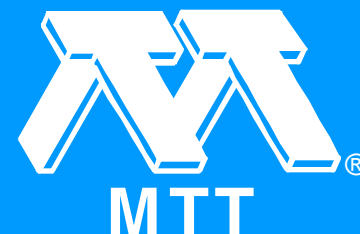
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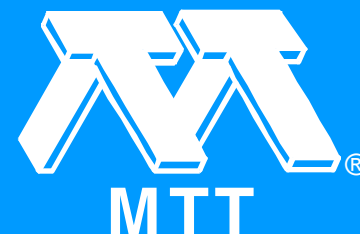
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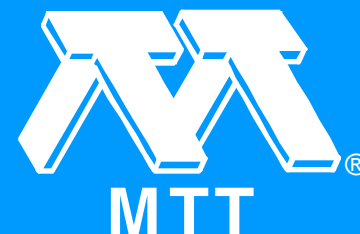
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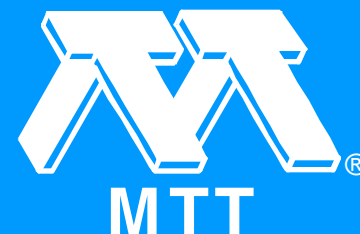


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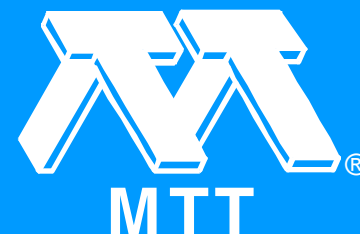
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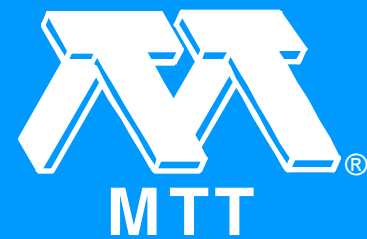
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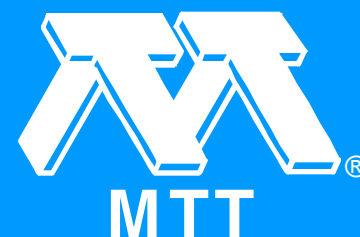
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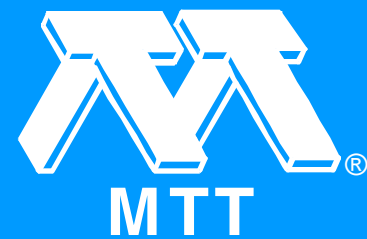
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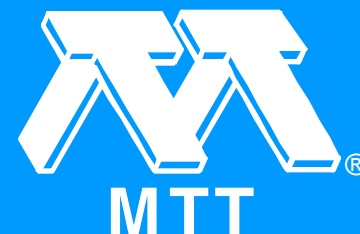
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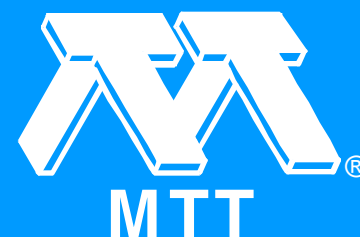


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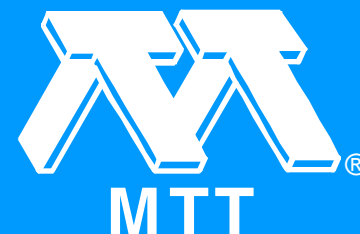
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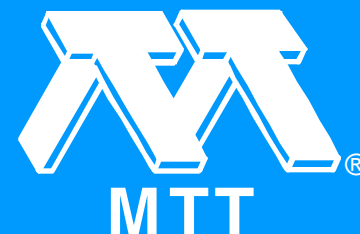


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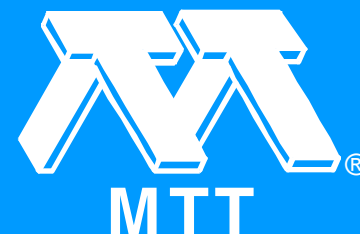
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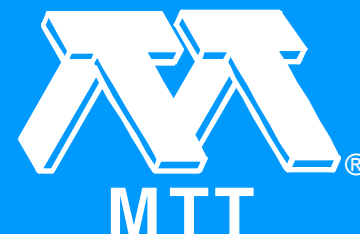
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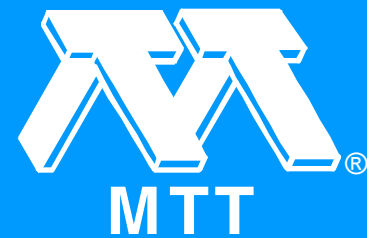


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