

Microwave Digital Archive

IEEE Microwave Theory and Techniques Society

1997

Welcome

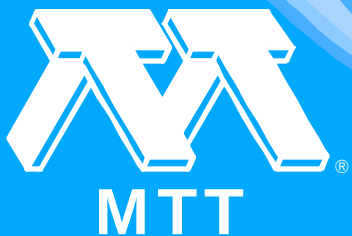
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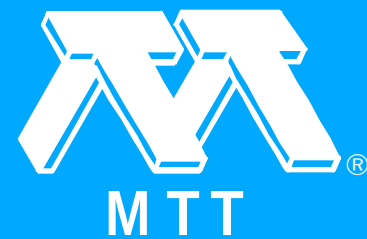
The Microwave Theory and Techniques Society of the IEEE has finished a complete archive of all reviewed and published material since 1953. Yearly updates of the published material will be compiled in the future. As digital media changes over the years, it will be necessary to update the format of the material, so this initial electronic release blazes a trail into the future.

The section "Getting Started" tells you how to optimize the Acrobat Reader Preferences to improve the readability of the document. If you need customer support before January 2001, call 831.657.2420 or 800.447.9100. If you find errors in the CD-ROM, e-mail a note to c.jackson@ieee.org, or mail a comment to the current President of the MTT Society.

Remember that the quality of the old journals 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 uses and personal study.

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Thank You and Enjoy!



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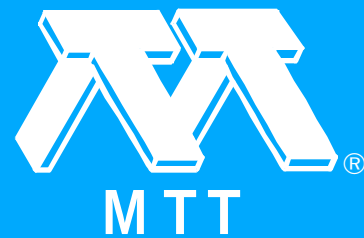
ACKNOWLEDGMENTS

This CD- ROM was assembled from the electronic files provided to us by Adam Philippidis at IEEE headquarters and from scanned originals provided by Ted Saad. Many people have contributed to the entire CD-ROM Archival effort. Most notably, Ted Saad provided nearly all the hard copy material, and sacrificed his entire collection of journals for the project. He also wrote a number of the original articles. Another notable contributor, Roger Pollard convinced the Society that this was a worthwhile project. The team at Sony Electronic Publishing Services, and Adam Philippidis, at the IEEE Headquarters, have also provided substantial amounts of help in completing this archival project.

REFERENCES

IEEE Catalog Number: JP-17-0-0-C-0

ISBN: 0-7803-9906-4



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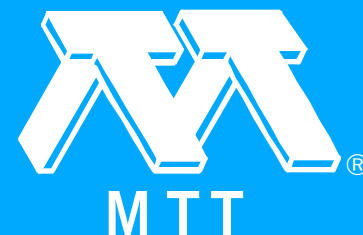
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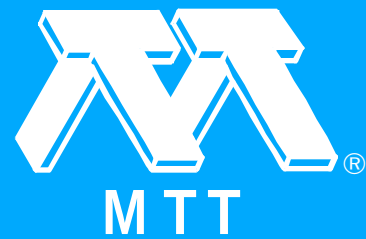
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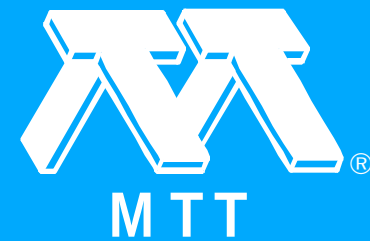
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INTRODUCTION

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

Before you start browsing and using the information on this CD-ROM, you will need to install Adobe Acrobat Reader + Search 3.0. If you already have Acrobat Reader installed on your system, make sure it is version 3.0 or higher and includes the Search plug-in.

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

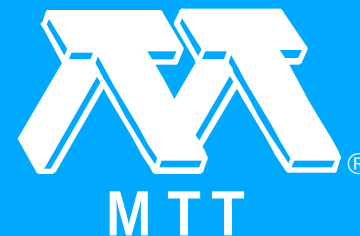


ACROBAT PREFERENCES

To make viewing and searching easier, we recommend changing two default Acrobat Preferences (found under File > Preferences on the menu bar.)



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In the dialog box shown for **General** Preferences, turn OFF the “Open Cross-Document Links in Same Window” option; this will keep the Guide file open when you view article files and allows you to return to the same page in the Guide when you close an article.

In the dialog box shown for **Search** Preferences, turn ON the “Show Fields” 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 Toolbar if the function is properly installed. Specifics of the Search function are described later in this section.

EXITING AN ARTICLE

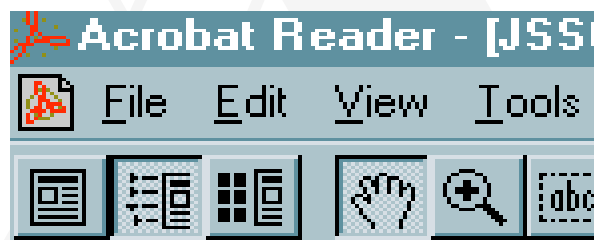
To exit an article after viewing, and return to the electronic guide, select File > Close from the menu bar. To switch between the article and the electronic guide or any other PDF file that is open, select “Window” and pick the open file you wish to return to.



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USING BOOKMARKS

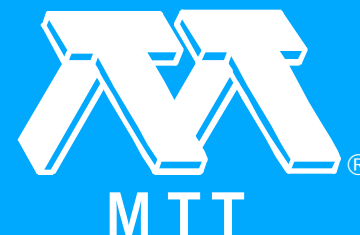
In addition to links, you can navigate through the Electronic Guide using Bookmarks. If they are not already visible, choose View > Bookmarks and Page from the menu bar or press the “Display Page and Bookmarks” button on the tool bar. A panel opens on the left side of the screen displaying Bookmarks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



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

Entries with lower level Bookmarks show an arrowhead, pointing down when subordinate Bookmarks are visible, pointing right when hidden. To view subordinate Bookmarks, click on the arrowhead. To hide them, click on the arrowhead again. Dragging the right margin of the bookmark panel resizes it.



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PRINTING ARTICLES

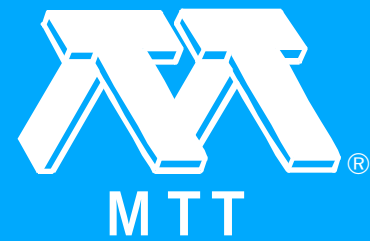
Articles may have text outside normal print-area defaults. We recommend selecting “Shrink to Fit” in the print menu (File > Print) to capture the complete image for your printout. This setting will become your new default.

SELECTING GRAPHICS

To copy graphics to the Clipboard, choose Tools > Select Graphics from the menu bar. The cursor changes to the cross-hair icon.

Drag a rectangle around the graphic to select it. When you release the mouse button, the selected graphic is highlighted.

Choose Edit > Copy from the menu bar to copy the selected graphic to the Clipboard. To view the graphic, choose Window > Show Clipboard. The graphic is copied in the WMF (Windows), PICT (Macintosh), or XPIXMAP (UNIX) format. With UNIX, the graphic is pasted in the primary selection.



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NAVIGATION BUTTONS

This Guide contains a variety of navigational aids to help you easily explore the contents.

Section Map

The Electronic Guide is constructed in sections: e.g. Sessions, Authors, Getting Started. 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.

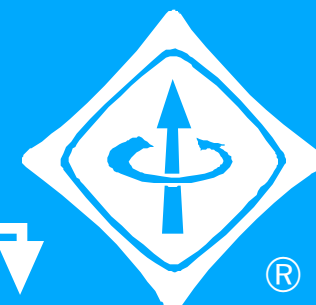
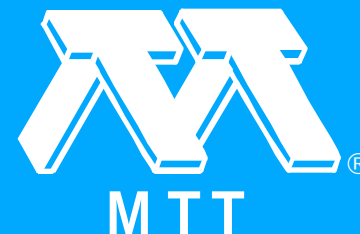
Next Page button

Click to advance to the next page in the section.

Previous Page button

Click to go back to the previous page in the section. The first and last pages of a section show only one button.

The Page Up and Page Down keys perform the same functions.

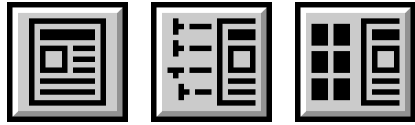


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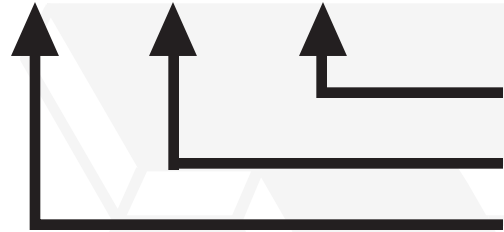


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ACROBAT TOOLBAR



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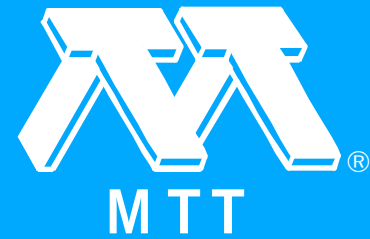
Display Thumbnails and Page
Display Bookmarks and Page
Display Page



Zoom/Selection



Select Text
Zoom In (Magnify)
Move Page Image



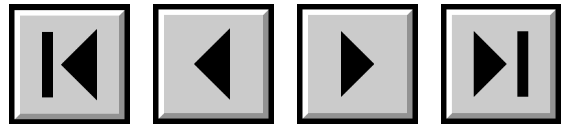
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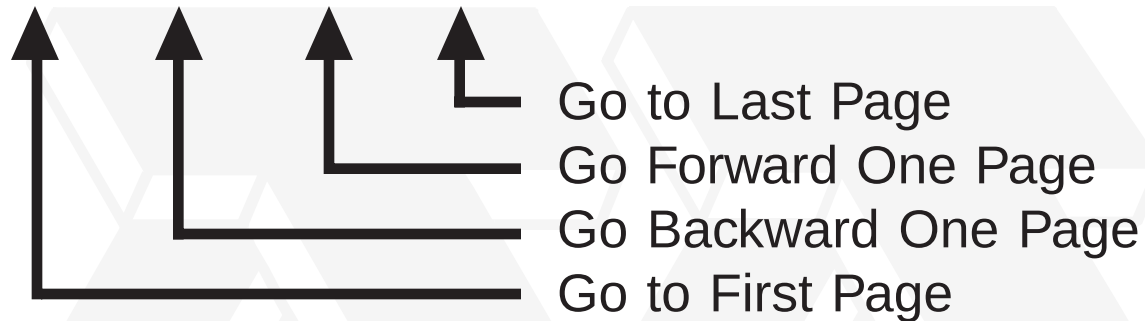


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ACROBAT TOOLBAR (continued)



Navigation

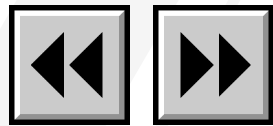


Go to Last Page

Go Forward One Page

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Go to First Page

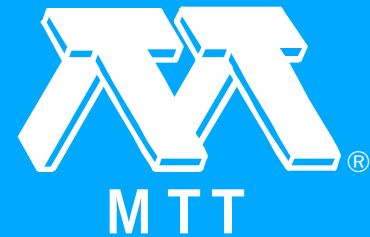


History



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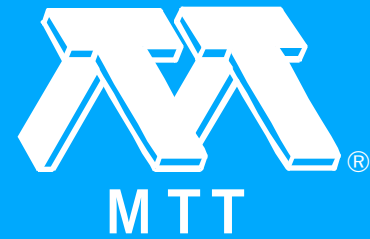


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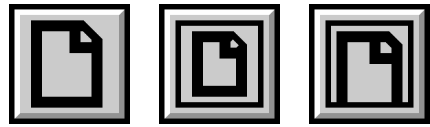
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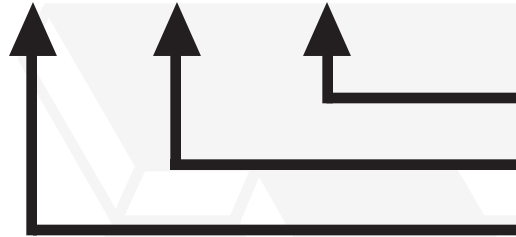
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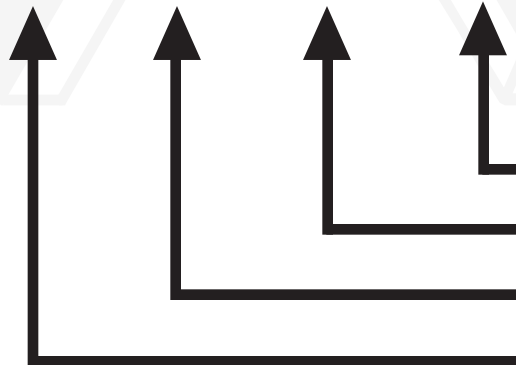
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Fit Page
Actual Size



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Previous Hit
View Search Results
Search
Find



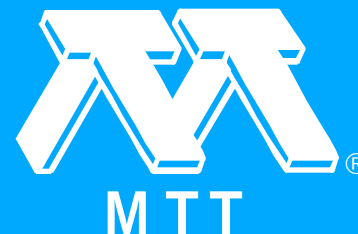
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SEARCHING

Two types of searching are possible with Acrobat: Find and full-text Search. Choosing Find (from the Toolbar or Tools > Find) opens a dialog box. Type a search string in the field provided, check the appropriate options and press the “Find” button. Find searches linearly through the currently open Acrobat file (not necessarily the entire Electronic Guide) from the cursor forward.

Choosing the Search button or Search menu item (Tools > Search), selecting the Query item, opens a dialog box from which you can access the more powerful full-text search engine (if you installed Acrobat with the Search plug-in 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. Entering a term in one or more of the fixed fields (Title, Author, Subject or Keywords) will cause a search for hits in only those fields.



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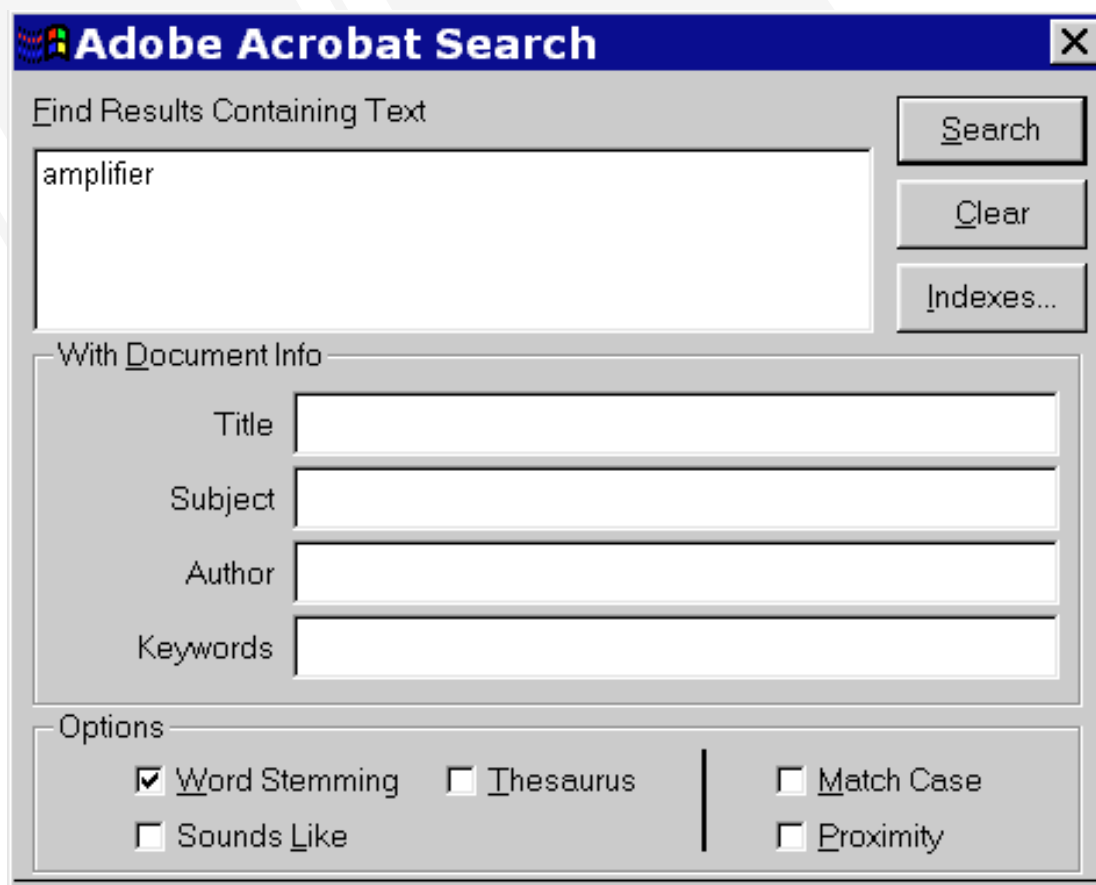
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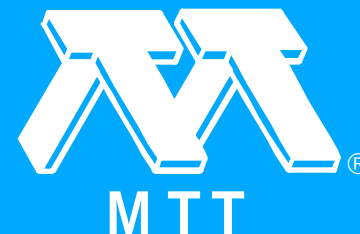
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If you are not finding files you think should show in the results list, Acrobat may not be attached to the correct index file. To check, press the “Indexes...” button for a list of available indexes. If this title is not listed, press the “Add...” 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. If none exists, this title was not indexed.

See the Search Online Guide (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'. The main area is titled 'Find Results Containing Text' and contains a text input field with the word 'amplifier'. To the right of this field are three buttons: 'Search', 'Clear', and 'Indexes...'. Below this is a section titled 'With Document Info' containing four labeled text 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). The 'Proximity' checkbox is also present but is partially obscured by the bottom edge of the dialog.

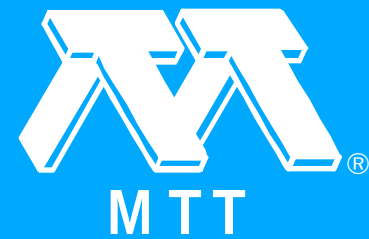


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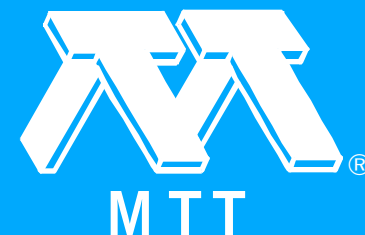
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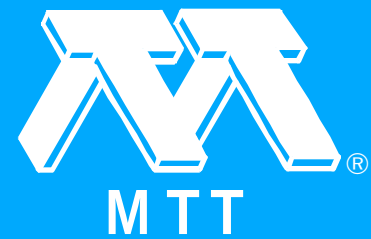
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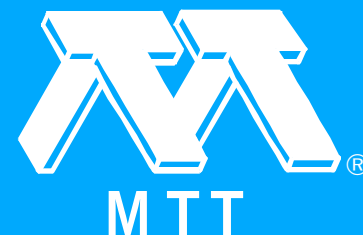


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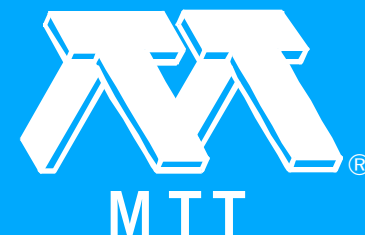


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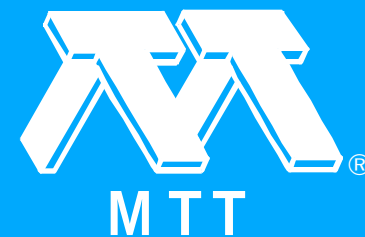


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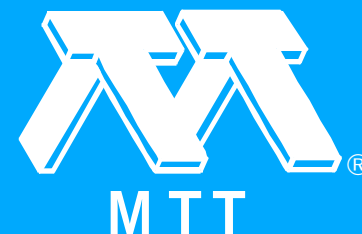
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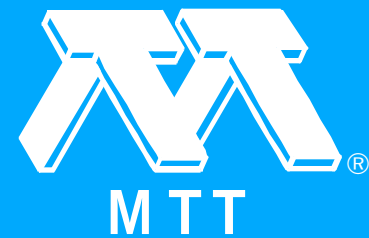
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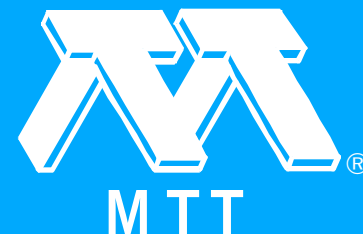
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- ❑ A table-based bias and temperature-dependent small-signal and noise equivalent circuit model
- ❑ Noniterative stable transmission/reflection method for low-loss material complex permittivity determination
- ❑ Large-signal microwave characterization of AlGaAs/GaAs HBT's based on a physics-based electrothermal model
- ❑ Wave-beam shaping using multiple phase-correction mirrors
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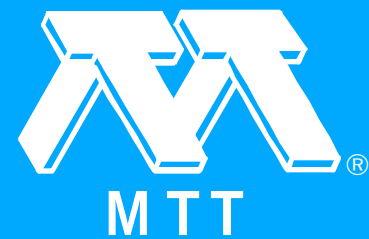
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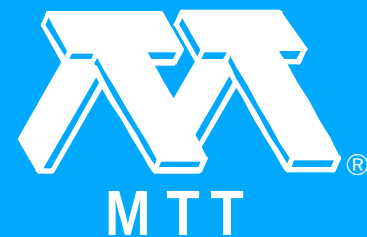
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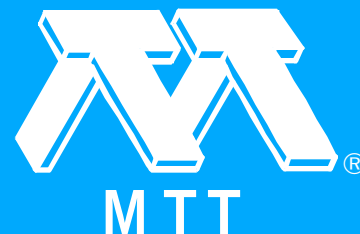


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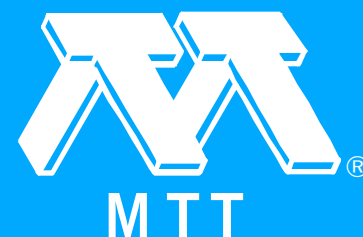
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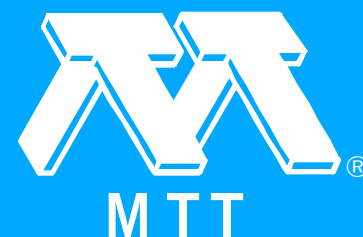
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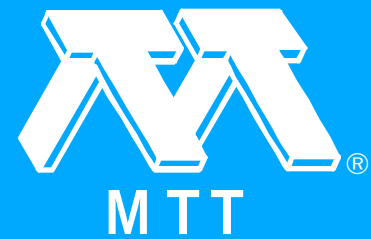
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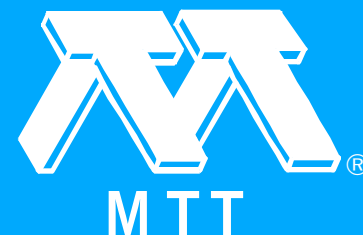
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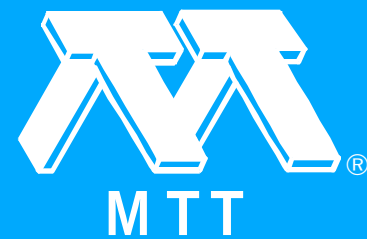
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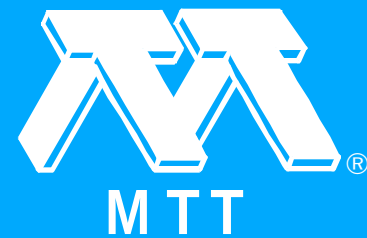
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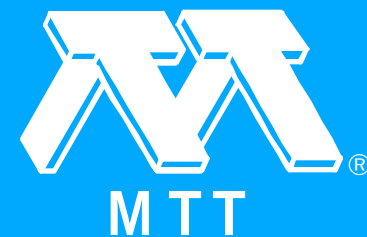
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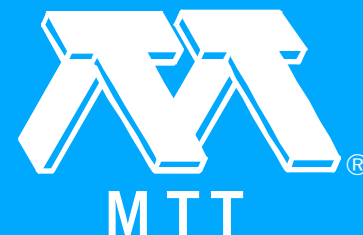
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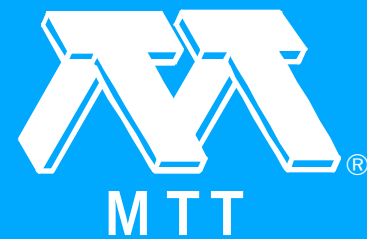
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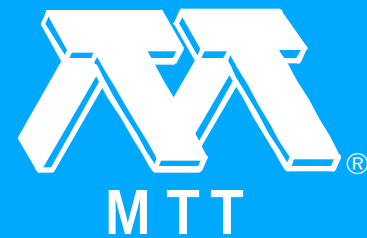
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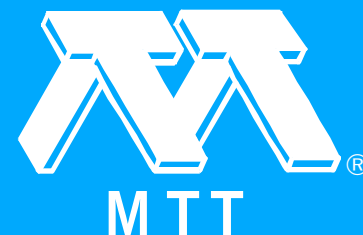
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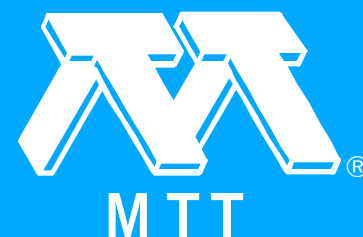
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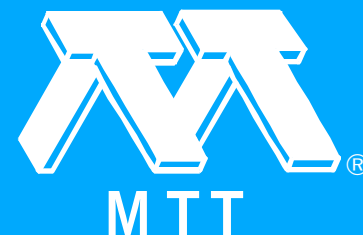
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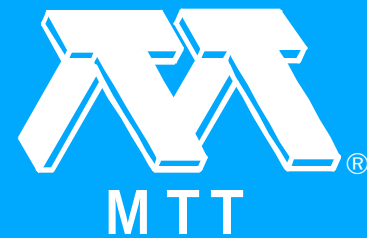
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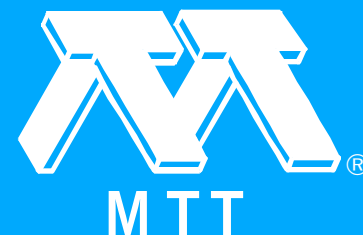
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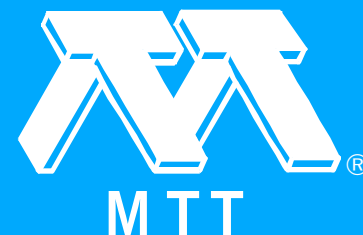
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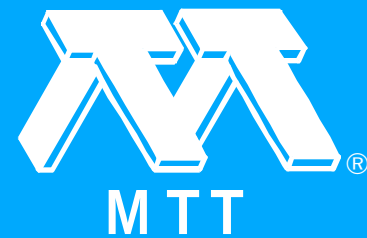
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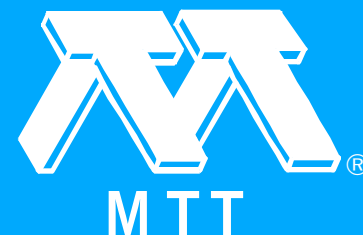
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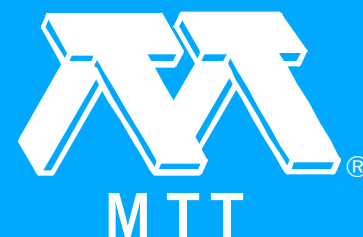
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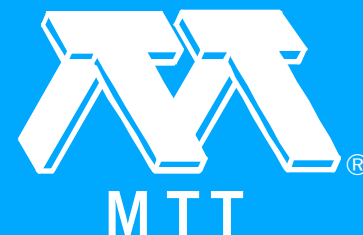
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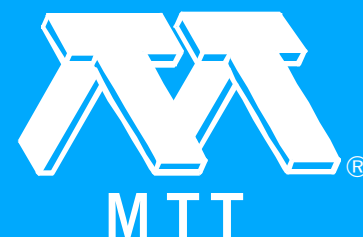
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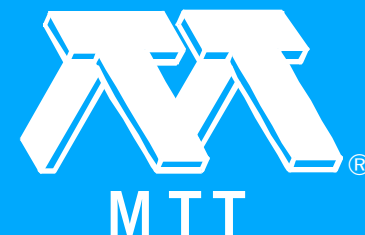
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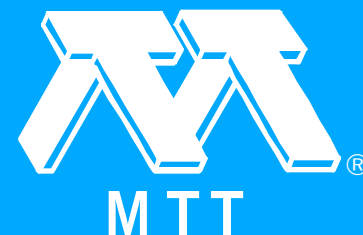
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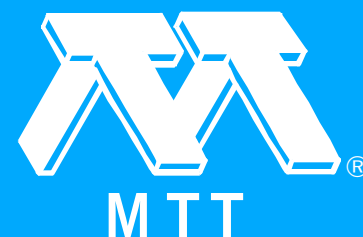
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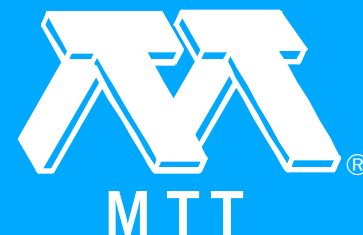
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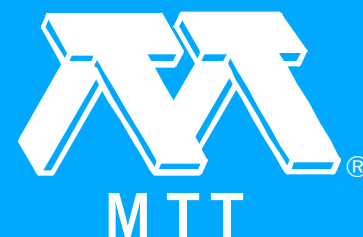
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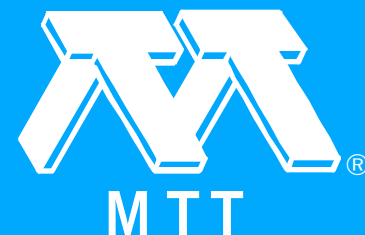
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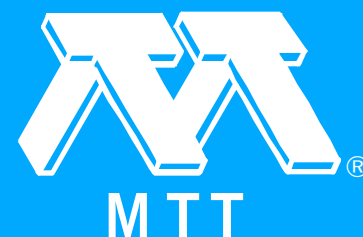
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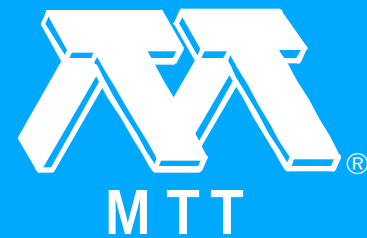
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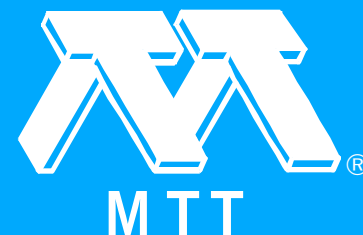
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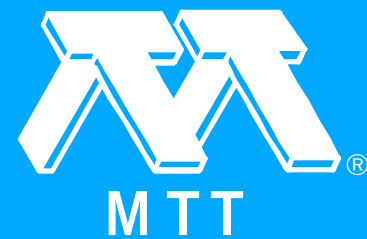
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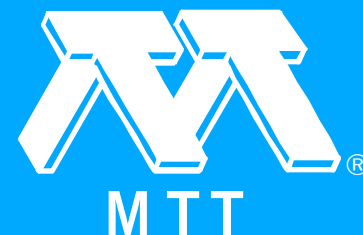
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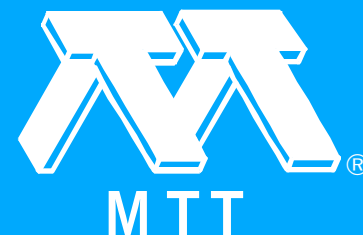
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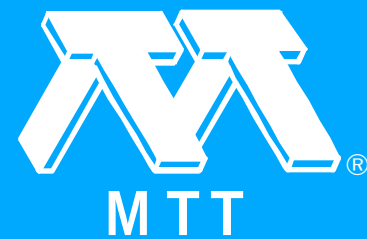
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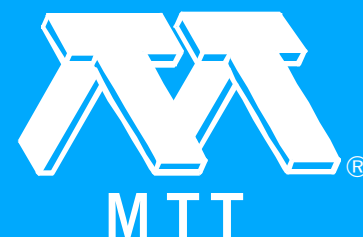
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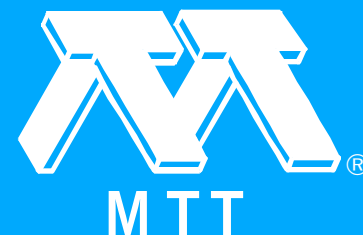
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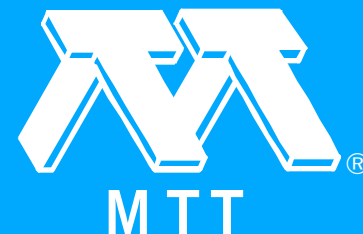
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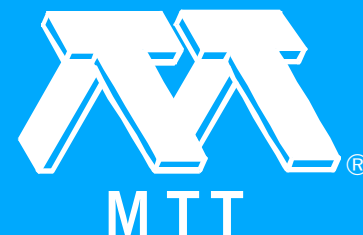


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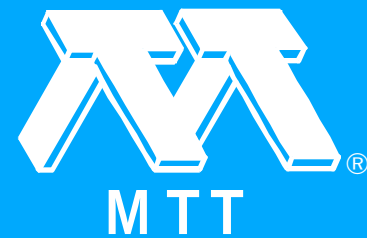
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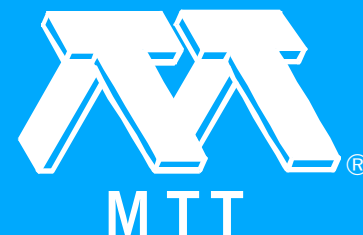
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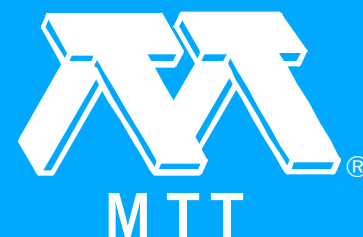
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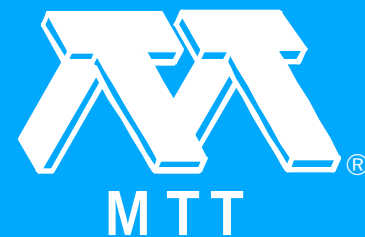
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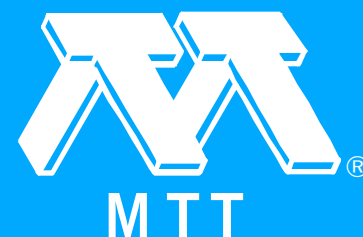
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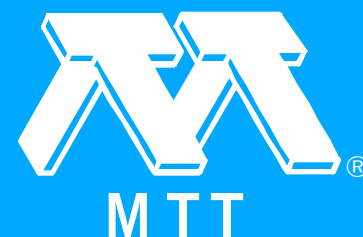
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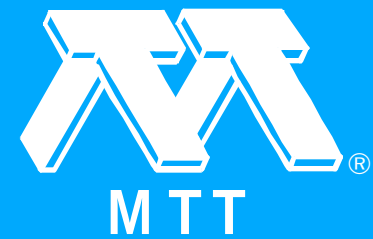
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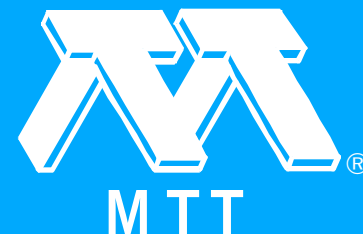
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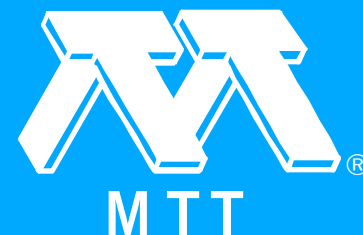
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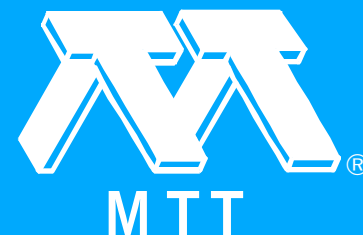
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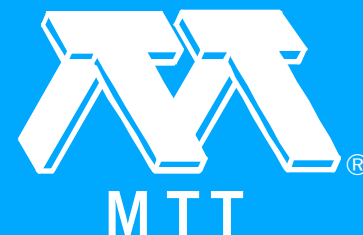
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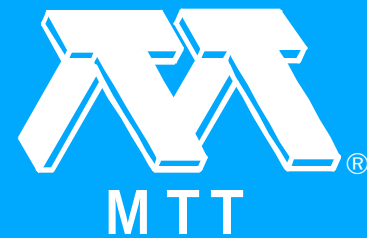
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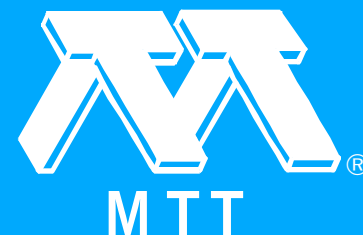
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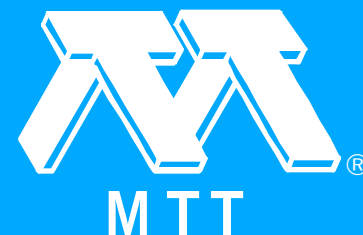
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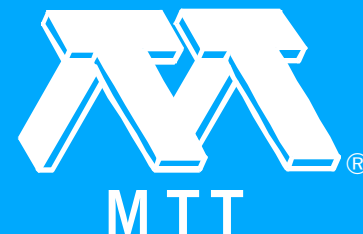
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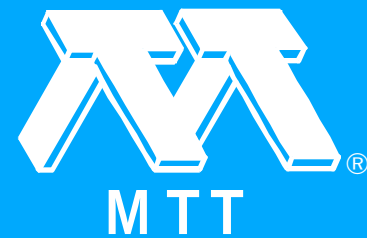
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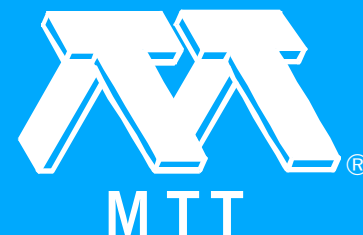
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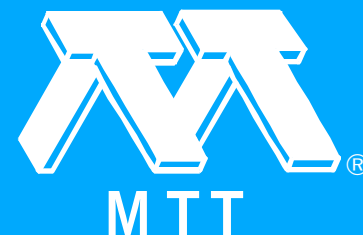
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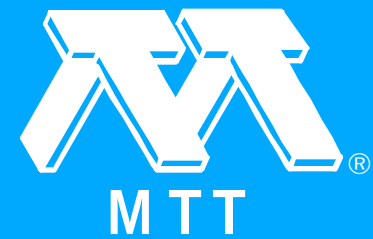
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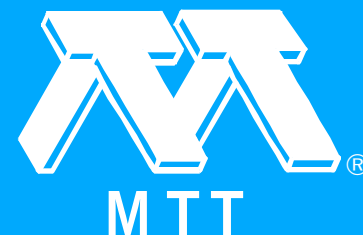
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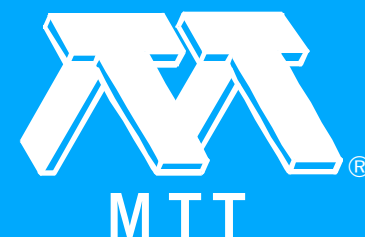
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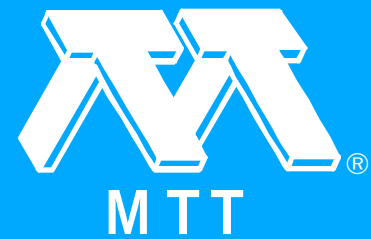
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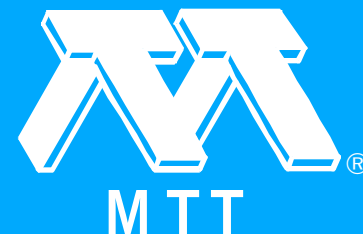
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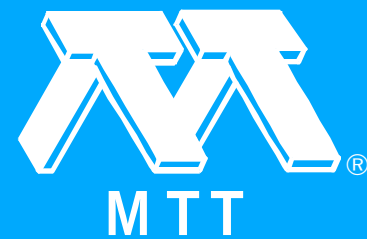
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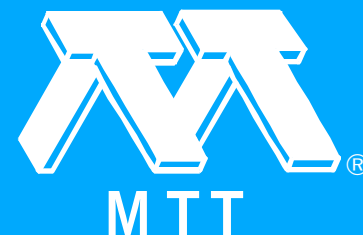
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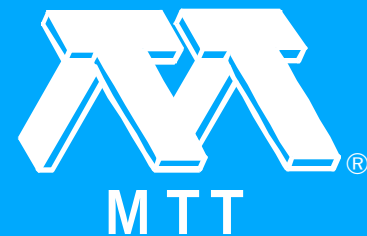
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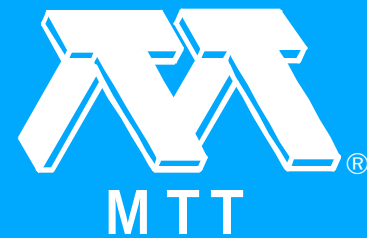
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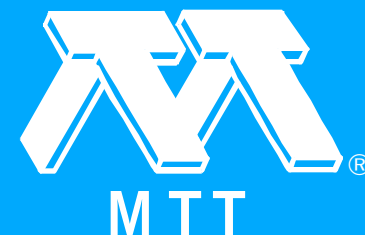
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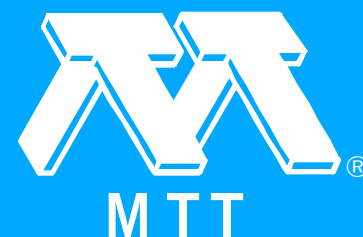
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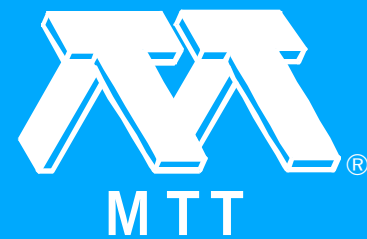
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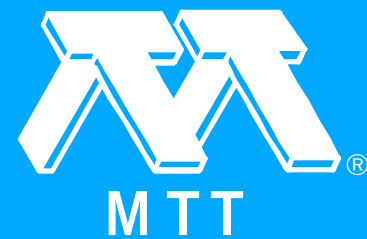
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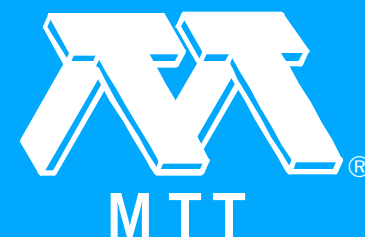
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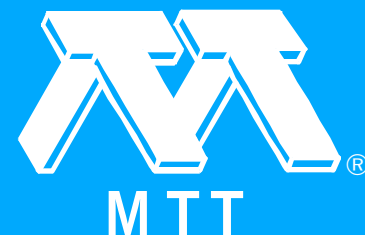
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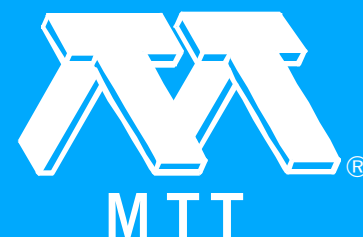
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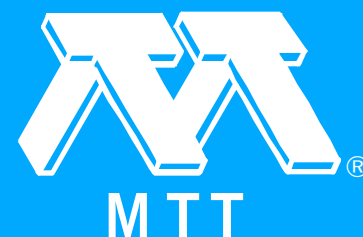
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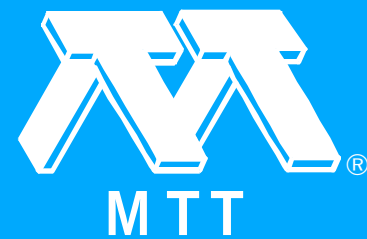
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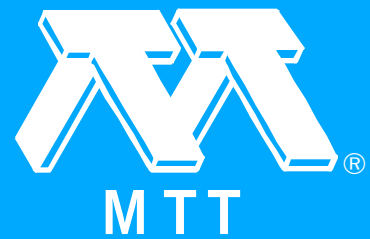
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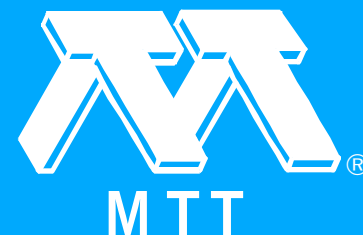
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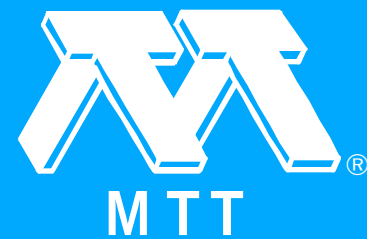
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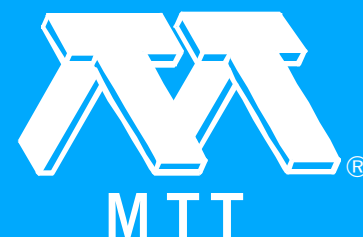
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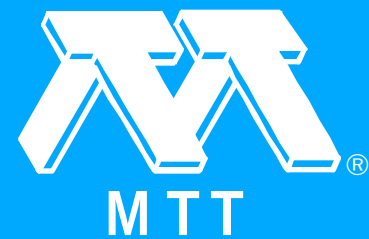
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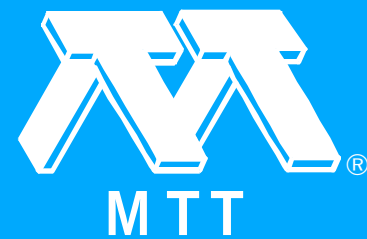
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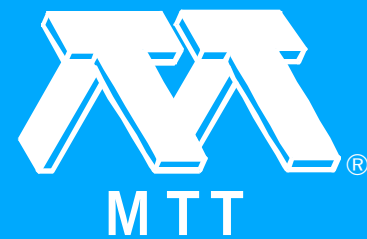
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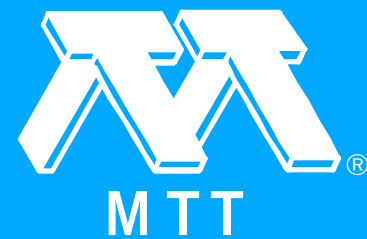
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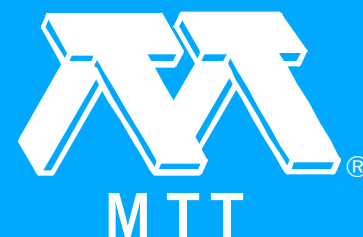
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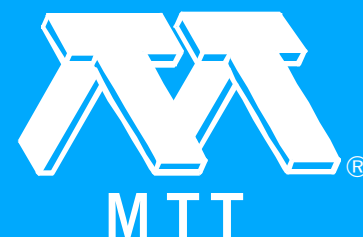
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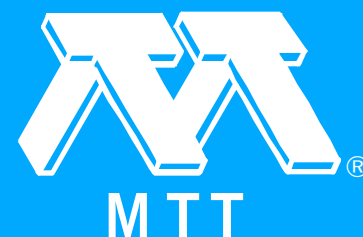
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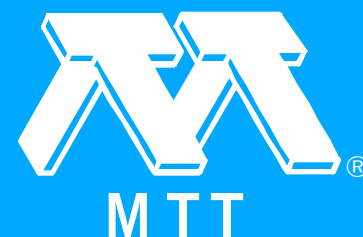
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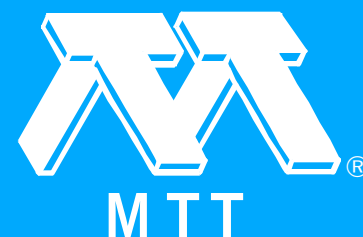
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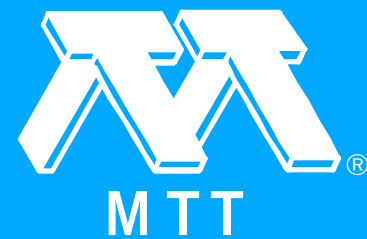
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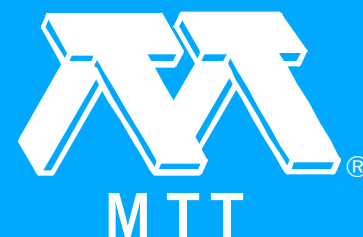
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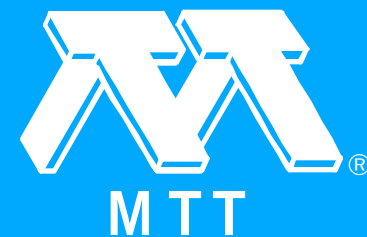
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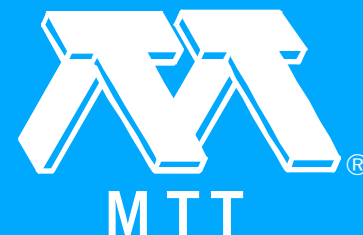
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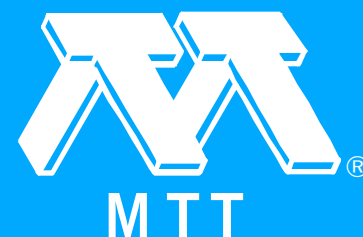
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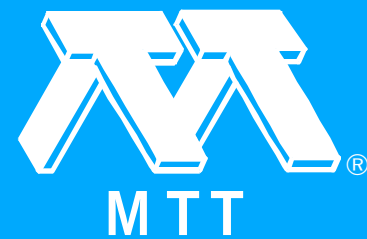
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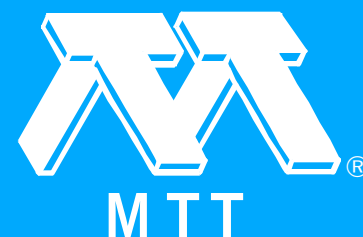
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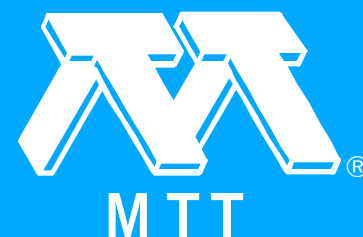
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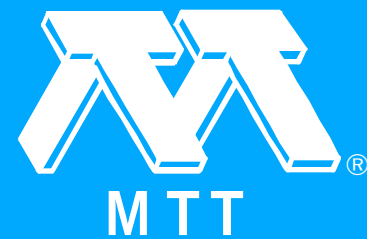
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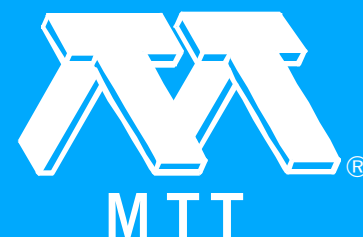
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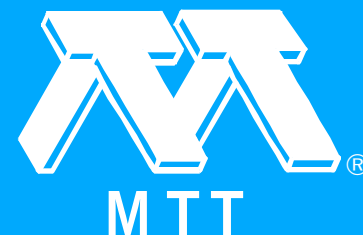
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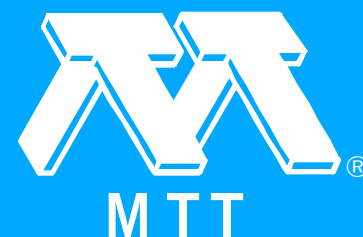
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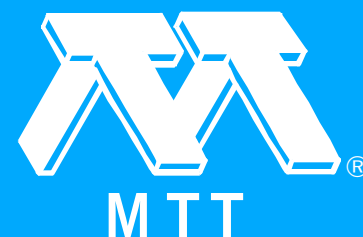
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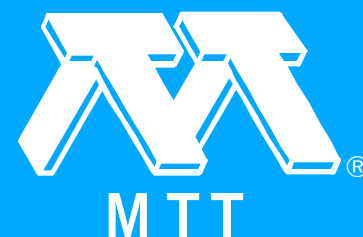
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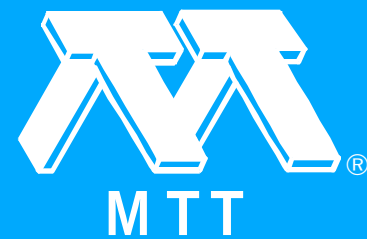
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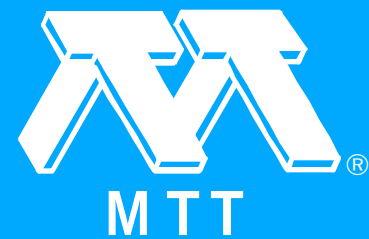
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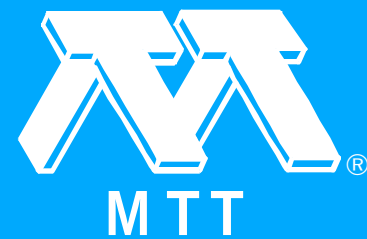
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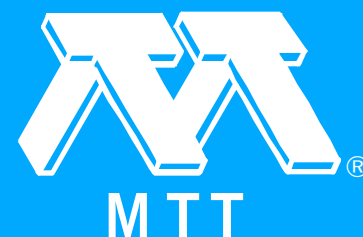
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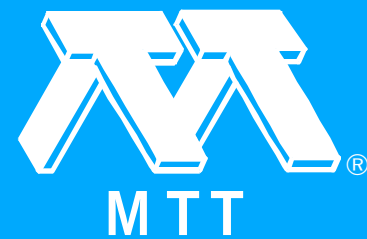
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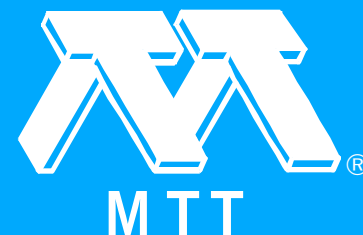
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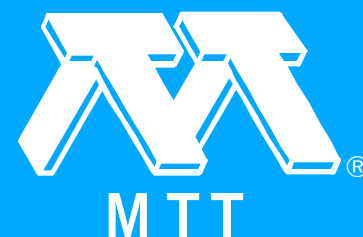
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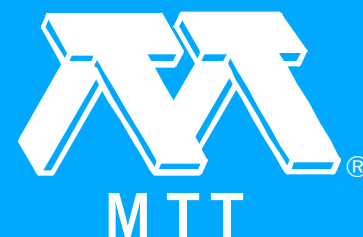
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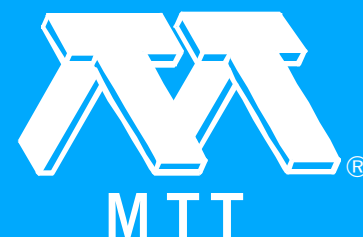
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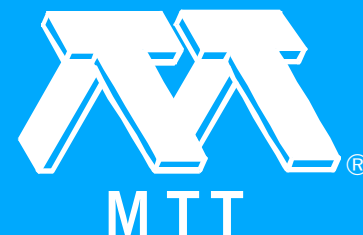
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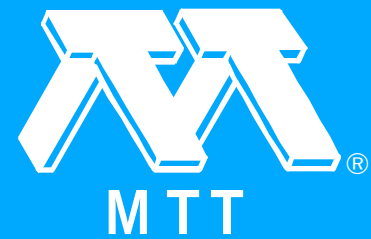
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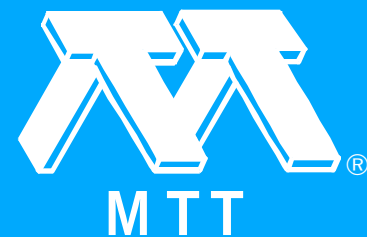
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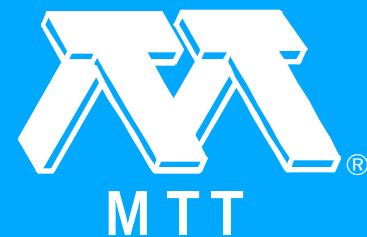
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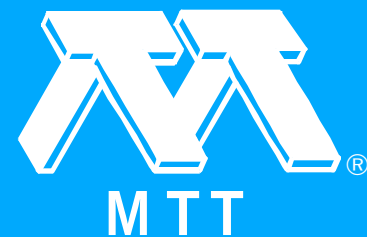
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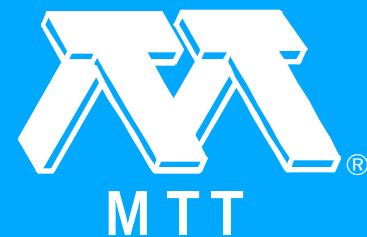
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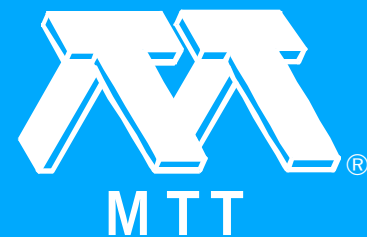
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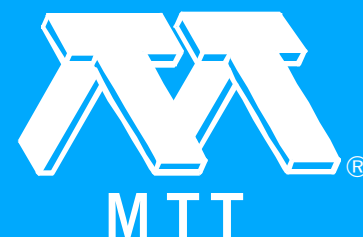
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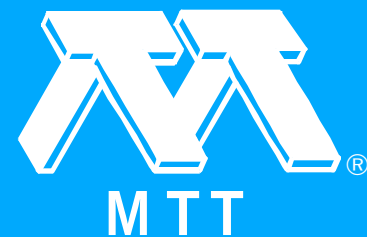
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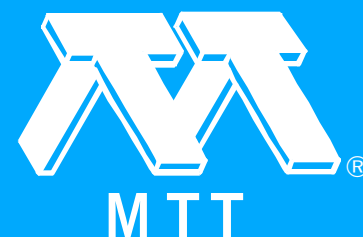
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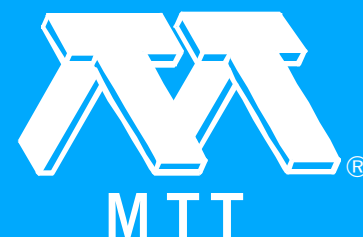
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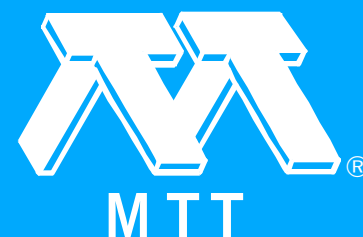
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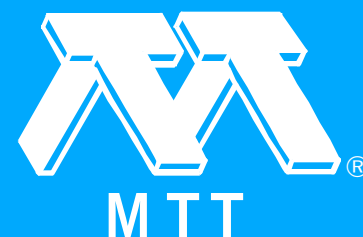
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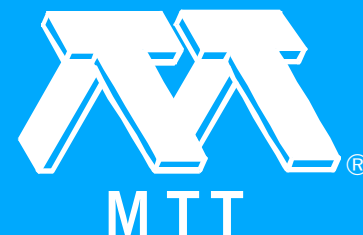
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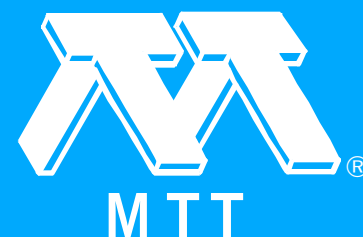
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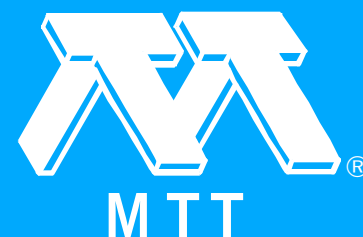
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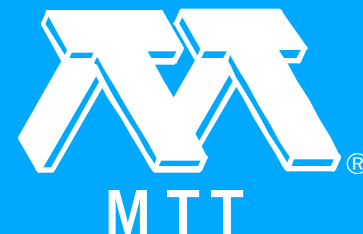
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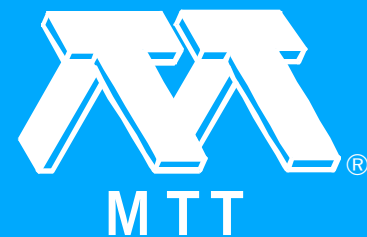
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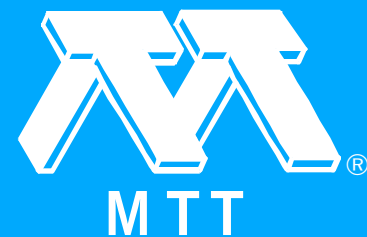
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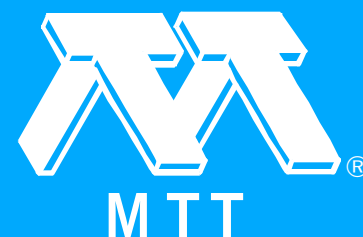
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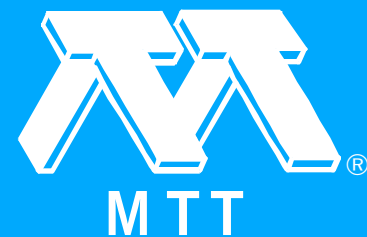
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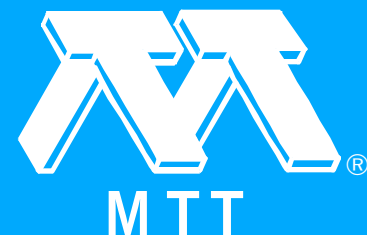
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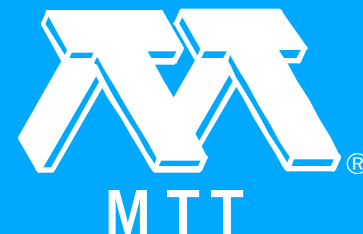
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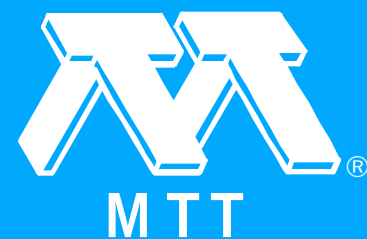
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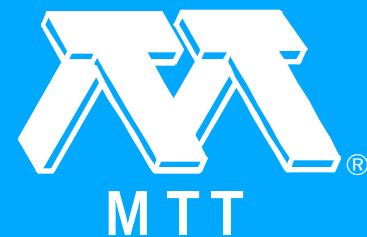
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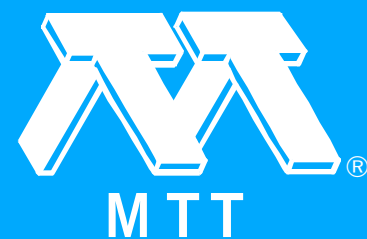
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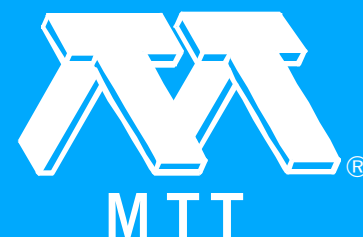
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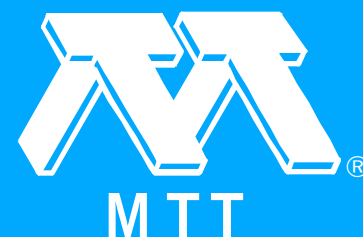
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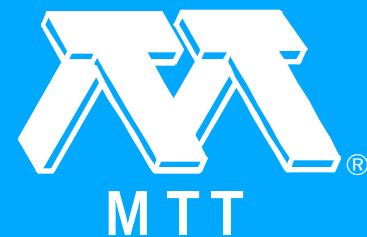
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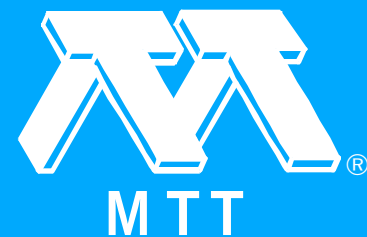
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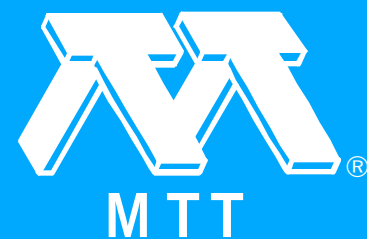
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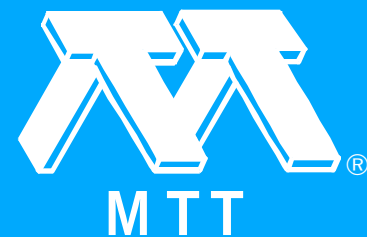
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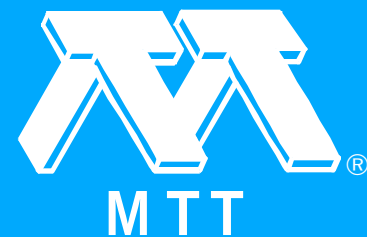
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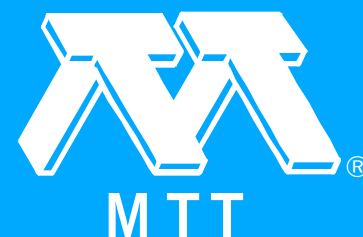
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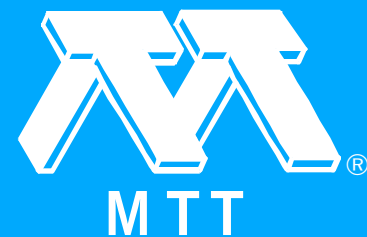
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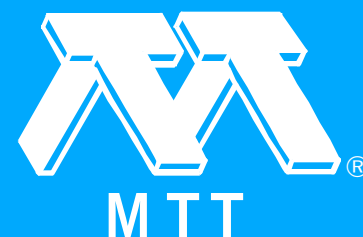
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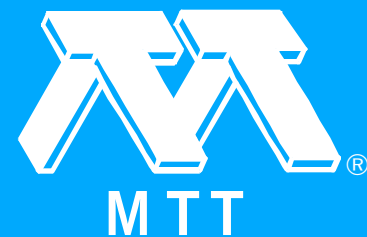
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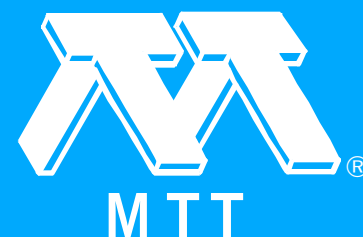
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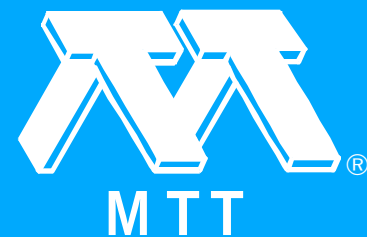
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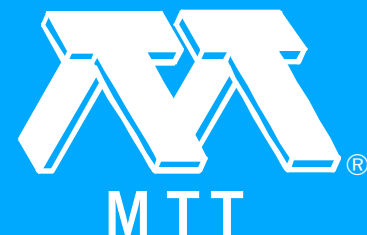
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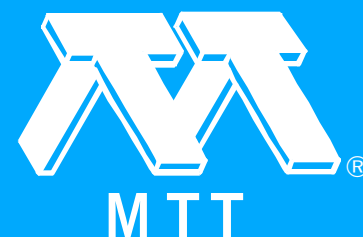
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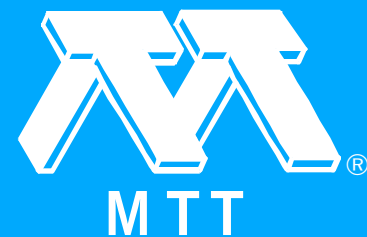
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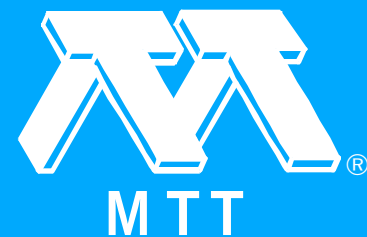
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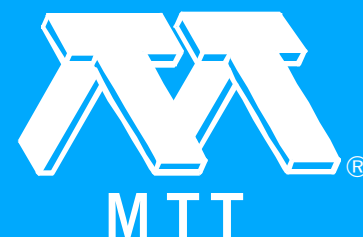
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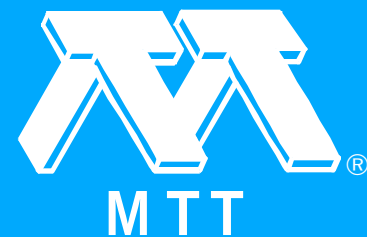
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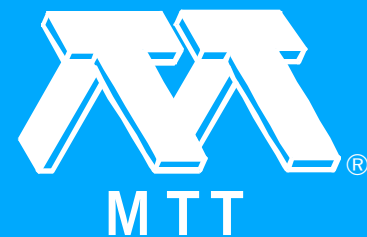
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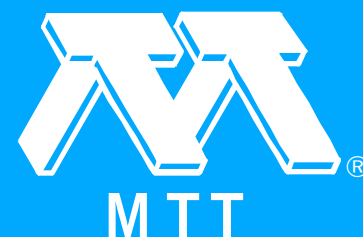
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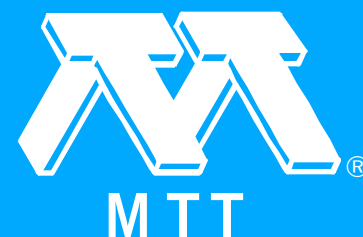


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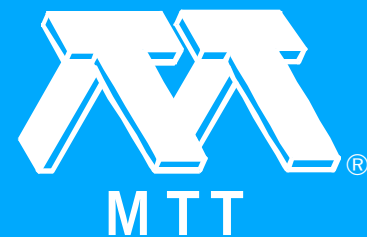
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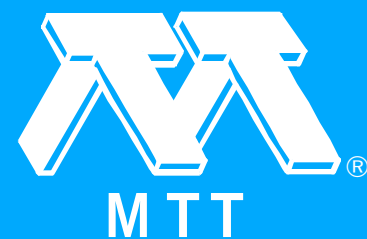
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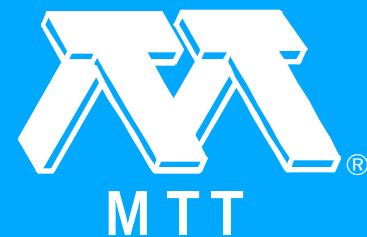
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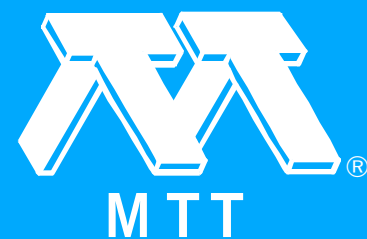
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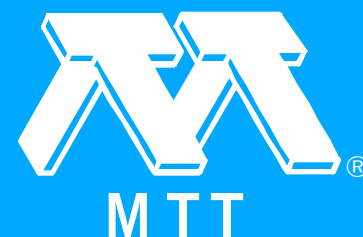
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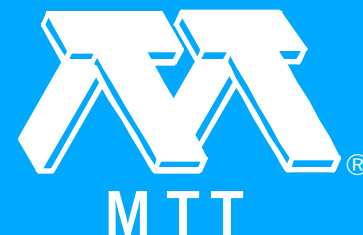
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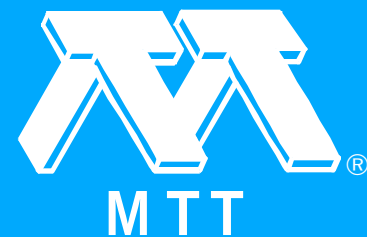
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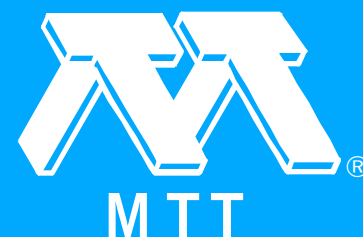
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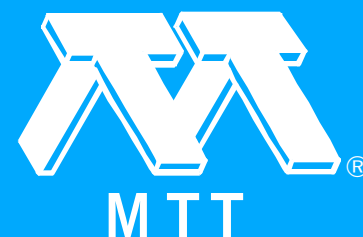
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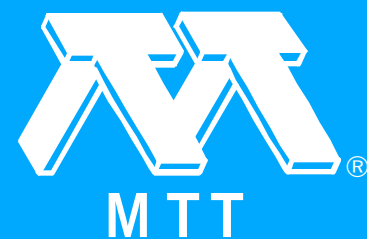
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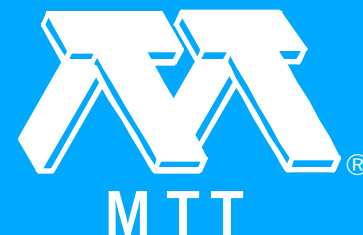
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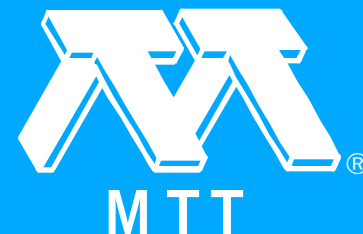
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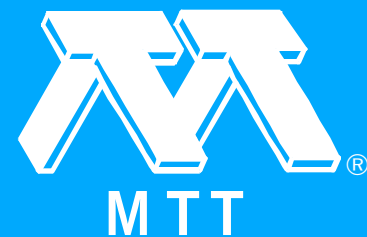
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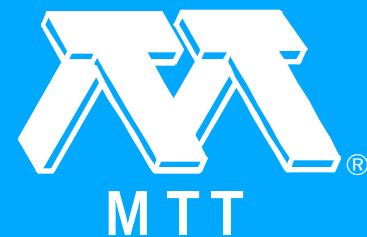
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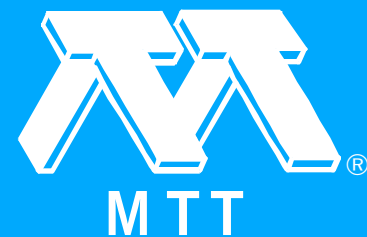
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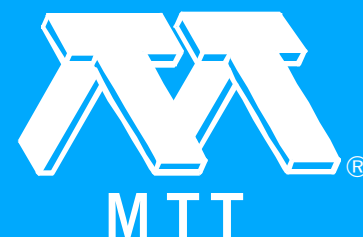
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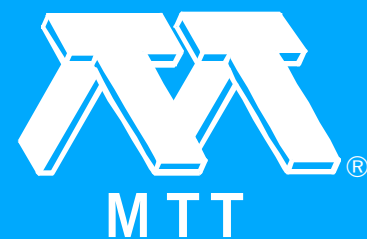
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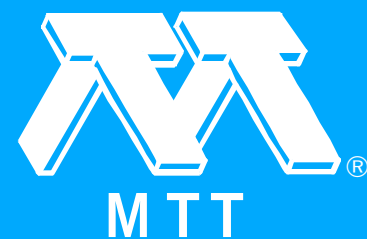
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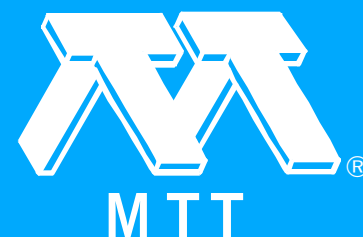
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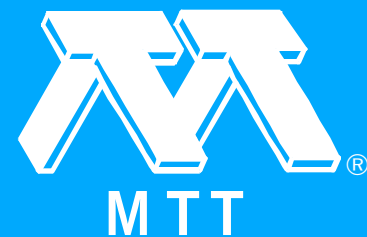
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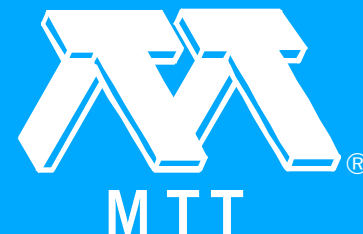
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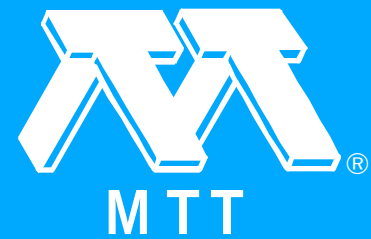
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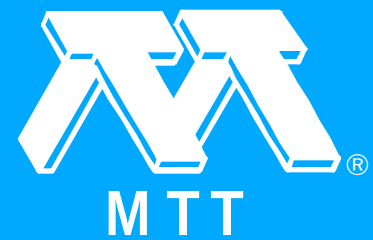
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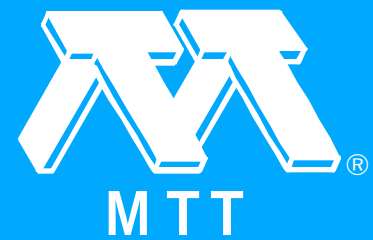
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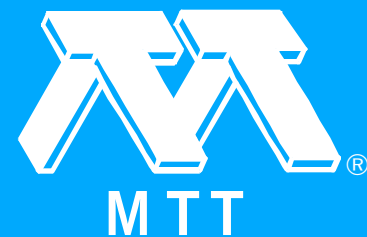
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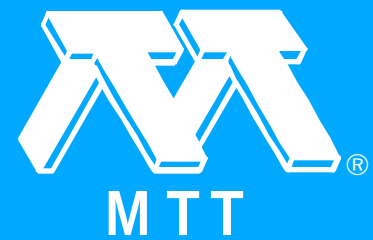
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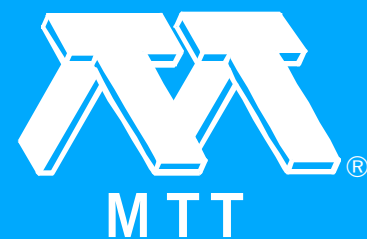
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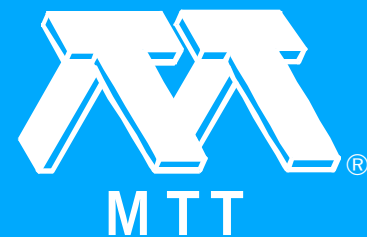
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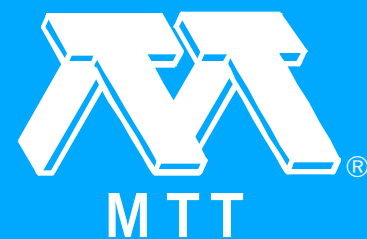
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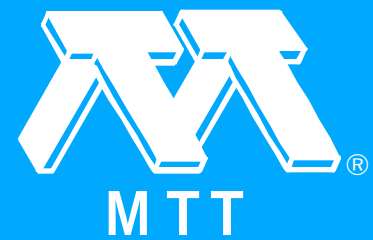
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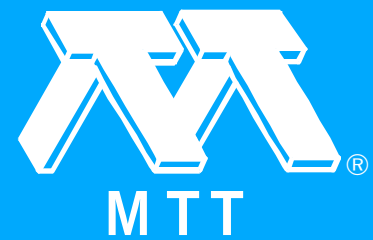
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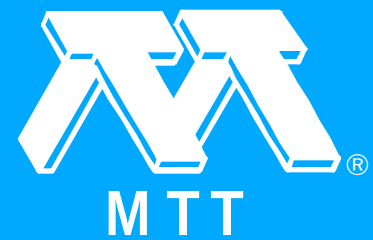
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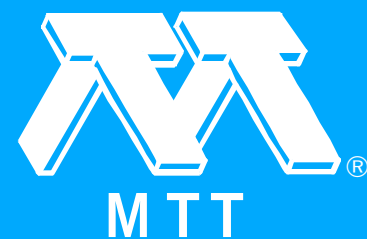
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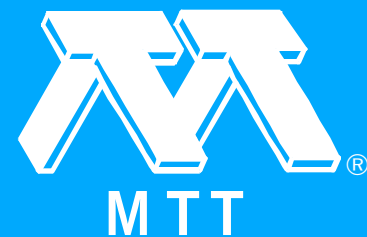
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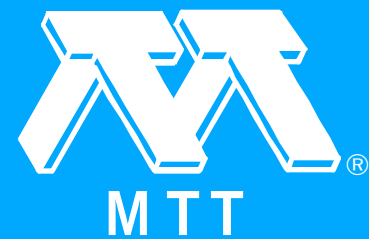
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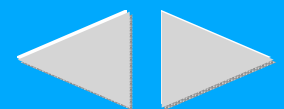
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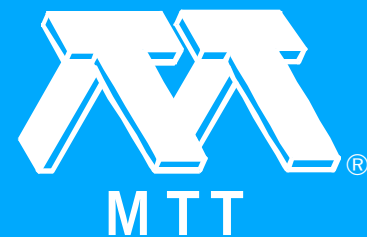
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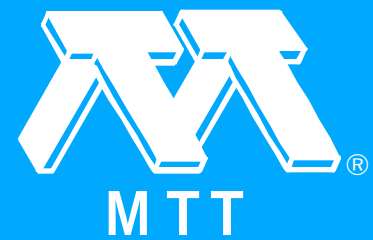
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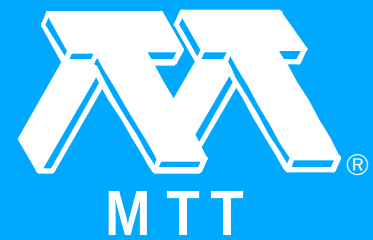
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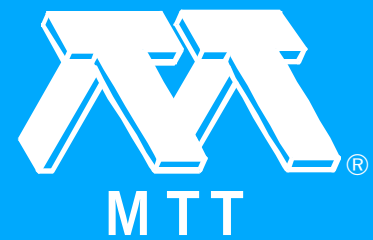
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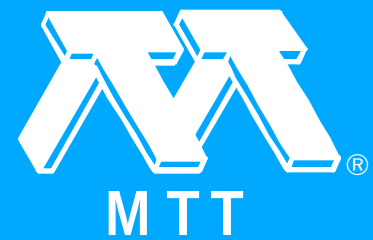
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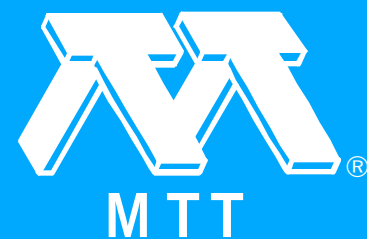
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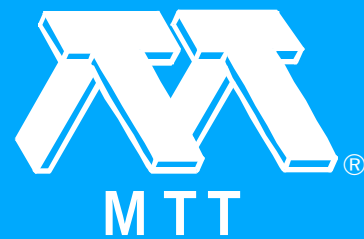


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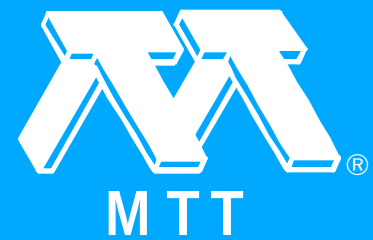
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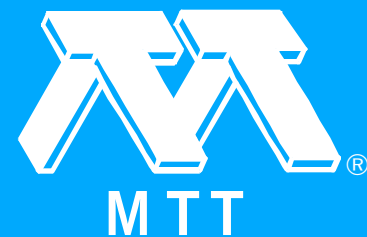
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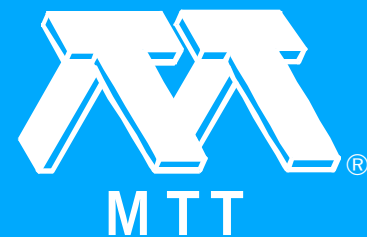
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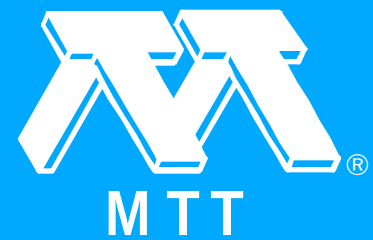
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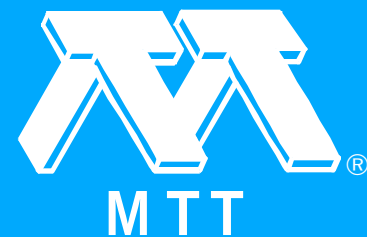
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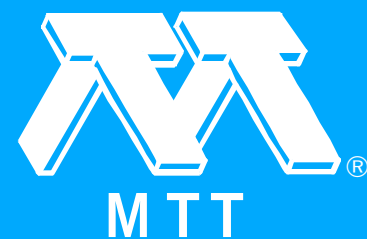
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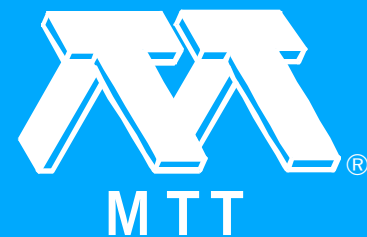
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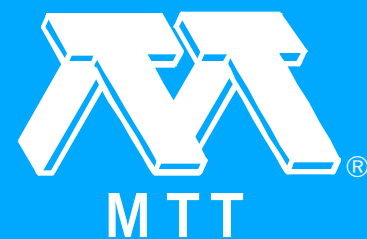
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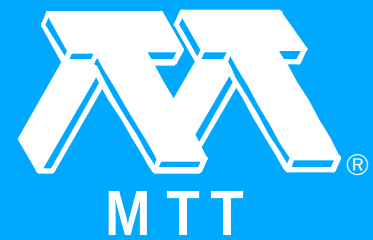
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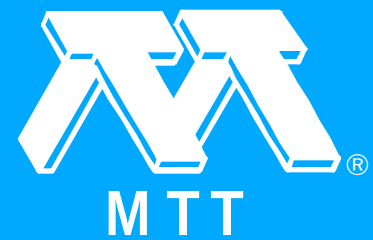
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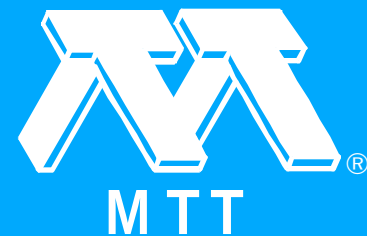
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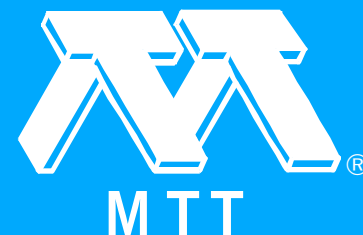
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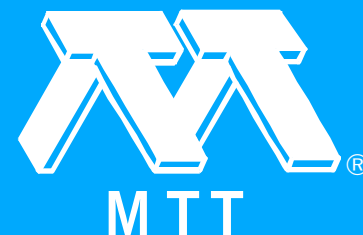
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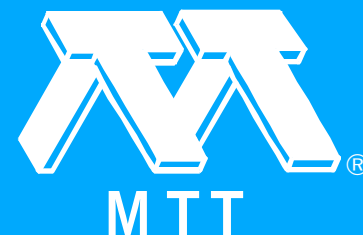
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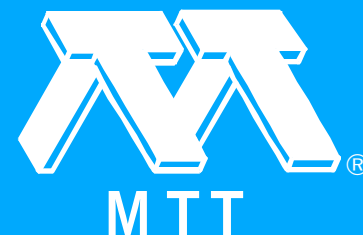
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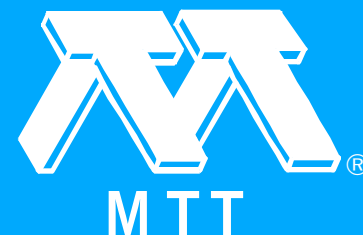
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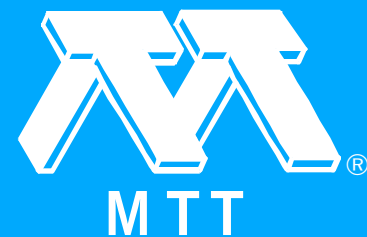
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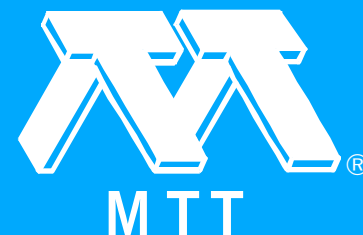
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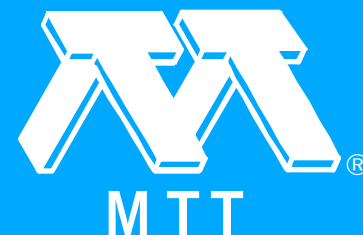
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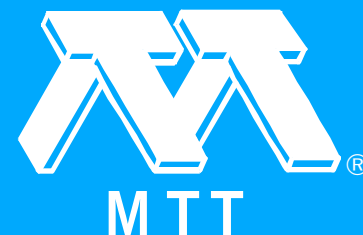
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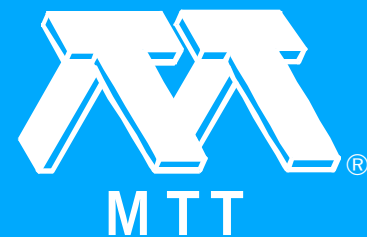
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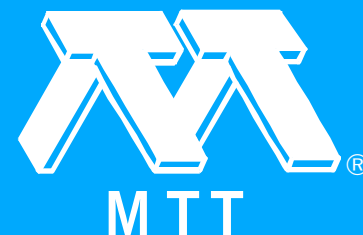
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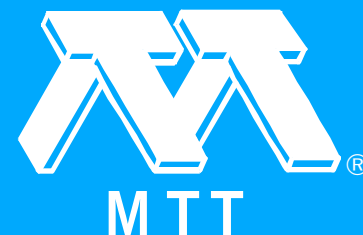
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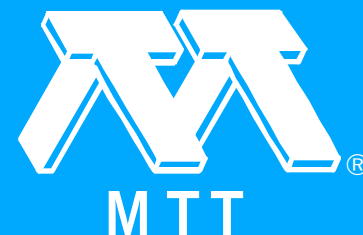


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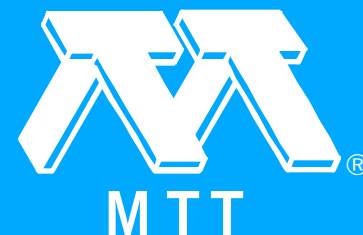
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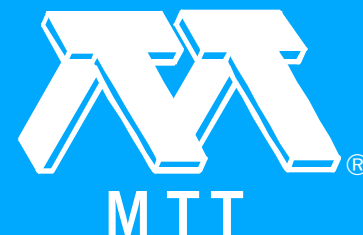
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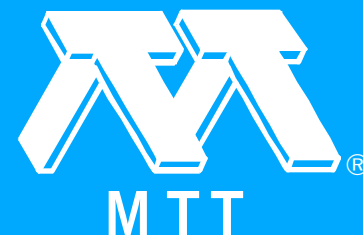
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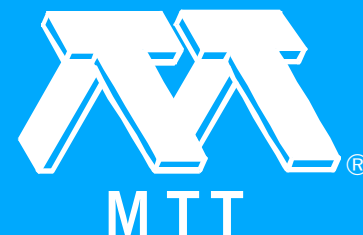
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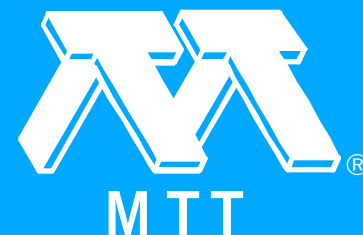
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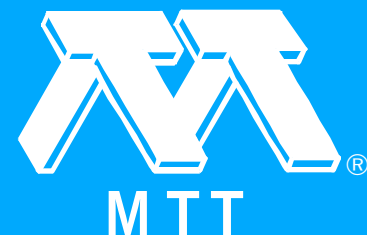
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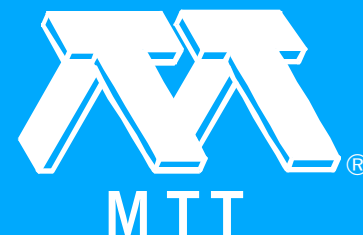
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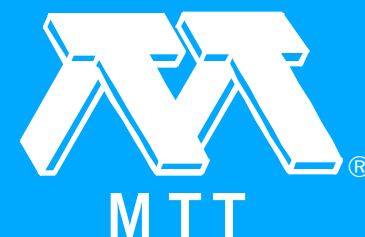
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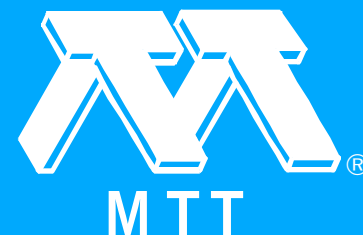
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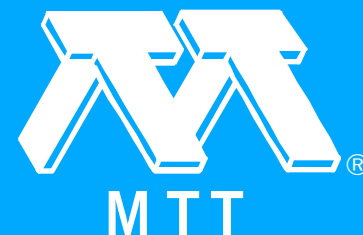
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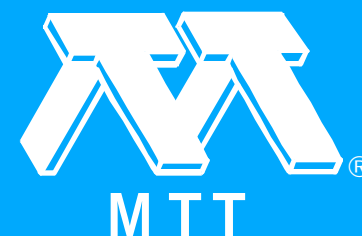
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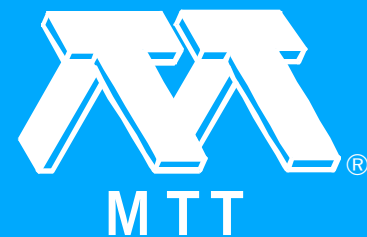
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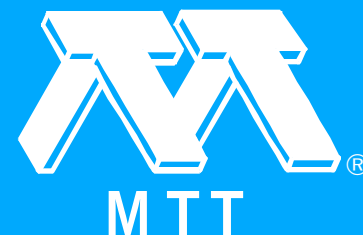
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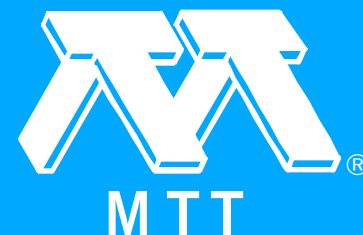
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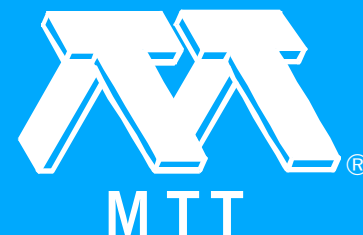
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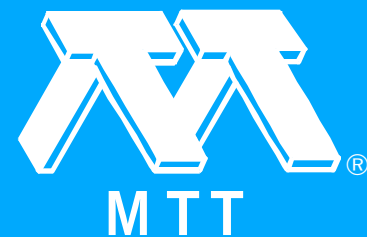
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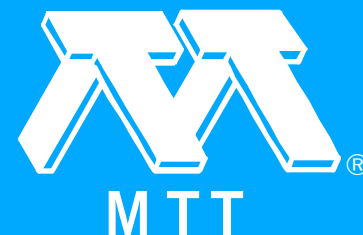
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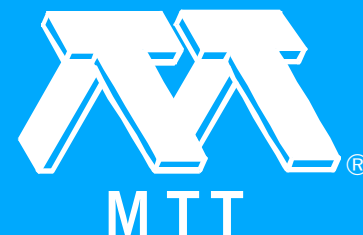
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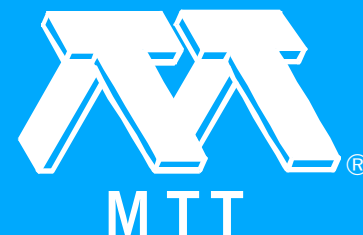
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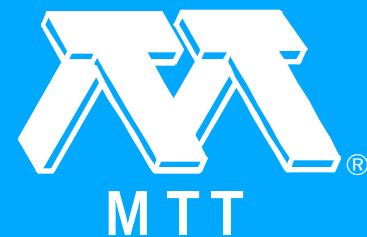
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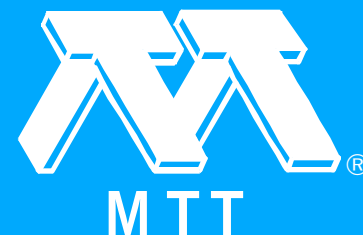
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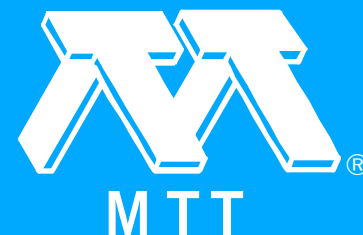
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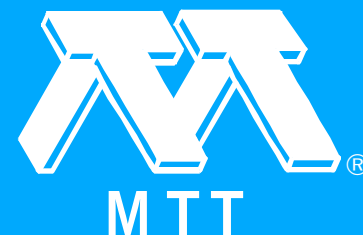
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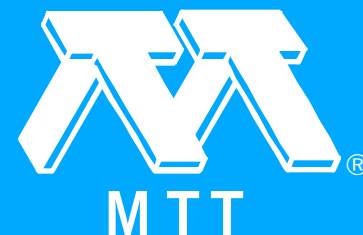
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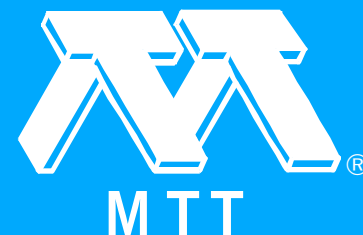
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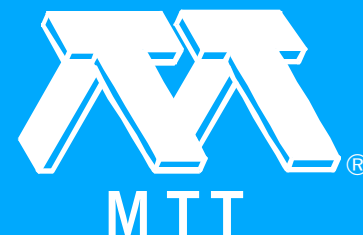
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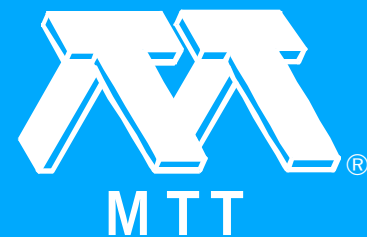
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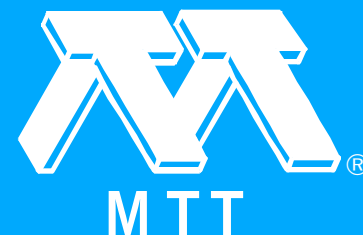
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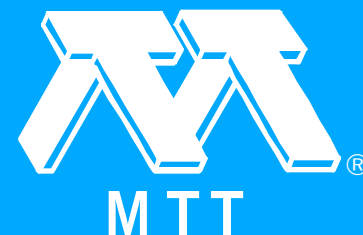
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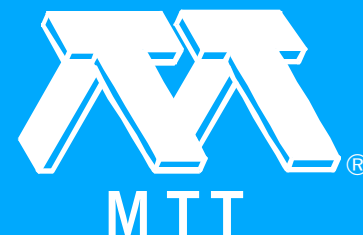
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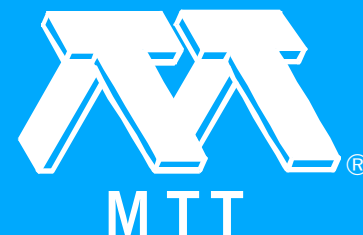
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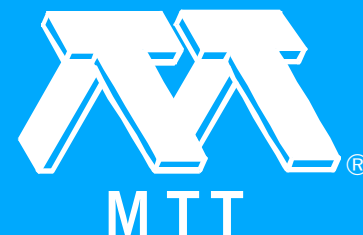
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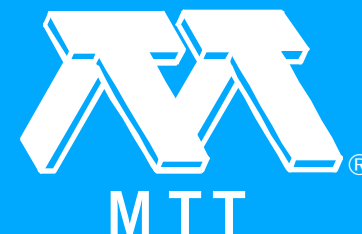
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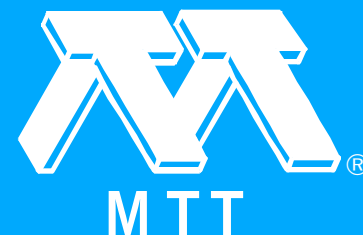
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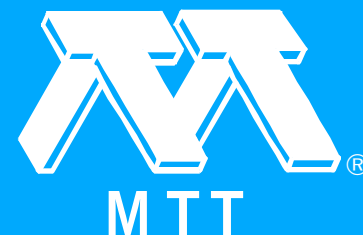
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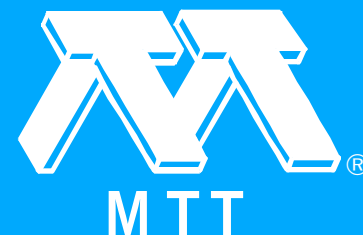
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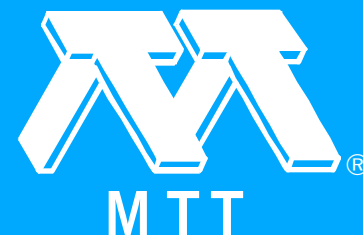
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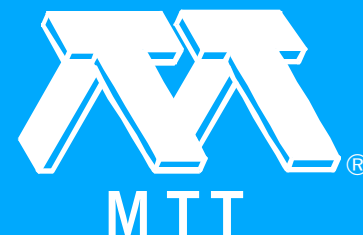
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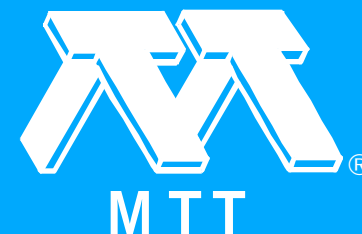
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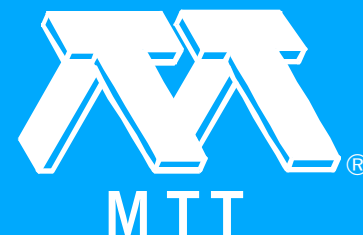
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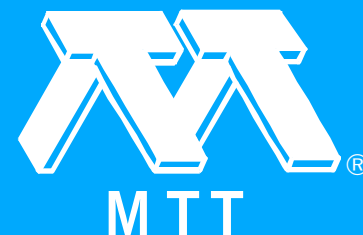
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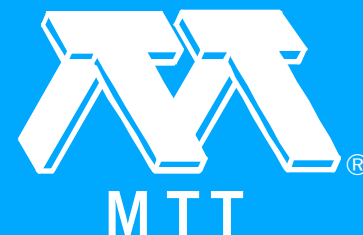
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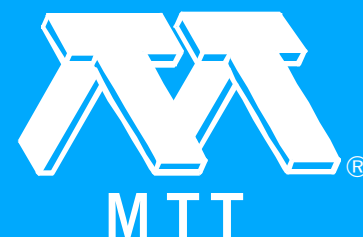
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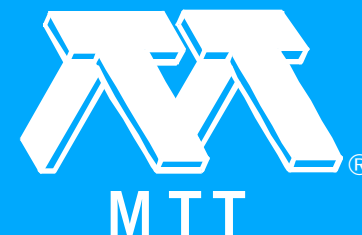
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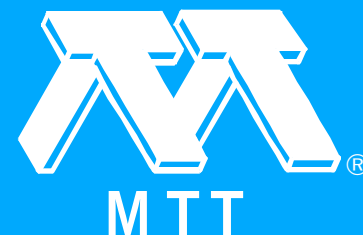
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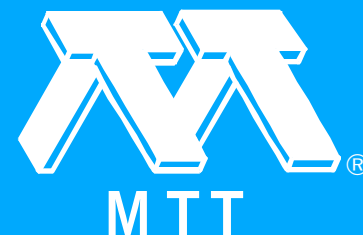
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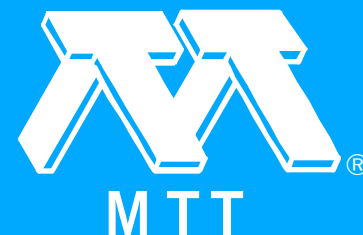
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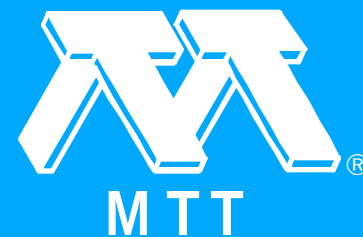
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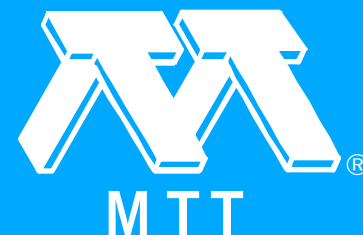
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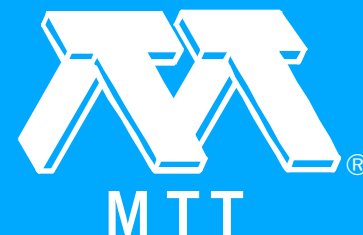
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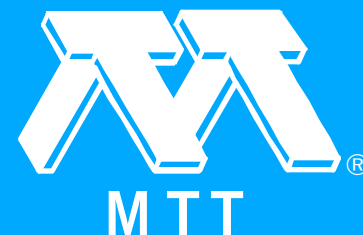
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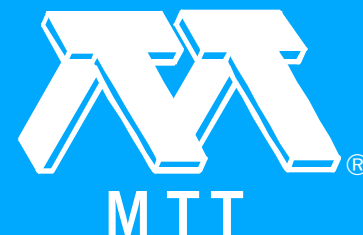
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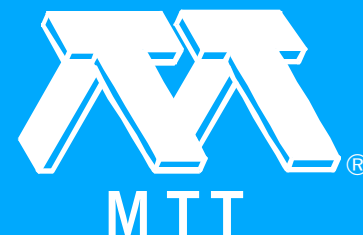
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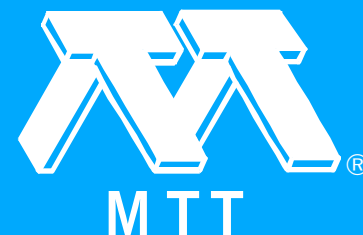
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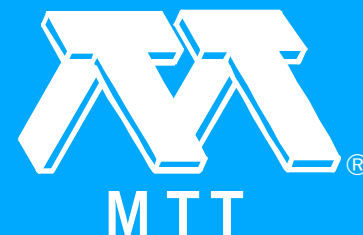


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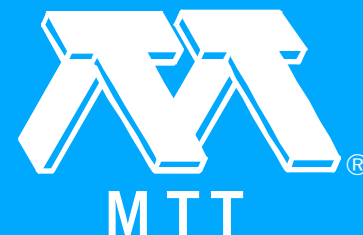
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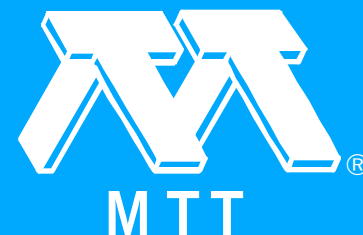


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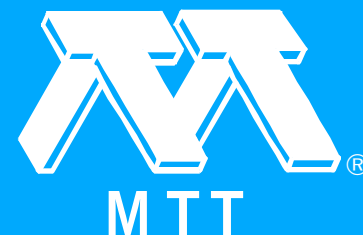
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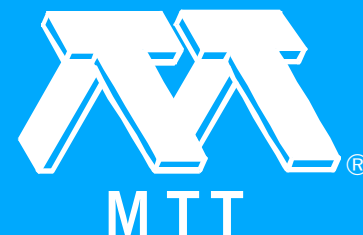
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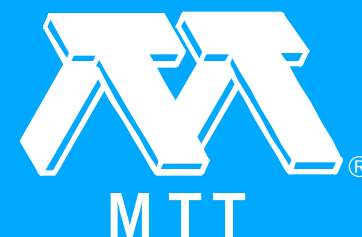
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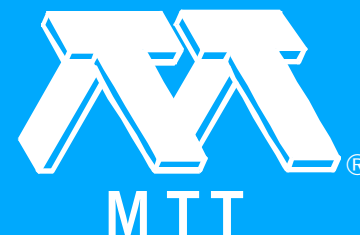
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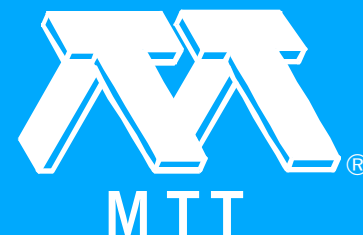
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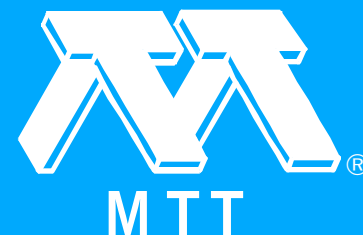


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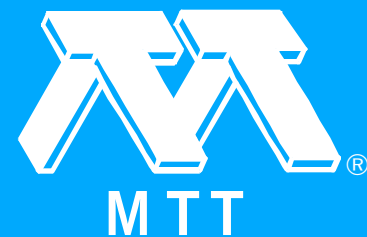
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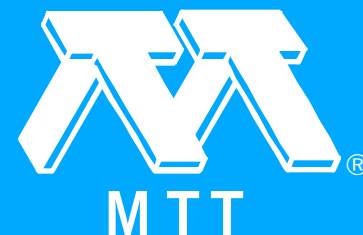
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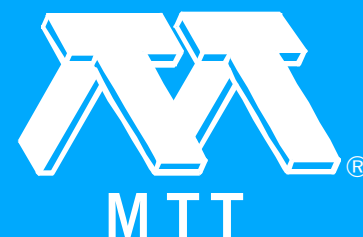
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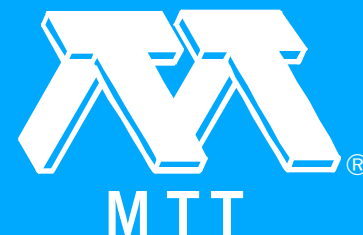
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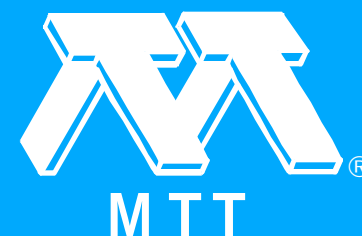
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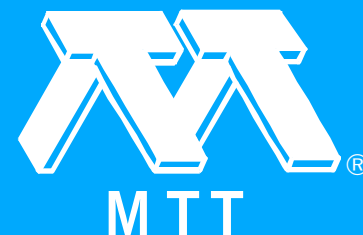
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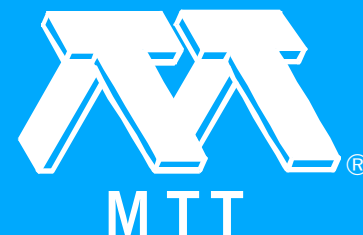
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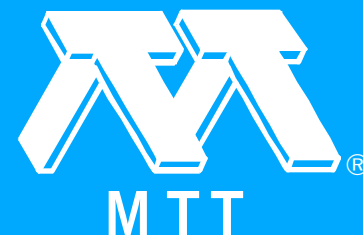
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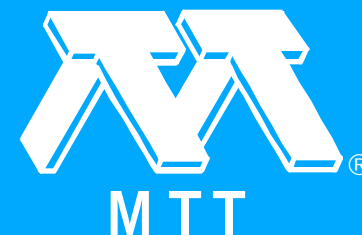
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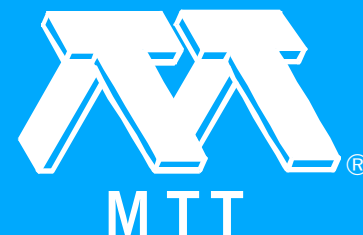
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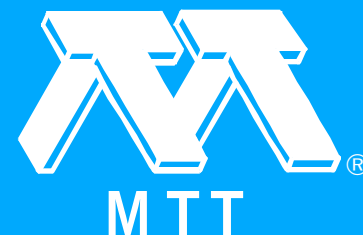
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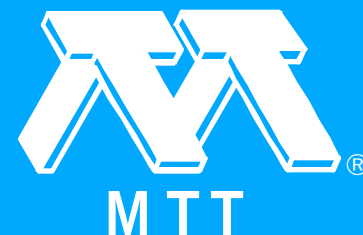
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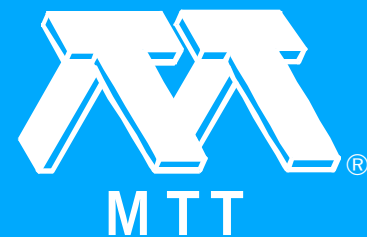
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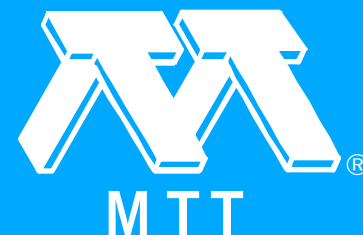
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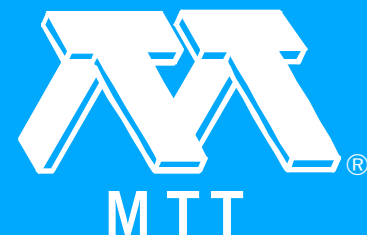
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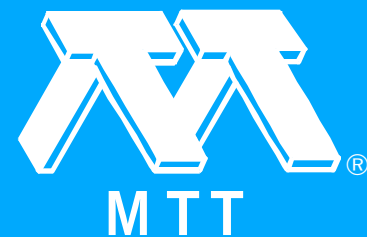
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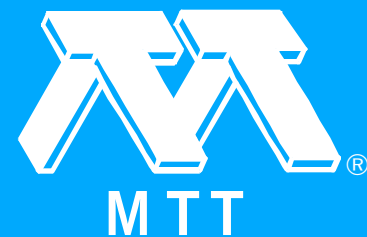
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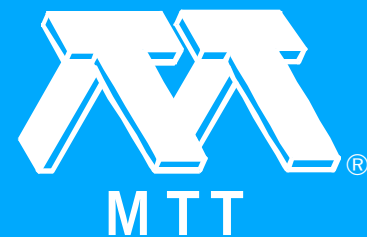
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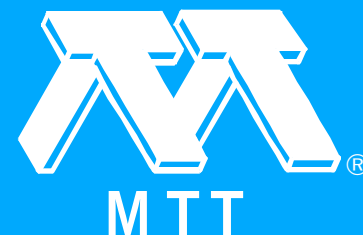
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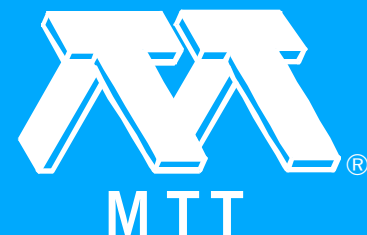
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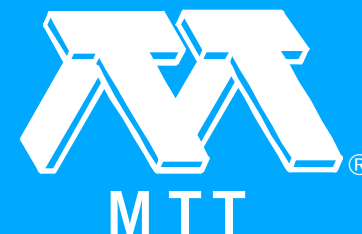
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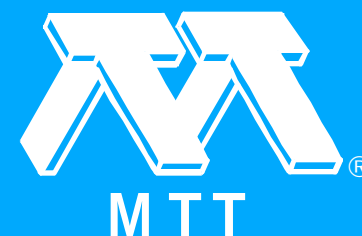
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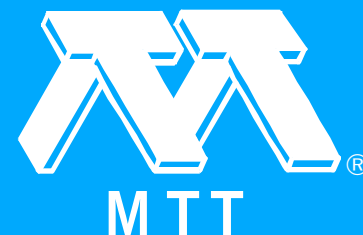
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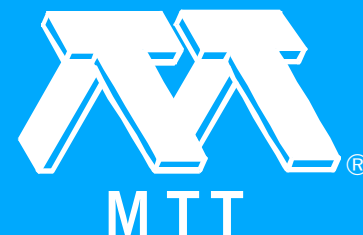
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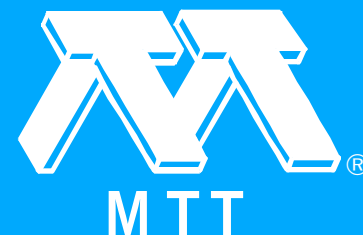
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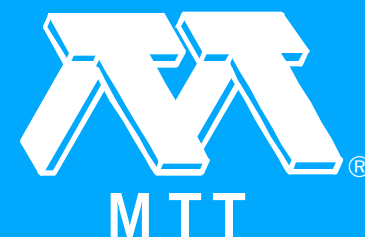
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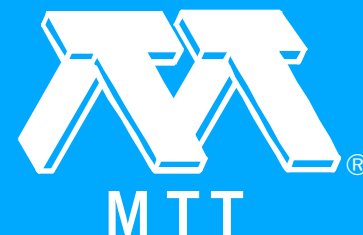
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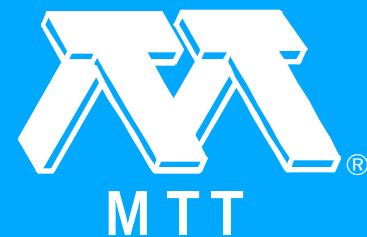
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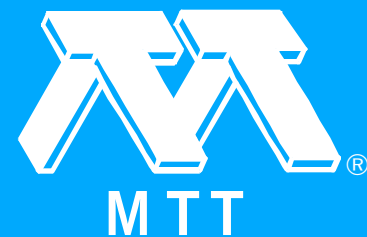
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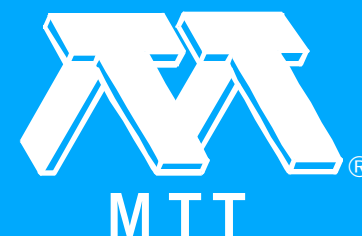
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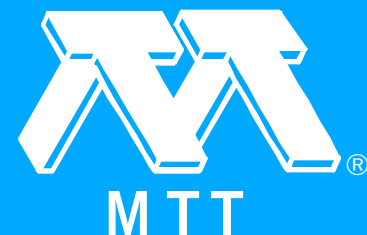
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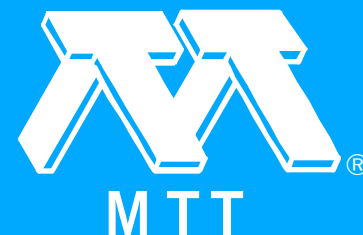
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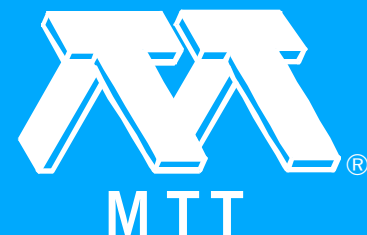
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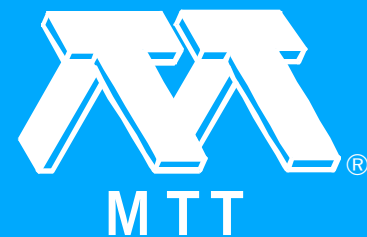
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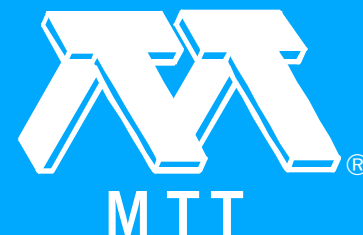
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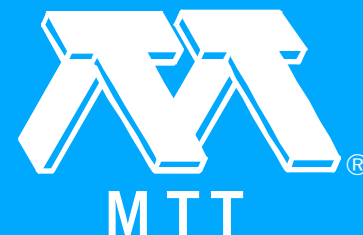
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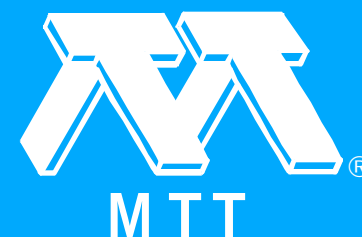
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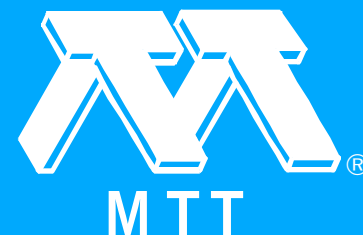
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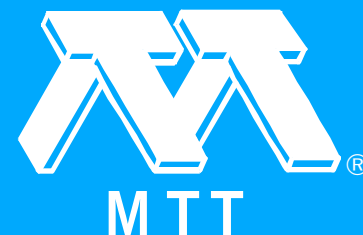
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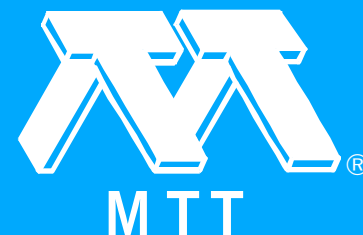
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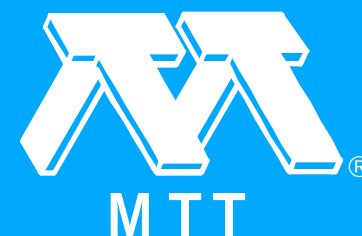
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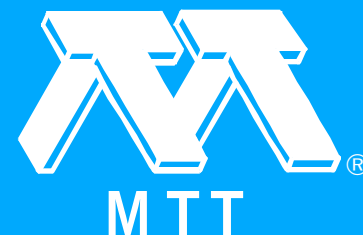
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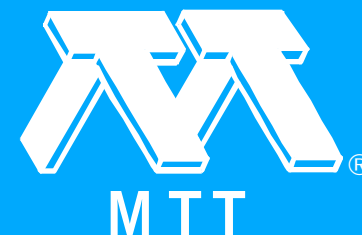
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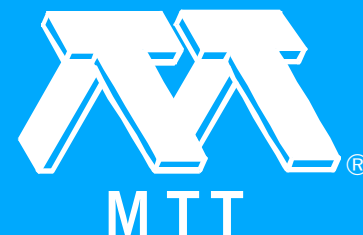
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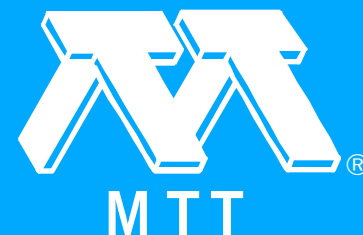
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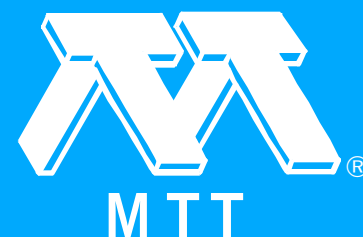
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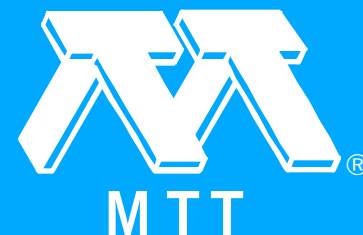
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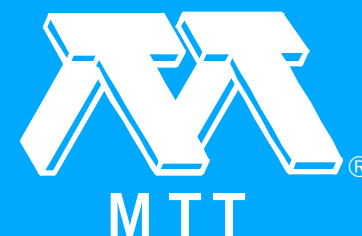
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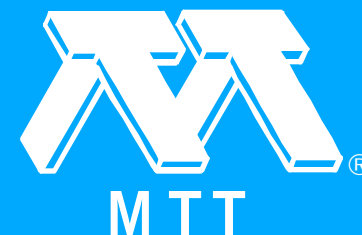
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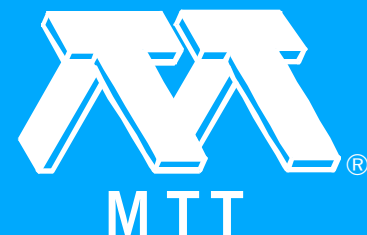
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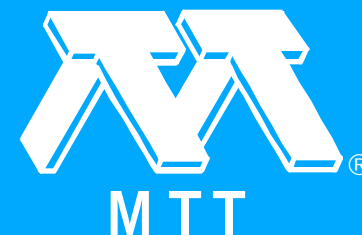
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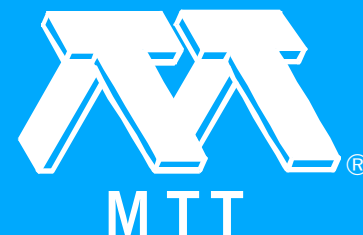
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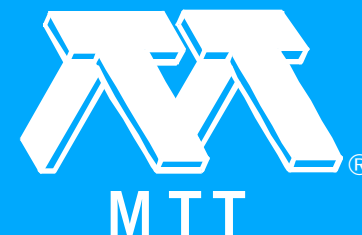
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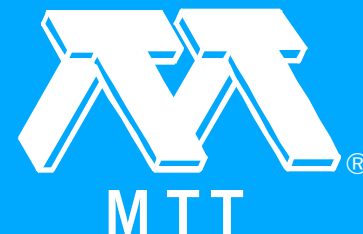
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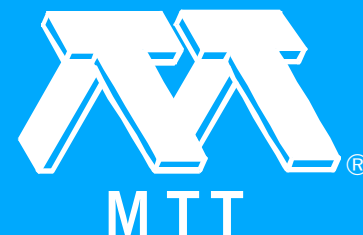
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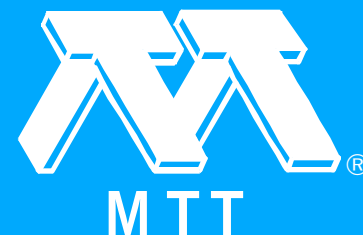
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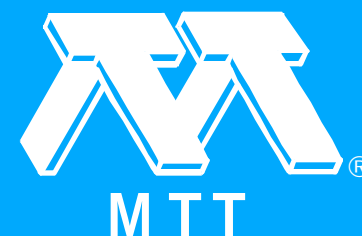
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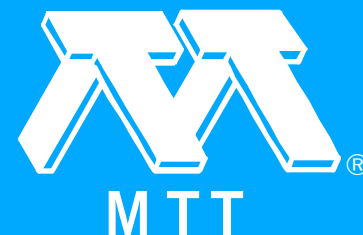
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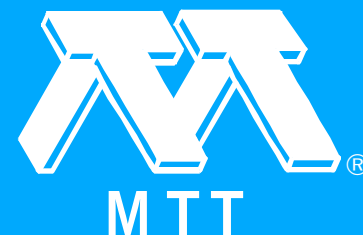
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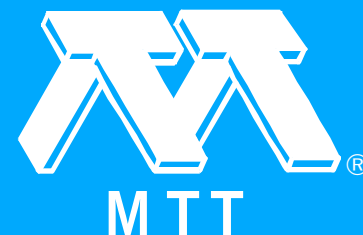
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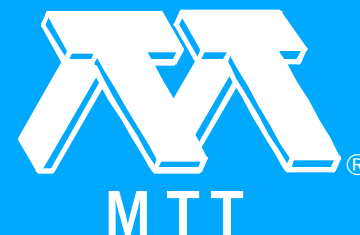
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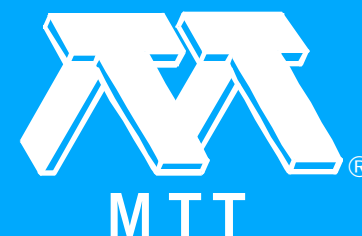
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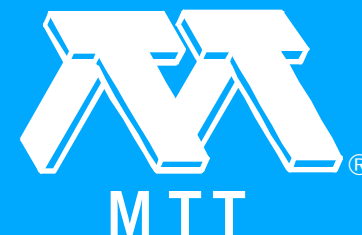
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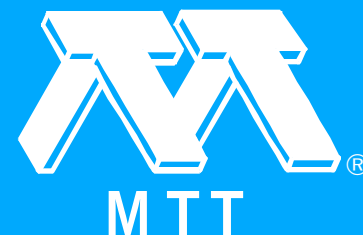
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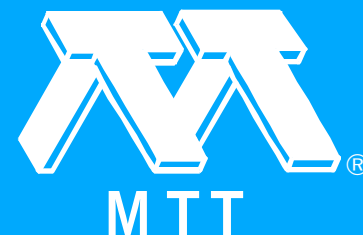
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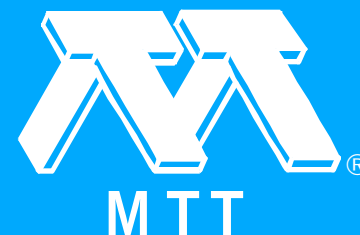
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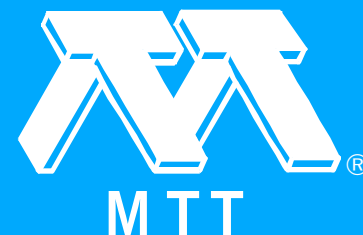
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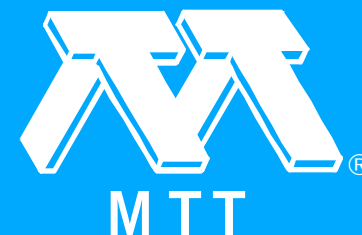
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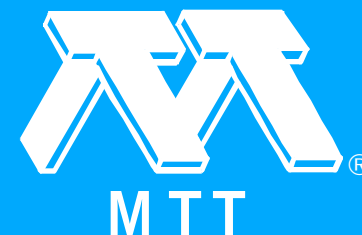
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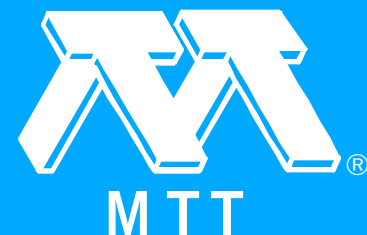
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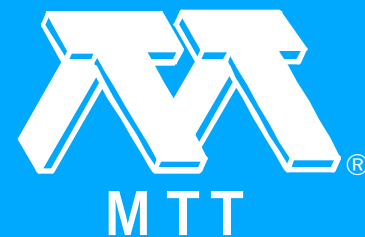
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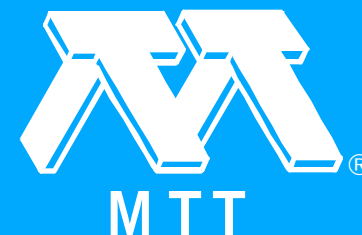
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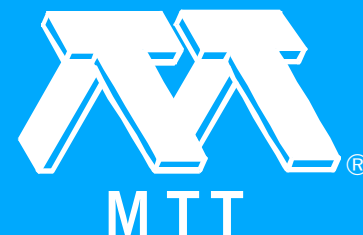
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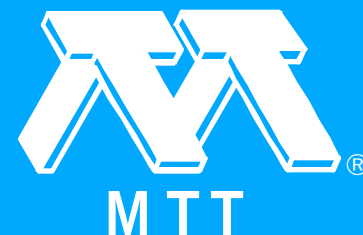
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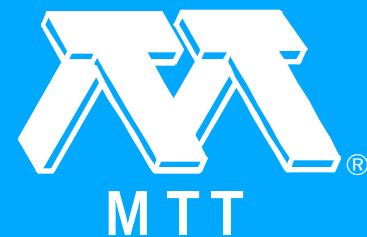
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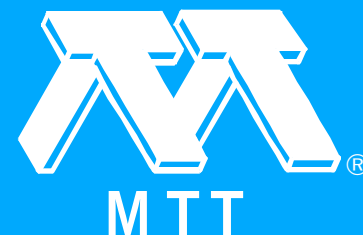
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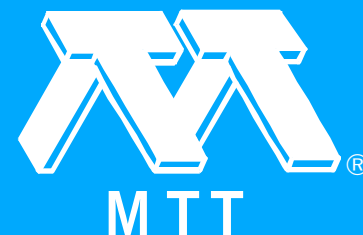
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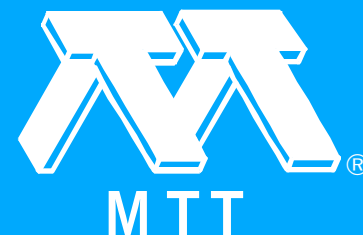
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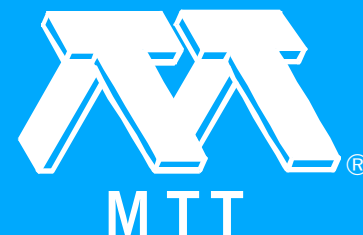
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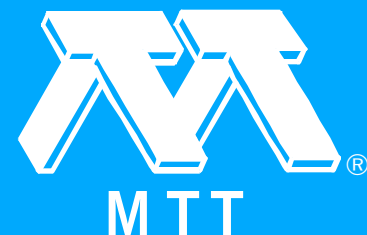
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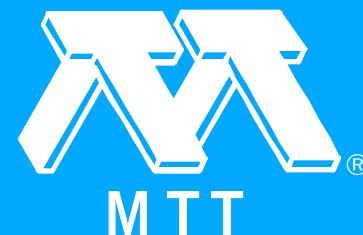
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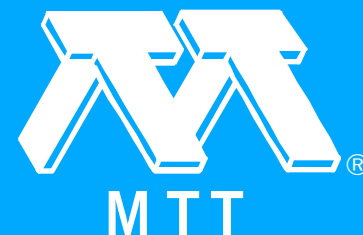
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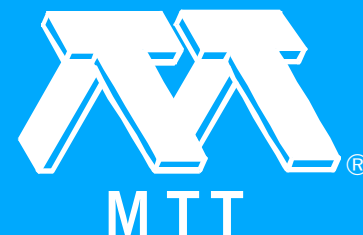
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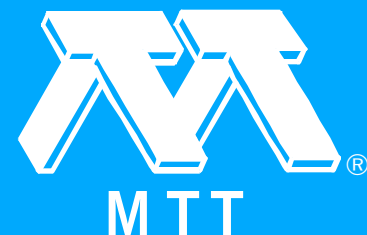
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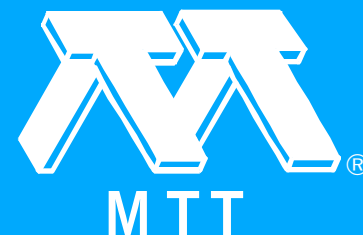
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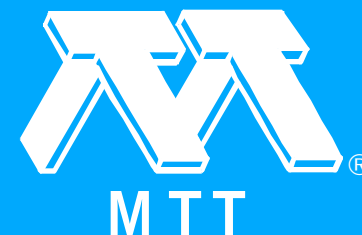
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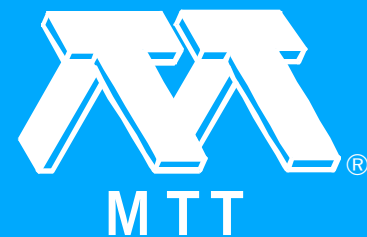
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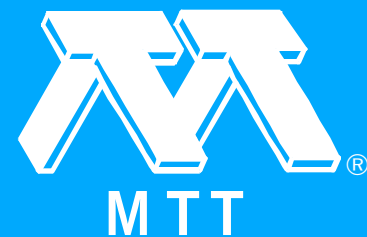
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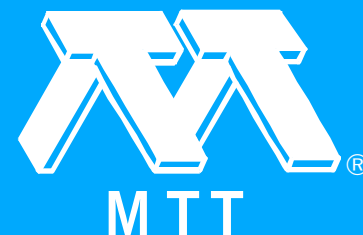
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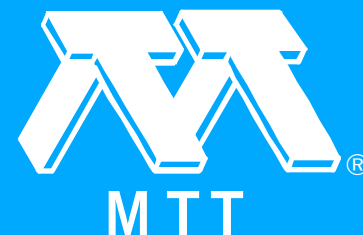
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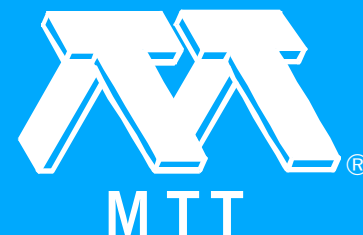
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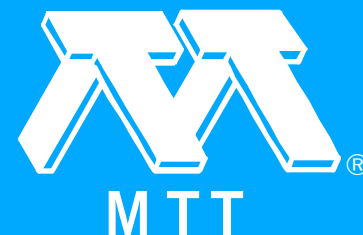
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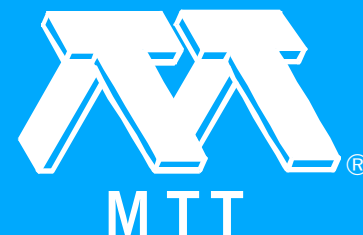
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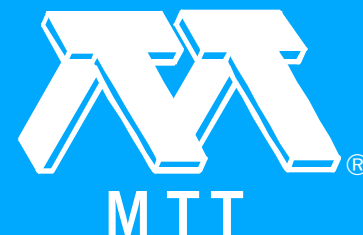
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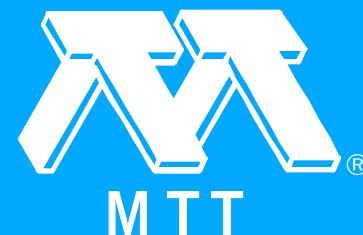
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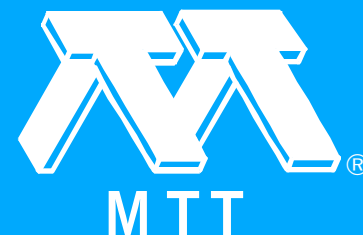
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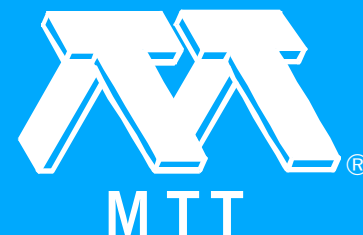
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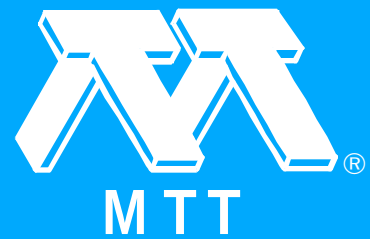
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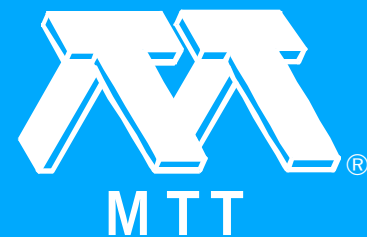
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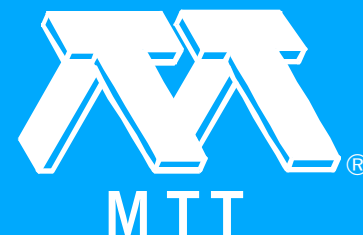
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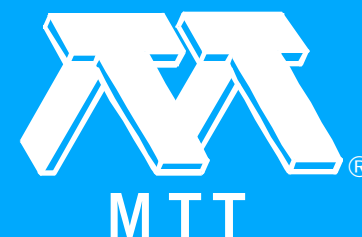
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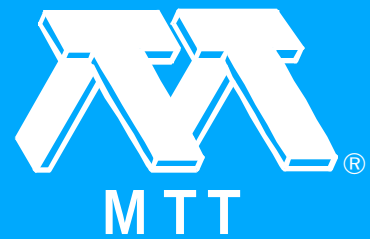
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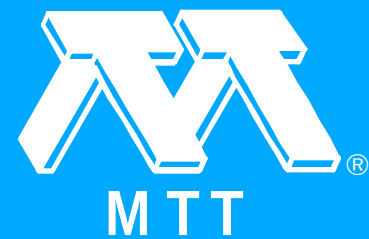
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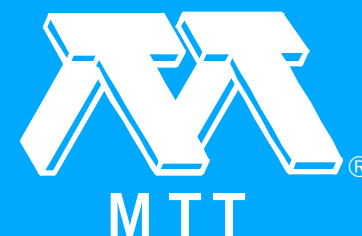
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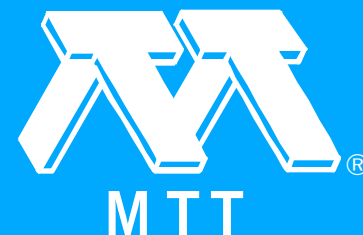
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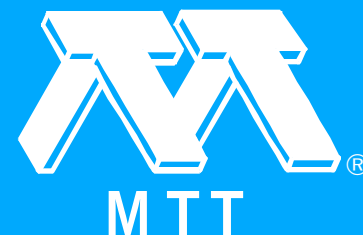
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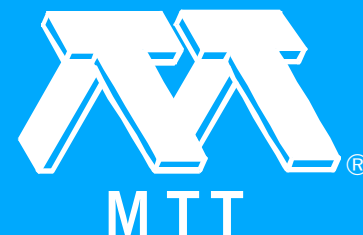
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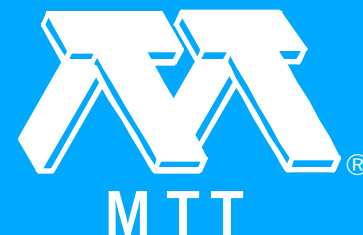
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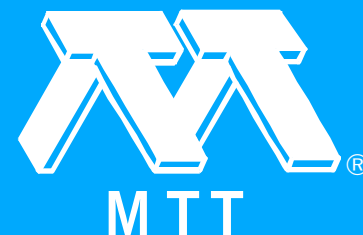
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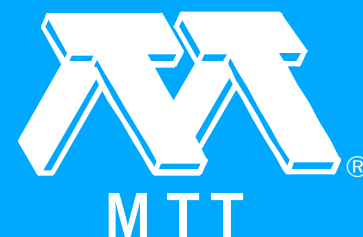
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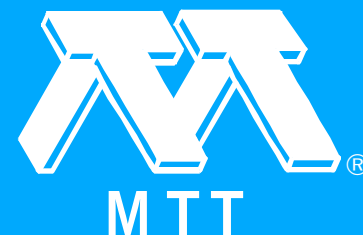
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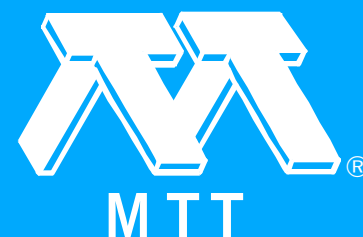
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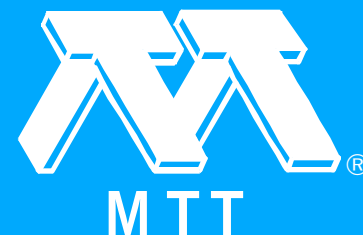
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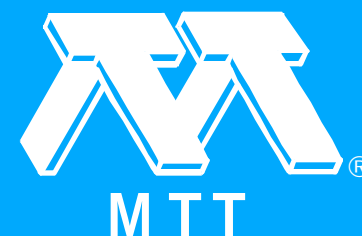
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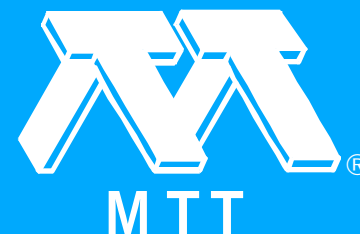
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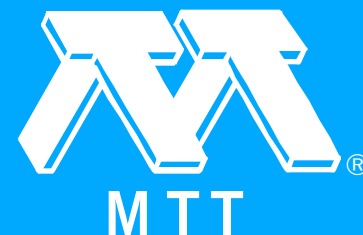
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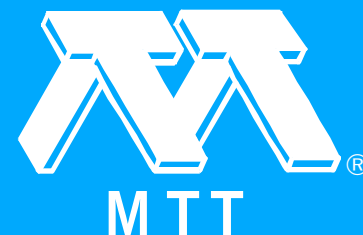
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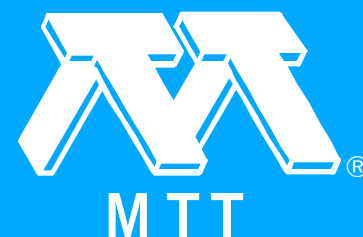
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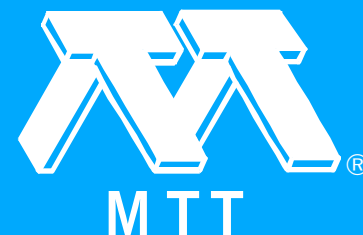
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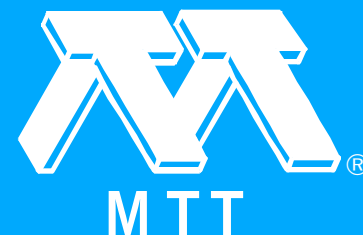
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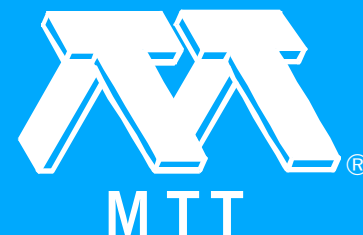
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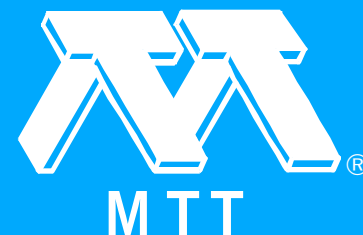
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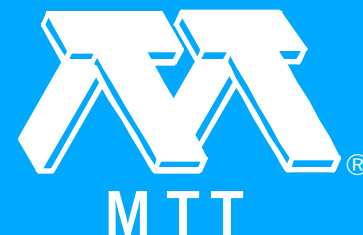
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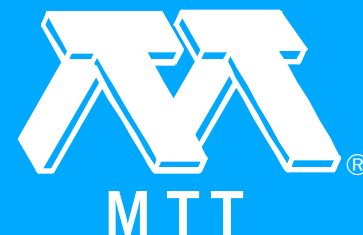
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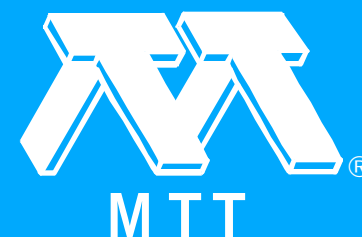
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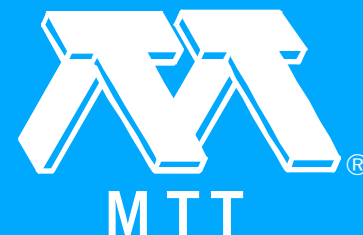
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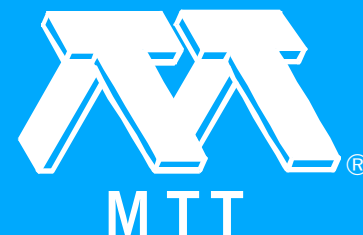
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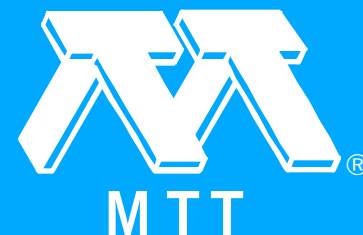
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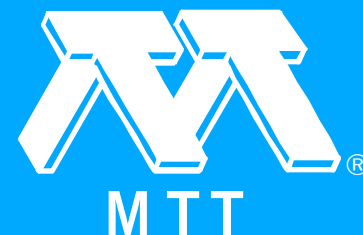
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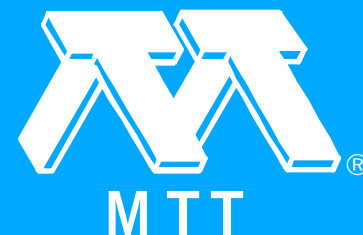
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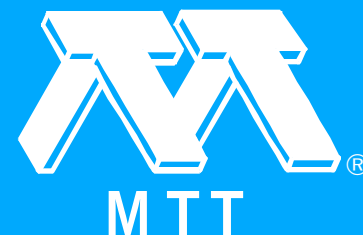
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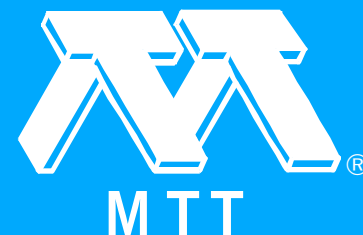
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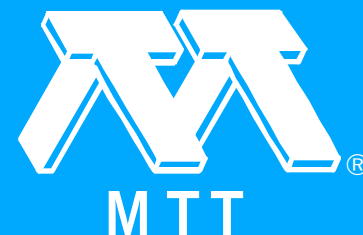


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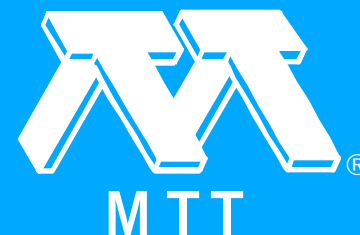
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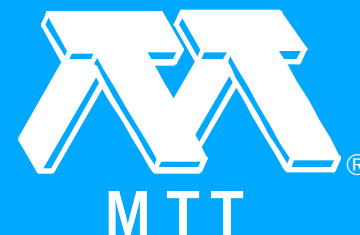
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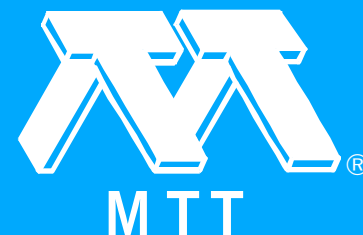
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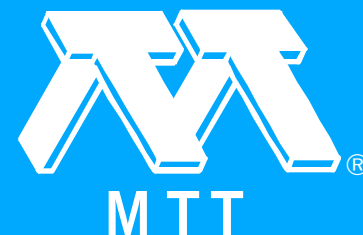


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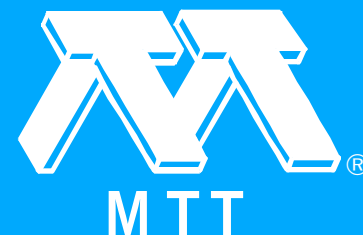
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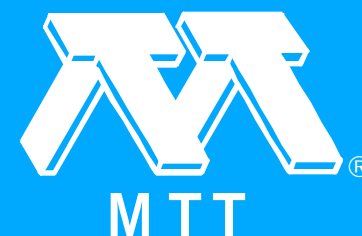
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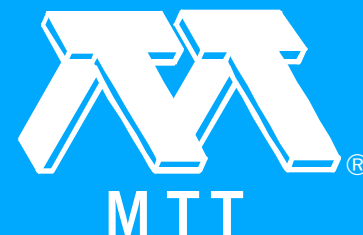
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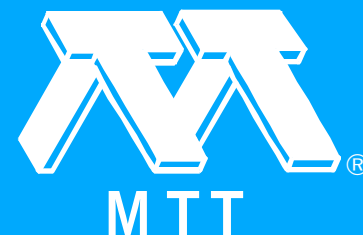
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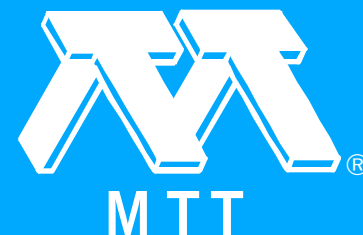


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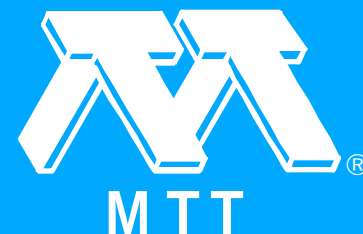
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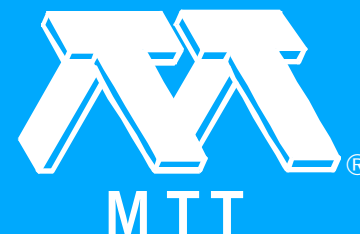
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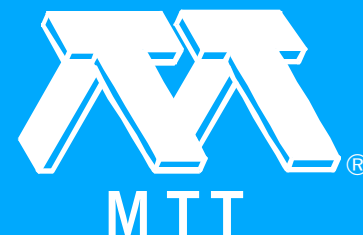
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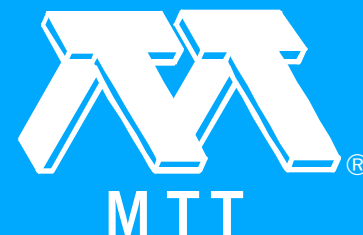
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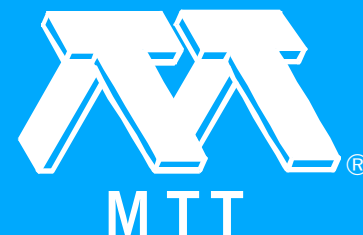
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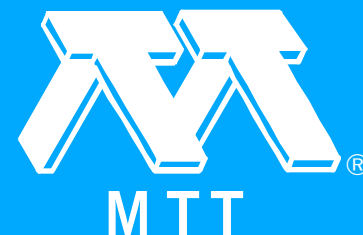


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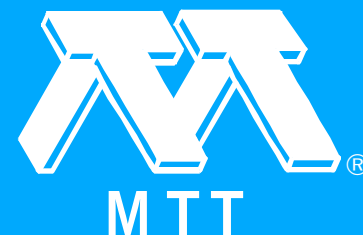
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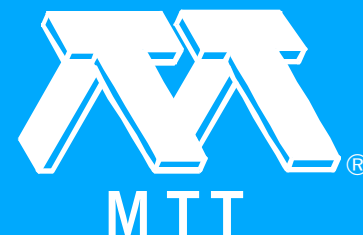
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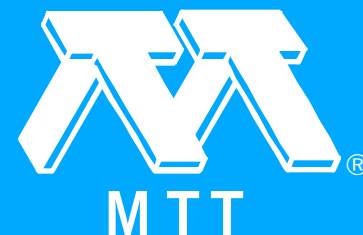
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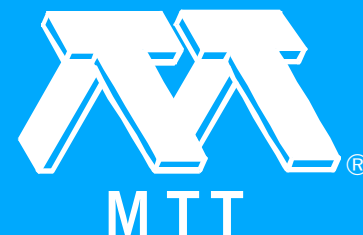
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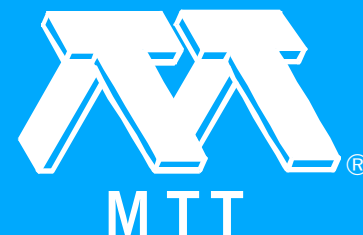
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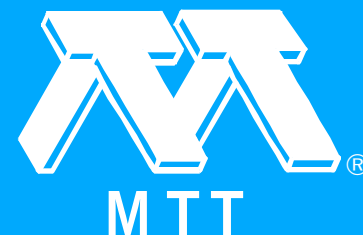
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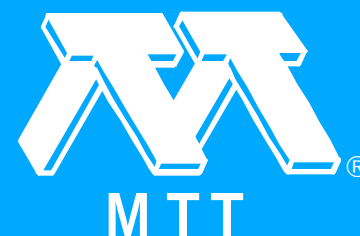
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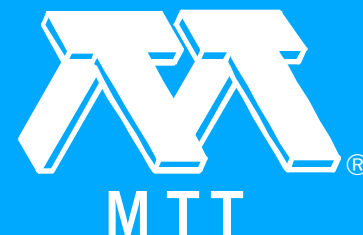
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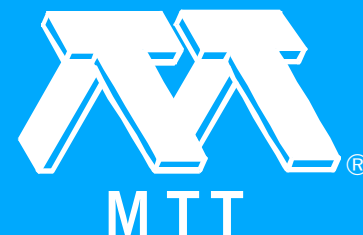
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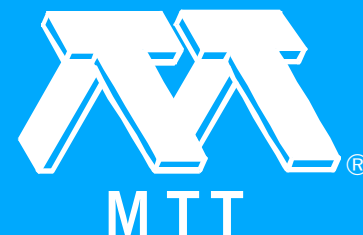
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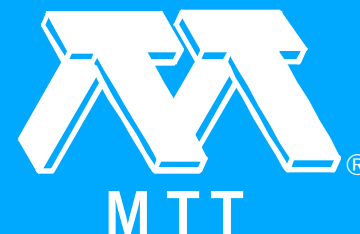
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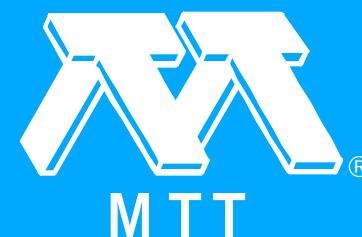
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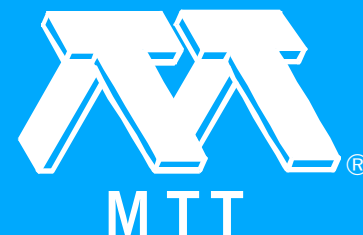


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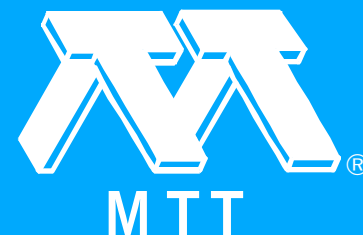
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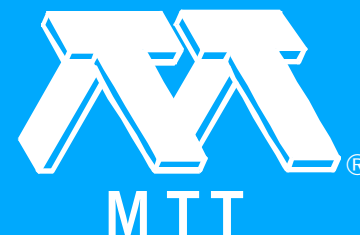
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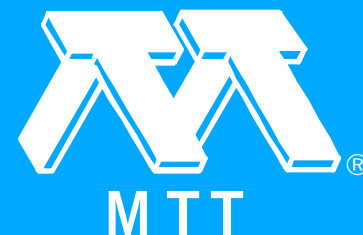
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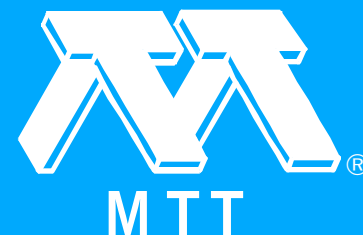


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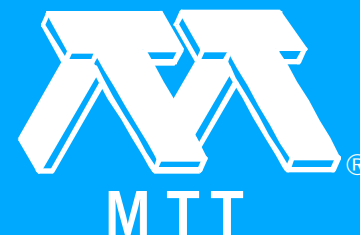
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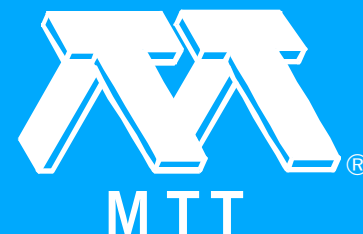
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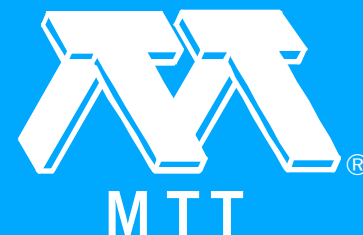
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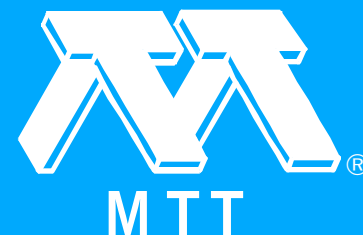


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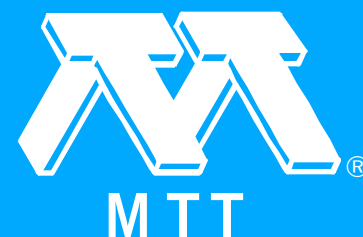


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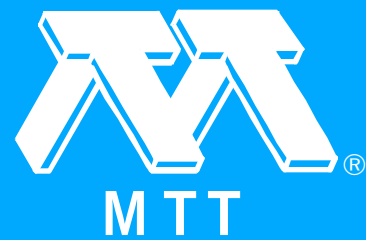
- ❑ Rigorous and efficient fabrication-oriented CAD and optimization of complex waveguide networks (1997 Vol. II [MWSYM])
- ❑ Rigorous and efficient fabrication-oriented CAD and optimization of complex waveguide networks (Dec. 1997, Part II [T-MTT])
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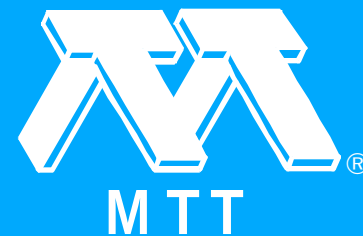
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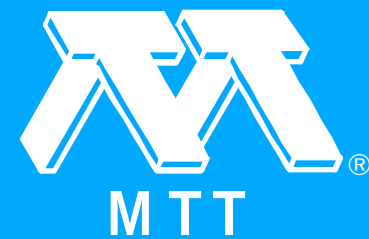
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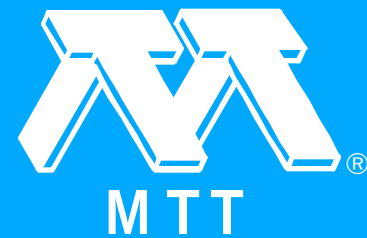


Abstracts

Editorial (Jan. 1997 [T-MTT])

R.J. Trew. "Editorial (Jan. 1997 [T-MTT])." 1997 Transactions on Microwave Theory and Techniques 45.1 (Jan. 1997 [T-MTT]): 1-1.

Over the past two years I have received numerous inquiries concerning the review procedures for both the regular TRANSACTIONS and the Special Issues that we publish periodically. Several enquiries were about the number of reviewers listed on the inside of the back cover. This list indicates reviewers who have actively participated in the review process the preceding year.



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General analytical solutions of static Green's functions for shielded and open arbitrarily multilayered media

K. Li, K. Atsuki and T. Hasegawa. "General analytical solutions of static Green's functions for shielded and open arbitrarily multilayered media." 1997 Transactions on Microwave Theory and Techniques 45.1 (Jan. 1997 [T-MTT]): 2-8.

In this paper, we present for the first time general analytical solutions of the static Green's functions for shielded and open arbitrarily multilayered media. The analytical formulas for the static Green's functions, which are expressed in the form of the Fourier series or the Fourier integrals, have simple form and are applicable to arbitrary number of the dielectric layers. The derivation of the formulas is primarily based on a technique by which a recurrence relation between L layers and $L+1$ layers is developed. Green's functions for a three-layered dielectric structure are given as an example of the general formulas. These general analytical solutions will provide a new and efficient tool to the analysis of the multilayered medium structures.

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Abstracts

An efficient method for analysis of arbitrary nonuniform transmission lines

Ke Lu. "An efficient method for analysis of arbitrary nonuniform transmission lines." 1997 Transactions on Microwave Theory and Techniques 45.1 (Jan. 1997 [T-MTT]): 9-14.

The analytical solution of an ideal linear varied nonuniform transmission line (LNTL) has been obtained and the exact linear two-port ABCD matrix of LNTL has been given correctly for the first time. By using cascaded LNTL sections to approximate an arbitrary characteristic impedance profile, a new technique has been presented in this paper for analyzing an arbitrary nonuniform transmission line (NTL). The technique is far better than the conventional technique in terms of the computational accuracy and intensity since it uses a piecewise-linear characteristic impedance profile in place of the stepped profile used by the conventional technique. Several numerical examples have been given to demonstrate the method.



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Demonstration of photonically controlled GaAs digital/MMIC for RF optical links

I.W. Smith, R.C. Sharp, J.A. Ruiz, M. O'Connell, A. Kelsey, S.E. Davis, S.-L.G. Chu, A. Brunel and K. Tabatabaie-Alavi. "Demonstration of photonically controlled GaAs digital/MMIC for RF optical links." 1997 Transactions on Microwave Theory and Techniques 45.1 (Jan. 1997 [T-MTT]): 15-22.

We report design, fabrication, and test of a monolithic GaAs optoelectronic integrated circuit (OEIC) implementing a broad-band optically driven digital/analog radio frequency (RF) interface. The integrated circuit (IC) was fabricated using a foundry-compatible enhancement/depletion metal-semiconductor field-effect transistor (MESFET) process with no added lithography steps. A single optical fiber carries externally amplitude modulated 0.85- μm light to the on-chip GaAs metal-semiconductor-metal interdigitated photodetector. RF as well as simultaneous digital information encoded at up to 10 Mb/s using a novel waveform set is transmitted over the fiber. The serial digital data is self-clocked into on-chip registers to control the RF signal chain, which includes a three-bit digital attenuator. The circuit operates in an asynchronous mode to detect digital and RF on the single optical-fiber input, control RF level, and transmit the 2-8-GHz RF to the IC's electrical output. Measurements characterizing the RF and digital performance of the IC as well as a demonstration of the full optoelectronic mixed-mode functioning of the IC are presented.

Click on title for a complete paper.



Abstracts

A time-domain full-wave extraction method of frequency-dependent equivalent circuit parameters of multiconductor interconnection lines

Jin Zhao and Zheng-Fan Li. "A time-domain full-wave extraction method of frequency-dependent equivalent circuit parameters of multiconductor interconnection lines." 1997 *Transactions on Microwave Theory and Techniques* 45.1 (Jan. 1997 [T-MTT]): 23-31.

A time-domain full-wave method for the extraction of frequency-dependent equivalent circuit parameters of multiconductor interconnection lines is presented in this paper. The circuit parameters extracted by this method can be inserted into circuit simulation software to investigate time-domain responses of a high-speed IC system with multiconductor interconnects. Because the definitions of the voltage and the current are not unique in full-wave analysis, transformation among circuit parameters according to different definitions of the voltage and current is also presented. The method is based on the finite-difference time-domain (FDTD) method, and the reliability of this method is illustrated by its application to representative problems.



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Abstracts

Reconstruction of nonuniform transmission lines from time-domain reflectometry

Ching-Wen Hsue and Te-Wen Pan. "Reconstruction of nonuniform transmission lines from time-domain reflectometry." 1997 Transactions on Microwave Theory and Techniques 45.1 (Jan. 1997 [T-MTT]): 32-38.

A novel technique is developed to reconstruct the physical structures of a nonuniform transmission line from its time-domain or frequency-domain reflection (scattering) coefficient. This technique takes the past history of reflection processes of nonuniform line into considerations, and its accuracy exceeds that of a conventional time-domain reflectometry (TDR) technique. Experimental results are presented to illustrate the validity of this reconstruction technique.



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A self-consistent method for complete small-signal parameter extraction of InP-based heterojunction bipolar transistors (HBT's)

J.M.M. Rios, L.M. Lunardi, S. Chandrasekhar and Y. Miyamoto. "A self-consistent method for complete small-signal parameter extraction of InP-based heterojunction bipolar transistors (HBT's)." 1997 Transactions on Microwave Theory and Techniques 45.1 (Jan. 1997 [T-MTT]): 39-45.

A complete method for parameter extraction from small-signal measurements of InP-based heterojunction bipolar transistors (HBT's) is presented. Employing analytically derived equations, a numerical solution is sought for the best fit between the model and the measured data. Through parasitics extraction and an optimization process, a realistic model for a self-aligned HBT technology is obtained. The results of the generated s-parameters from the model for a $2 \times 10^{-4} \text{ cm}^2$ emitter area device are presented over a frequency range of 250 MHz-36 GHz with excellent agreement to the measured data.



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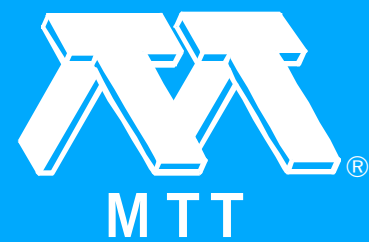
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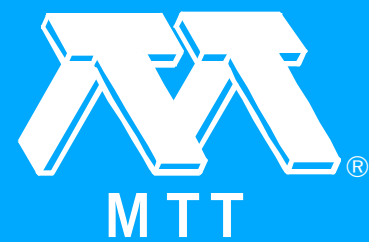
A table-based bias and temperature-dependent small-signal and noise equivalent circuit model

P.B. Winson, S.M. Lardizabal and L. Dunleavy. "A table-based bias and temperature-dependent small-signal and noise equivalent circuit model." 1997 Transactions on Microwave Theory and Techniques 45.1 (Jan. 1997 [T-MTT]): 46-51.

A new algorithm is presented for construction of accurate table-based bias and temperature dependent field-effect transistor (FET) small-signal and noise models. The algorithm performs two-dimensional (2-D) linear interpolation on a single stored data table to quickly produce bias and temperature-dependent model simulations. Comparisons of simulated FET S-parameters, noise figure, and device figures of merit (e.g., $G_{\text{sub max}}$) versus measured data show the model to be accurate over a wide range of bias and temperatures. Model enabled simulations of a single-stage FET-based low-noise monolithic microwave integrated circuit (MMIC) amplifier are also shown to compare favorably with measured amplifier data. The new algorithm improves on previously available approaches in three ways: (1) it allows efficient and accurate small signal device and circuit simulations over bias and temperature; (2) it allows circuit optimization with respect to bias and temperature; and (3) it provides substantial data storage reduction over alternate approaches. Because one compact data table represents a single sample device, the approach can be readily adapted for use in a statistical FET model data base.

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Noniterative stable transmission/reflection method for low-loss material complex permittivity determination

A.-H. Boughriet, C. Legrand and A. Chapoton. "Noniterative stable transmission/reflection method for low-loss material complex permittivity determination." 1997 Transactions on Microwave Theory and Techniques 45.1 (Jan. 1997 [T-MTT]): 52-57.

This paper describes a new noniterative transmission/reflection method applicable to permittivity measurements using arbitrary sample lengths in wide-band frequencies. This method is based on a simplified version of the well-known Nicolson-Ross-Weir (NRW) method. For low-loss materials, this method is stable over the whole frequency range: no divergence is observed at frequencies corresponding to integer multiples of one half wavelength in the sample. The accuracy on the dielectric permittivity is similar to that obtained with a more recently proposed iterative technique. A general equation for complex permittivity determination including the Stuchly, NRW, and new noniterative methods, is also proposed.

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Large-signal microwave characterization of AlGaAs/GaAs HBT's based on a physics-based electrothermal model

C.M. Snowden. "Large-signal microwave characterization of AlGaAs/GaAs HBT's based on a physics-based electrothermal model." 1997 Transactions on Microwave Theory and Techniques 45.1 (Jan. 1997 [T-MTT]): 58-71.

A physics-based multicell electrothermal equivalent circuit model is described that is applied to the large-signal microwave characterization of AlGaAs/GaAs HBT's. This highly efficient model, which incorporates a new multifinger electrothermal model, has been used to perform dc, small-signal and load-pull characterization, and investigate parameter-spreads due to fabrication process variations. An enhanced Newton algorithm is presented for solving the nonlinear system of equations for the model and associated circuit simulator, which allows a faster and more robust solution than contemporary quasi-Newton nonlinear schemes. The model has been applied to the characterization of heterojunction bipolar transistor (HBT) microwave power amplifiers.

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Wave-beam shaping using multiple phase-correction mirrors

Y. Hirata, Y. Mitsunaka, K. Hayashi and Y. Itoh. "Wave-beam shaping using multiple phase-correction mirrors." 1997 Transactions on Microwave Theory and Techniques 45.1 (Jan. 1997 [T-MTT]): 72-77.

This paper describes a scheme for shaping a given wave beam into the desired profile using multiple phase-correction mirrors. This mirror system was applied to a gyrotron internal converter to flatten the radiated beam profile at the window. The flat output beam is reconverted into HE₁₁ mode, a basic propagation mode for corrugated waveguides, by another pair of phase-correction mirrors for transmission into a fusion reactor. In addition, a wave-beam splitting and combining technique is also presented.





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A Millimeter-Wave Band MMIC Dual-Quadrature Up-Converter Using Multilayer Directional Couplers

A. Minakawa, T. Imaoka and N. Imai. "A Millimeter-Wave Band MMIC Dual-Quadrature Up-Converter Using Multilayer Directional Couplers." 1997 Transactions on Microwave Theory and Techniques 45.1 (Jan. 1997 [T-MTT]): 78-82.

This paper describes a newly developed monolithic-microwave integrated circuit (MMIC) dual-quadrature up-converter with very high local oscillator (LO) signal leakage suppression and good LO and RF return loss for use in the millimeter-wave band. The dual-quadrature LO suppression technique is also described, and the requirements for an imbalance in the quadrature couplers to obtain large LO suppression are clarified. The up-converter consists of two unit mixers and two high-performance multilayer directional couplers. These high-performance directional couplers enable large LO suppression. In an LO frequency range from 42.5 to 47.5 GHz, the MMIC up-converter achieved a conversion loss of less than 17=1 dB, and the LO was suppressed 22=4 dB lower than the desired RF output signal, which is the greatest value among those reported.

[Click on title for a complete paper.](#)



Adaptive nulling loop control for 1.7-GHz feedforward linearization systems

E.E. Eid and F.M. Ghannouchi. "Adaptive nulling loop control for 1.7-GHz feedforward linearization systems." 1997 Transactions on Microwave Theory and Techniques 45.1 (Jan. 1997 [T-MTT]): 83-86.

An adaptive analog control system is introduced for the nulling loop (first loop) of a 1.7-GHz feedforward linearization system. The sensitivity to temperature and frequency variations is experimentally shown for a conventional feedforward system, leading to the need for an adaptive control system. Two error signals based on detected power levels are introduced and used to control the nulling loop vector modulator to ensure cancellation of the main signal. Finally, the experimental performance of this system is presented.

Abstracts

On the nature of critical points in leakage regimes of a conductor-backed coplanar strip line

A.B. Yakovlev and G.W. Hanson. "On the nature of critical points in leakage regimes of a conductor-backed coplanar strip line." 1997 Transactions on Microwave Theory and Techniques 45.1 (Jan. 1997 [T-MTT]): 87-94.

Leaky dominant mode propagation regimes of a conductor-backed coplanar strip line are rigorously analyzed using the concept of critical or equilibrium points from catastrophe and bifurcation theories, in conjunction with a full-wave integral equation solution. The existence of nondegenerate or Morse critical points (MCPs) and degenerate or fold (turning) critical points (FPs) in coupling and leakage regions are associated with the occurrence of improper real and complex (leaky) solutions. The locations and types of critical points determine the stability and instability of the transmission line system with respect to small changes in geometrical parameters. The dispersion behavior of improper real and complex (leaky) solutions are efficiently reproduced in the local neighborhood of MCPs and FPs using a Taylor series expansion about those points. The qualitative and quantitative dynamic behavior of the transmission line modes can be investigated by examining the evolution of nondegenerate and degenerate points versus some structural parameter, such as strip width. The proposed analysis enables the prediction of bifurcation situations and the existence of improper real and complex solutions and gives a complete description of the system's structural behavior.



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Millimeter-wave wide-band amplifiers using multilayer MMIC technology

T. Imaoka, S. Banba, A. Minakawa and N. Imai. "Millimeter-wave wide-band amplifiers using multilayer MMIC technology." 1997 Transactions on Microwave Theory and Techniques 45.1 (Jan. 1997 [T-MTT]): 95-101.

This paper describes millimeter-wave wide-band single-ended and balanced amplifiers using novel multilayer monolithic microwave/millimeter-wave integrated circuit (MMIC) technology. The fundamental characteristics of thin-film transmission lines and a 50-GHz-band multilayer MMIC directional coupler are described through measurements up to 60 GHz. A single-ended amplifier fabricated in a 1.1 mm/spl times/0.8 mm area, shows a gain of about 12 dB with a noise figure of better than 5 dB around 50 GHz. A balanced amplifier fabricated using the multilayer MMIC directional couplers and single-ended amplifiers, shows a gain of 10-17 dB with input and output return losses of better than 14 dB from 33 to 53 GHz. The transmission lines and directional couplers can be effectively combined with millimeter-wave active circuits without degrading the circuit performance or increasing the circuit area. To our knowledge, these are the first millimeter-wave active circuits employing multilayer MMIC technology.

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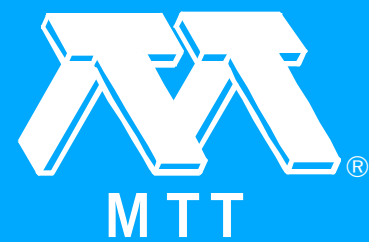
Radiation properties of circumferential slots on a coaxial cable

Jean-Fu Kiang. "Radiation properties of circumferential slots on a coaxial cable." 1997 Transactions on Microwave Theory and Techniques 45.1 (Jan. 1997 [T-MTT]): 102-107.

Both the Galerkin's and mode-matching methods are used to analyze the reflection and radiation properties of a coaxial cable with a circumferential slot on the outer conductor. The effects of higher order modes are also included. The accumulated effect of multiple slots on the reflected signal is also studied by using a Monte Carlo simulation.

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Complete FDTD analysis of microwave heating processes in frequency-dependent and temperature-dependent media

F. Torres and B. Jecko. "Complete FDTD analysis of microwave heating processes in frequency-dependent and temperature-dependent media." 1997 Transactions on Microwave Theory and Techniques 45.1 (Jan. 1997 [T-MTT]): 108-117.

It is well known that the temperature rise in a material modifies its physical properties and, particularly, its dielectric permittivity. The dissipated electromagnetic power involved in microwave heating processes depending on $\epsilon''(\omega)$, the electrical characteristics of the heated media must vary with the temperature to achieve realistic simulations. In this paper, we present a fast and accurate algorithm allowing, through a combined electromagnetic and thermal procedure, to take into account the influence of the temperature on the electrical properties of materials. First, the temperature dependence of the complex permittivity ruled by a Debye relaxation equation is investigated, and a realistic model is proposed and validated. Then, a frequency-dependent finite-differences time-domain (FDTD) method is used to assess the instantaneous electromagnetic power lost by dielectric hysteresis. Within the same iteration, a time-scaled form of the heat transfer equation allows one to calculate the temperature distribution in the heated medium and then to correct the dielectric properties of the material using the proposed model. These new characteristics will be taken into account by the EM solver at the next iteration. This combined algorithm allows a significant reduction of computation time. An application to a microwave oven is proposed.



Numerical computation of fat layer effects on microwave near-field radiation to the abdomen of a full-scale human body model

H.-R. Chuang. "Numerical computation of fat layer effects on microwave near-field radiation to the abdomen of a full-scale human body model." 1997 Transactions on Microwave Theory and Techniques 45.1 (Jan. 1997 [T-MTT]): 118-125.

Numerical computation results of fat layer effects on the microwave near field radiation to the abdomen of a three-dimensional (3-D) full-scale human body model are presented. The human body is modeled as a 3-D homogeneous muscle phantom with a fat layer covering the abdomen part. The dipole wire-antenna located proximate to the abdomen is used as the microwave radiation source at 915 MHz. This is to study the effects on hyperthermia heating by using the microwave applicator (at 915 MHz) or the near-field exposure from the proximate handset antenna to the human body at ISM band wireless communication band (902-928 MHz). Coupled integral equations (CIE) and the method of moments (MoM) are employed to numerically compute electromagnetic (EM) energy deposition specific absorption rate (SAR) from the radio frequency (RF) antenna applicator into the proximate fat layer covered abdomen. The antenna input impedance (proximate to the body), return loss (RL), and the resonant antenna length (proximate to the body) will also be numerically determined to increase the microwave power delivered into the body. The study of fat layer effects is important for microwave hyperthermia applications. It is also important for the investigation of the potential health hazard from the near-field radiation of a wireless communication antenna.



Abstracts

A systematic design method of multilayer composite-glass with thin metallic layer

B.F. Wang, W.J. Zhang and Wai-Kai Chen. "A systematic design method of multilayer composite-glass with thin metallic layer." 1997 Transactions on Microwave Theory and Techniques 45.1 (Jan. 1997 [T-MTT]): 126-129.

A new design method for multilayer composite glass with absorbing thin film is presented. This composite glass has a high microwave reflective factor and good transparency in the visible light region. It is useful in vehicle stealth technology and microwave protection of a large-capacity microwave transmission system.



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Duality transformation for nonreciprocal and nonsymmetric transmission lines

I.V. Lindell and A.H. Sihvola. "Duality transformation for nonreciprocal and nonsymmetric transmission lines." 1997 Transactions on Microwave Theory and Techniques 45.1 (Jan. 1997 [T-MTT]): 129-131.

Duality transformation is introduced to the theory of generalized (nonreciprocal and nonsymmetric) transmission lines making it possible to find solutions to problems in terms of solutions to dual problems without having to go through the solution process. The generalized transmission lines have emerged when more general media have been introduced to classical waveguide geometries, for example, microstrip lines on chiral substrates. It is seen that there actually exist two duality transformations and the self-dual voltage and current solutions are propagating waves in the transmission line. The transformation can be, e.g., applied to transform a nonsymmetric transmission line to a symmetric one.

Abstracts

A new model of generalized inverter and its applications

Jun Chen, Wei Hong and Changhong Liang. "A new model of generalized inverter and its applications." 1997 Transactions on Microwave Theory and Techniques 45.1 (Jan. 1997 [T-MTT]): 132-135.

A new model of generalized inverter is presented, The model is generalized from the conventional K-, J-inverter. So it is easy to be applied directly to design microwave circuits such as impedance transformers, filters, and couplers of any complex discontinuities, when the symmetrical and asymmetrical networks are involved. The theory based on the new model is developed to enrich the microwave theory on network synthesis. Examples are given to show the effectiveness and convenience in application.



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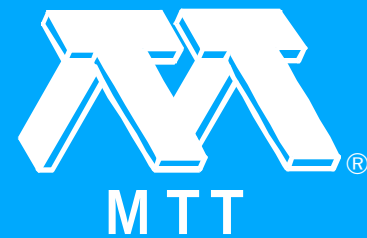


Abstracts

A design procedure for monolithic matrix amplifier

C. Paoloni and S. D'Agostino. "A design procedure for monolithic matrix amplifier." 1997 Transactions on Microwave Theory and Techniques 45.1 (Jan. 1997 [T-MTT]): 135-139.

A procedure for the design of monolithic matrix amplifier is proposed. A simplified expression for small signal gain based on unilateral field-effect transistor (FET) model is derived. In particular, the Design-Oriented FET model previously published is adopted. The introduction of a set of design charts allows the designer a fast and accurate prediction of low frequency gain and 3-dB cutoff frequency of a given matrix amplifier. Good agreement with experimental data and simulations confirms the validity of the proposed design method.



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Calculation of distributed capacitances of spiral resonators

Zunfu Jiang, P.S. Excell and Z.M. Hejazi. "Calculation of distributed capacitances of spiral resonators." 1997 Transactions on Microwave Theory and Techniques 45.1 (Jan. 1997 [T-MTT]): 139-142.

A method for calculating the distributed capacitances and resonant frequencies of spiral resonators is described. First, the charge distribution on a spiral is found by a simplified model and the moment method, then the distributed capacitance is calculated. The equivalent inductance of the spiral resonator is then evaluated according to a standard formula, and the resonant frequencies are finally computed. The calculated results are compared with experimental data, and a good agreement between them is shown.





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Design of modified phase reversal electrode in broad-band electrooptic modulators at 100 GHz

Kwok-Wah Hui, B.Y. Wu, Y.M. Choi, J.H. Peng and K.S. Chiang. "Design of modified phase reversal electrode in broad-band electrooptic modulators at 100 GHz." 1997 Transactions on Microwave Theory and Techniques 45.1 (Jan. 1997 [T-MTT]): 142-145.

An analysis is given on the modified phase reversal structure of electro-optic modulators. It is shown that the bandwidth to half-wave voltage ratio (BVR) increases with the number of phase reversal sections. Under the assumption that the number of electrode sections is M , a set of M -elements second-order nonlinear equations has been derived and solved by Newton's iteration method. The calculated results provide the optimum overlap integral for each section of a phase reversal modulator in order to "flatten" the frequency response of the device.

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A resonant-cap power combiner for two-terminal millimeter-wave devices

T. Bauer, J. Freyer and M. Claassen. "A resonant-cap power combiner for two-terminal millimeter-wave devices." 1997 Transactions on Microwave Theory and Techniques 45.1 (Jan. 1997 [T-MTT]): 146-148.

A power combiner for three active two-terminal devices located under a common resonant cap is presented. An equivalent circuit with lumped elements describing the coupling between the devices is derived from a numerical finite-element simulation of the resonator. The applied monolithically integrated mounting technique for the active devices minimizes parasitic elements and gains high reproducibility and symmetry. Experimental results with GaAs IMPATT diodes on diamond heatsink of up to 500 mW at 91 GHz with a dc to RF conversion efficiency of 9.0% and excellent combining efficiency demonstrate the capability for power generation in the mm-wave region.

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A physical, yet simple, small-signal equivalent circuit for the heterojunction bipolar transistor

Y. Gobert, P.J. Tasker and K.H. Bachem. "A physical, yet simple, small-signal equivalent circuit for the heterojunction bipolar transistor." 1997 Transactions on Microwave Theory and Techniques 45.1 (Jan. 1997 [T-MTT]): 149-153.

A physical, yet simple, small-signal equivalent circuit for the heterojunction bipolar transistor (HBT) is proposed. This circuit was established by analyzing in detail the physical operation of the HBT. The model verification was carried out by comparison of the measured and simulated S- and Z-parameters for both passive (reverse-biased) and active bias conditions. A feature of this model is that it uses a direct extraction method to determine the parasitic elements, in particular, the parasitic capacitances. The excellent agreement between the measured and simulated parameters was verified all over the frequency range from 0.25 to 75 GHz.

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A rigorous analysis of a cross waveguide to large circular waveguide junction and its application in waveguide filter design

Ke-Li Wu and R.H. MacPhie. "A rigorous analysis of a cross waveguide to large circular waveguide junction and its application in waveguide filter design." 1997 Transactions on Microwave Theory and Techniques 45.1 (Jan. 1997 [T-MTT]): 153-157.

A rigorous analysis is obtained for the problem of scattering at the junction of a cross-shaped waveguide and a larger circular waveguide. The general case of an arbitrary offset and orientation of the cross waveguide axes is considered. The fields matching over the cross aperture of the smaller guide is facilitated by using the transformation of the circular cylindrical Bessel-Fourier modal fields of the circular guide into a finite series of exponential plane wave functions. This permits an analytical finite series solution for the elements of the fields mode matching matrix, from which the general scattering matrix of the junction is obtained. The application of the formulation to circular waveguide filter design is emphasized in the numerical examples. Excellent agreements between theoretical and experimental results are obtained in all the numerical examples.

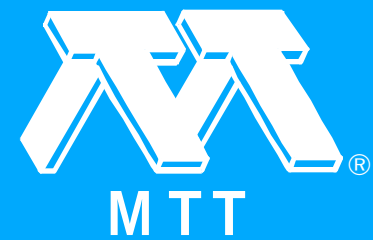
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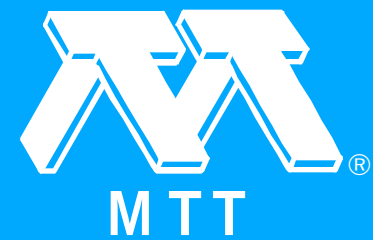
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Field analysis of rectangular waveguide open junction

C.T. Iatrou and M. Cavenago. "Field analysis of rectangular waveguide open junction." 1997 Transactions on Microwave Theory and Techniques 45.2 (Feb. 1997 [T-MTT]): 165-172.

The problem of a rectangular waveguide open junction is investigated using field theory and the relevant model of two normally intersected, infinite parallel-planes waveguides. Evanescent waveguide modes generated by waveguide wall edges and/or the discontinuity in dielectric are taken into account; an infinite set of equations is derived, where the mode coupling is given by the dielectric slab modes. Proper pole handling is discussed, and a solution for the system is given. Expressions are derived for the reflected, transmitted, and radiated power, which are shown to be sufficiently reliable in the domain of practical interest, regarding the width and the dielectric loading of the gap. The analysis shows that a substantial fraction of the microwave power leaks from the dielectric gap, confirming the absolute necessity of using a choke-flange at the waveguide junction.

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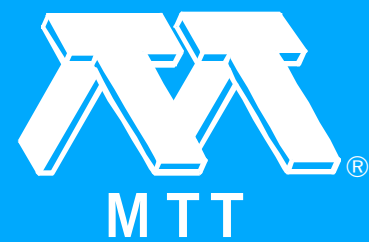
Nonlinearity of superconducting transmission line and microstrip resonator

O.G. Vendik, I.B. Vendik and T.B. Samoilova. "Nonlinearity of superconducting transmission line and microstrip resonator." 1997 Transactions on Microwave Theory and Techniques 45.2 (Feb. 1997 [T-MTT]): 173-178.

The simplest model of nonlinear response of a superconducting thin film is used for modeling the nonlinear phenomena in a superconducting transmission line and a microstrip resonator. The specified characteristic power of the transmission line is suggested to use as a fitting parameter for numerical description of the microstrip line nonlinearity at microwaves. Quantitative agreement of simulated and experimental data has been obtained for the incident power dependent transmission coefficient of a microstrip line section and a high quality microstrip resonator. Numerical results have also been obtained for the power of the third harmonic radiated from the nonlinear resonator.

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An original approach to the design of bandpass cavity filters with multiple couplings

G. Macchiarella. "An original approach to the design of bandpass cavity filters with multiple couplings." 1997 Transactions on Microwave Theory and Techniques 45.2 (Feb. 1997 [T-MTT]): 179-187.

A novel approach to the design of general cavity filters with each cavity coupled to an arbitrary number of other cavities is presented. This approach is based on a suitable characterization of the filter structure which does not require one to model separately the cavities (resonators) and the coupling elements. Suitably defined equivalent admittances are associated with each cavity allowing one to design the filter structure once the parameters of a suitable low-pass prototype are given; an efficient procedure for the synthesis of such a prototype with equiripple passband response is also presented which allows one to arbitrarily prescribe transmission zeros placed in the complex plane (even asymmetrically). The described design approach is particularly convenient when the filter structure does not allow a simple modeling of the resonators and coupling elements separately. This is the case of slot-coupled cavity filters and of filter structures based on arrays of coupled transmission lines. It is also shown that the simplified design approach often adopted in the past, where only two coupled cavities at a time are considered, can produce large errors even in the case of filters with all attenuation poles at infinity (i.e., two couplings per cavity).

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Monolithic MESFET distributed baluns based on the distributed amplifier gate-line termination technique

A.H. Barea and I.D. Robertson. "Monolithic MESFET distributed baluns based on the distributed amplifier gate-line termination technique." 1997 Transactions on Microwave Theory and Techniques 45.2 (Feb. 1997 [T-MTT]): 188-195.

The principles of the distributed amplifier are applied to realize wide-band monolithic distributed baluns. The technique reported here is based on using the gate-line "termination" of a distributed amplifier topology as the noninverting output and the inherent phase inversion property of the metal-semiconductor field-effect transistor (MESFET) to provide the antiphase output from the drain-line. Closed-form expressions are derived for the two output voltage signals and their respective power gains. The theoretical performance of the balun is then examined as a function of the important MESFET parameters and other circuit parameters. Some practical design considerations are given followed by the measured results of two monolithic prototypes. The first is a basic two-section balun, while the second employs a four-section balun with a three-stage positive gain slope preamplifier to compensate for the increase in gate-line loss with frequency. Balun operation over 0.5-20 GHz and 0.5-12 GHz has been demonstrated for the two-section and four-section balun, respectively.

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A new approach for a phase controlled self-oscillating mixer

Xue-Song Zhou, Xiangdong Zhang and A.S. Daryoush. "A new approach for a phase controlled self-oscillating mixer." 1997 Transactions on Microwave Theory and Techniques 45.2 (Feb. 1997 [T-MTT]): 196-204.

The analytical and experimental demonstration of subharmonic synchronization and phase shifting of a push-pull self-oscillating mixer is presented for the first time. Inherent high mixing gain of the self-oscillating mixer circuit is exploited to generate a strong signal at the same frequency of the reference signal, which is related to the local oscillator's (LO) phase information. A phase error between this signal and the reference signal is extracted in a phase comparator before phase locking. Analytical modeling of frequency and phase stabilization of the push-pull self-oscillating mixer is presented, which is also experimentally verified for a self-oscillating mixer at 12 GHz. This self-oscillating mixer circuit demonstrates efficient phase locking, 0/spl deg/-180/spl deg/ continuous phase shifting capability in addition to the reported large locking range (>10 MHz), low close-in to carrier phase noise (<7 dB degradation of a 6 GHz synthesized reference signal), and a high mixer conversion gain (>17 dB at 17 GHz). The demonstrated subharmonic phase locking approach replaces the need for a frequency multiplier or divider before the phase comparator. The synchronized push-pull self-oscillating mixer circuit is applicable to the millimeter-wave frequency distributed transmitters and receivers, where low-loss phase shifting and efficient subharmonic phase and frequency locking are hard to achieve.





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Hybrid-mode analysis of multilayered and multiconductor transmission lines

M.S. Alam, M. Koshiba, K. Hirayama and Y. Hayashi. "Hybrid-mode analysis of multilayered and multiconductor transmission lines." 1997 Transactions on Microwave Theory and Techniques 45.2 (Feb. 1997 [T-MTT]): 205-211.

Hybrid-mode propagation properties of multilayered and multiconductor transmission lines are studied by using an efficient vector finite element method (FEM) with high-order hybrid edge/nodal triangular elements, which can give frequency-dependent propagation constants directly. Characteristic impedances are also calculated from the FEM field solutions employing a reciprocity-related definition and taking the modal orthogonality into account. The numerical results of a coupled microstrip line are compared with those of the boundary integral equation technique, and good agreement is obtained. Also, a dual-plane triple microstrip line is analyzed. The approach is found to be very general and able to simultaneously handle different thicknesses and widths of strip conductors. The flexibility of the approach is also shown by including anisotropy in the dielectric substrates of such lines.

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Optimized E-plane bandpass filters with improved stopband performance

D. Budimir. "Optimized E-plane bandpass filters with improved stopband performance." 1997 Transactions on Microwave Theory and Techniques 45.2 (Feb. 1997 [T-MTT]): 212-220.

A computer-aided synthesis technique for E-plane bandpass filters with improved stopband performance is developed. An optimization procedure based on equal ripple optimization is adopted. The design of a symmetrical E-plane bandpass filter with improved stopband performance is considered; higher order mode interaction between E-plane discontinuities is included in the design. The predicted filter performance shows improved stopband performance and reduced filter dimensions compared with conventional E-plane bandpass filters. The validity of the method is confirmed by the measurement of a fabricated five resonator E-plane bandpass filter with improved stopband performance.

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A new approach to the design of dual-mode rectangular waveguide filters with distributed coupling

P. Savi, D. Trincherò, R. Tascone and R. Orta. "A new approach to the design of dual-mode rectangular waveguide filters with distributed coupling." 1997 Transactions on Microwave Theory and Techniques 45.2 (Feb. 1997 [T-MTT]): 221-228.

A synthesis procedure for a new configuration of four-pole dual-mode waveguide filters with distributed coupling is presented. In this configuration the dual-mode coupling is obtained by exploiting the well-known fact that the diagonal polarizations are coupled in an almost square waveguide. The obvious advantage of this type of structure is that the cross sections of all the discontinuities are rectangular, hence the global prediction of the filter is more accurate. The synthesis approach is based on a scattering matrix formulation where the dual-mode coupling is described in terms of a 2×2 propagation matrix. Universal design charts, which directly yield the scattering parameters of the various junctions, have been obtained. Comparisons with experimental results of a four-pole filter are also presented.

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Microstrip lines on substrates with segmented or continuous permittivity profiles

Jean-Fu Kiang. "Microstrip lines on substrates with segmented or continuous permittivity profiles." 1997 Transactions on Microwave Theory and Techniques 45.2 (Feb. 1997 [T-MTT]): 229-235.

The propagation properties of microstrip lines on a substrate with inhomogeneous permittivity and conductivity profiles are analyzed. The eigenmodes in each inhomogeneous layer are obtained by solving an eigen equation. These eigenmodes are then used to formulate the Green's function of the stratified medium. An integral equation is next derived in terms of the surface current on the strip. Galerkin's method is then applied to obtain a determinantal equation to be solved for the propagation constant. The effect of several permittivity and conductivity profiles are analyzed.

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Calculation of eigenmodes in a nonperiodic corrugated waveguide

I.G. Tigelis, M. Pedrozzi, P.G. Cottis and J.L. Vomvouridis. "Calculation of eigenmodes in a nonperiodic corrugated waveguide." 1997 Transactions on Microwave Theory and Techniques 45.2 (Feb. 1997 [T-MTT]): 236-244.

A theoretical technique for determining the dispersion relation, the electromagnetic field components, and the quality factor of a dielectric-loaded nonperiodic corrugated waveguide is presented for the case of azimuthally symmetric TM waves. The Floquet theorem is used to express the field distribution in the vacuum region, while an eigenfunction expansion is employed in each dielectric region, with the appropriate boundary conditions applied at the interfaces, leading to an infinite system of equations. This system is solved numerically by truncation, while the convergence of the solution is examined with the number of spatial harmonics. Based on this formulation, a numerical code, called FISHBONE-TM, is developed and its results are compared with those obtained with an established code (CASCADE) based on the scattering-matrix method.

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Nonlinear intermodulation coupling in ferrite circulator junctions

Hoton How, C. Vittoria and R. Schmidt. "Nonlinear intermodulation coupling in ferrite circulator junctions." 1997 Transactions on Microwave Theory and Techniques 45.2 (Feb. 1997 [T-MTT]): 245-252.

We have solved the nonlinear intermodulation coupling problem of a planar ferrite junction containing 3N ports. The coupling is represented as driving currents within the junction, and the induced fields can be solved by using the radiation and the boundary-value Green's functions. Maximum coupling of intermodulations occur if the excitation frequencies at the ports are close to the circulation frequency of the circulator. Also, we find that the static demagnetizing field can effectively increase the intermodulation output power.

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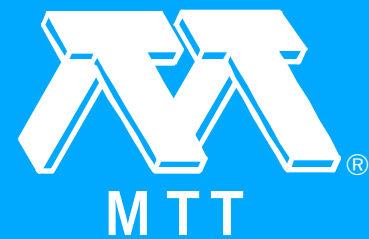
Analytical solution and frequency extraction of iris problems in waveguide by separation of variables

T. Rozzi, A. Morini, F. Ragusini and M. Mongiardo. "Analytical solution and frequency extraction of iris problems in waveguide by separation of variables." 1997 Transactions on Microwave Theory and Techniques 45.2 (Feb. 1997 [T-MTT]): 253-259.

The field nearby a thin iris discontinuity can be found in an exact manner by solving the wave equation in an appropriate coordinate system. To this end, it is necessary to select a coordinate system that fits the iris boundary. As an example, capacitive and inductive irises in rectangular waveguides have been solved by considering the Helmholtz equation in the elliptic-cylinder coordinate system. The presence of the waveguide environment is then enforced either by using the aperture field solution in a variational expression of the equivalent shunt susceptance or by taking images. The advantage of the new solution is that a single term solution, apart from being very accurate and numerically efficient, also contains the correct frequency dependence; thus providing results over the entire band. Moreover, wide-band equivalent circuits with frequency independent elements of the Foster's canonical form descend directly from the field analysis.

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Broad-band microwave characterization of bilayered materials using a coaxial discontinuity with applications for thin conductive films for microelectronics and material in air-tight cell

N. Belhadj-Tahar, O. Meyer and A. Fourier-Lamer. "Broad-band microwave characterization of bilayered materials using a coaxial discontinuity with applications for thin conductive films for microelectronics and material in air-tight cell." 1997 Transactions on Microwave Theory and Techniques 45.2 (Feb. 1997 [T-MTT]): 260-267.

A new measurement method of complex permittivity of bilayered materials has been developed using a coaxial discontinuity. The electromagnetic analysis is performed according to the "mode-matching" method. The reflection coefficient of the principal transverse electromagnetic (TEM) mode is calculated by matching the fields at the interfaces of the layered material and using the orthogonality properties of modes in cylindrical waveguides. The complex permittivity of several known liquid or solid materials in bilayered structure are measured using this method. The experimental results over a wide frequency band (1 kHz-18 GHz) are consistent with those in previous papers and with dc measurements.

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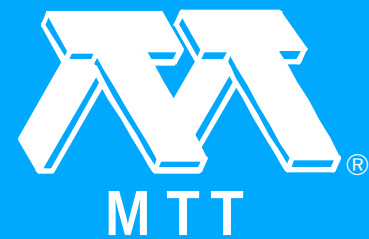


Abstracts

Propagation characteristics of a heaviside absorbing layer for TLM

I.G. Gosling and Pingyu Qu. "Propagation characteristics of a heaviside absorbing layer for TLM." 1997 Transactions on Microwave Theory and Techniques 45.2 (Feb. 1997 [T-MTT]): 268-273.

The perfectly matched layer for use with the finite-difference time-domain method is adapted to our transmission-line matrix simulation as what we call a heaviside absorbing layer (HAL). It is shown that the reflection coefficient for the wave incident on a HAL is less than that of the wave incident on a matched-load termination at all angles of incidence. Furthermore, the dispersion relation of a transmission-line matrix mesh of a symmetrical condensed node with both electric and magnetic loss stubs is derived. It provides guidance on how to choose the losses of HAL and other simulation parameters properly.



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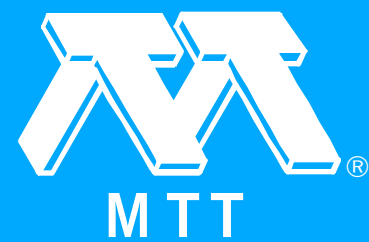
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Hybrid-mode computation of propagation and attenuation characteristics of parallel coupled microstrips with finite metallization thickness

Jen-Tsai Kuo and T. Itoh. "Hybrid-mode computation of propagation and attenuation characteristics of parallel coupled microstrips with finite metallization thickness." 1997 Transactions on Microwave Theory and Techniques 45.2 (Feb. 1997 [T-MTT]): 274-280.

The hybrid-mode mixed spectral domain approach (MSDA) is formulated to investigate the dispersion nature of multiple coupled microstrip lines with arbitrary metallization thickness. Incorporated into the solution procedure, a new set of basis functions with $1/\sqrt{\rho}$ field singularity near conductor edges is found to be effective in calculating both the phase and attenuation constants. The computation of conductor loss is based on the perturbation procedure. Over a broad band of frequency spectrum, excellent agreement is obtained between the calculated results and existing experiment data for the metallic losses of a single microstrip and effective dielectric constants of coupled lines. The influence of finite metallization thickness on the frequency dependent modal propagation and attenuation characteristics is presented for both a three-line and four-line structure.

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A simple evaluation of losses in thin microstrips

G.B. Stracca. "A simple evaluation of losses in thin microstrips." 1997 Transactions on Microwave Theory and Techniques 45.2 (Feb. 1997 [T-MTT]): 281-283.

A simple modification of Wheeler's incremental inductance rule is presented which allows the extension of the use of this rule for the evaluation in quasi-TEM operation of losses in thin microstrips (i.e., when the Wheeler's rule is considered no longer applicable). A good agreement of the proposed formula with available numerical results is obtained when thickness is comparable with skin depth. A comparison is also made with two approximate formulas proposed by some authors. The proposed modification to Wheeler's rule should be useful for computer-aided design (CAD) of monolithic microwave integrated circuits (MMIC's).

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Coupling of edge-element and mode-matching for multistep dielectric discontinuity in guiding structures

Shanjia Xu and Xinquing Sheng. "Coupling of edge-element and mode-matching for multistep dielectric discontinuity in guiding structures." 1997 Transactions on Microwave Theory and Techniques 45.2 (Feb. 1997 [T-MTT]): 284-287.

A new approach is proposed for dielectric multistep discontinuity in guiding structures which combines edge-element analysis with the mode-matching method and multimode network theory. It is demonstrated that the approach has the generality of the edge-element analysis and the simplicity of the multimode network method, while retaining the high accuracy of the mode-matching method. The calculations for different multistep discontinuities verify the effectiveness and suitability of the approach for analysis of three-dimensional (3-D) lossy dielectric discontinuity problem.

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Quasi-static analysis of shielded microstrip transmission lines with thick electrodes

N.H. Zhu, W. Qiu, E.Y.B. Pun and P.S. Chung. "Quasi-static analysis of shielded microstrip transmission lines with thick electrodes." 1997 Transactions on Microwave Theory and Techniques 45.2 (Feb. 1997 [T-MTT]): 288-291.

An extended point-matching method for analyzing the shielded microstrip transmission lines with thick electrodes has been developed based on the method by Marcuse (1989). This method provides a simple and fast approach to the quasi-static analysis of the structures. The calculated fields are used to estimate the characteristic impedance and effective dielectric constant of the structures. The results agree well with available theoretical results obtained using other methods, such as the finite element method and the boundary element method. This method can be further applied to other microstrip lines widely used in monolithic microwave integrated circuits (MMICs) applications.

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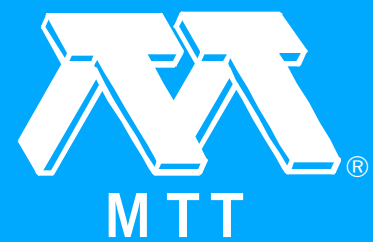
Design of Lange-couplers and single-sideband mixers using micromachining techniques

Chen-Yu Chi and G.M. Rebeiz. "Design of Lange-couplers and single-sideband mixers using micromachining techniques." 1997 Transactions on Microwave Theory and Techniques 45.2 (Feb. 1997 [T-MTT]): 291-294.

This paper reports on the design and performance of micromachined Lange-couplers and single-sideband mixers (SSB) on thin dielectric membranes at Ku-band. The micromachined Lange-coupler results in a 3.6/spl plusmn/0.8 dB coupling bandwidth from 6.5 to 20 GHz. The Lange-coupler and an interdigital filter are used in a 17-GHz SSB. The SSB mixer requires 1-2 mW of local oscillator (LO) power without dc bias and achieves a 30 dB upper-sideband (USB) image rejection for an IF frequency of 1 GHz and above. The micromachined membrane technology can be easily scaled to millimeter-wave monolithic microwave integrated circuits (MMIC's) to meet the low-cost requirements in automotive or portable communication systems.

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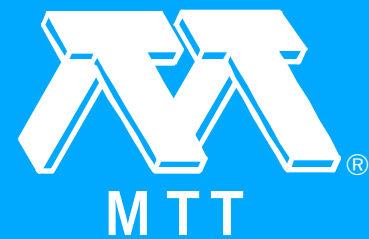
A method for investigating a class of inhomogeneous stripline circulators

G. Macchiarella, G.G. Gentili and A. Lobina. "A method for investigating a class of inhomogeneous stripline circulators." 1997 Transactions on Microwave Theory and Techniques 45.2 (Feb. 1997 [T-MTT]): 294-297.

Broad-band stripline circulators are studied by means of a mixed numerical technique which employs both boundary integral and segmentation methods; this technique allows the analysis of planar circuits where the substrate is constituted by several regions with arbitrary shapes and different electrical properties. It is known that tracking circulators require matching structures because they present a low-gyration impedance (real and almost constant in an octave frequency band). The matching structures (generally tapers or multisection's transmission line transformers) must be realized on a reciprocal substrate. The overall device (circular disk on ferrite substrate and matching structure on dielectric substrate) constitutes a planar circuit with an inhomogeneous medium. The method of study presented here allows the determination of the overall impedance matrix of the planar circuit constituted by the nonreciprocal disk with sections of striplines connected to each port; in this way, the discontinuities between reciprocal and nonreciprocal medium are included in characterization of the overall device. Moreover the accuracy of the representation is increased, In fact, the coupling ports of the overall device may be located at a suitable distance from the disk boundary where higher-order modes excited by the discontinuities have been sufficiently attenuated and only the TEM mode is present on the striplines (which is the only one considered in the design of the matching structures).

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Determination of the roots of the characteristic equation for corrugated and dielectric loaded circular waveguides

L. Costa da Silva. "Determination of the roots of the characteristic equation for corrugated and dielectric loaded circular waveguides." 1997 Transactions on Microwave Theory and Techniques 45.2 (Feb. 1997 [T-MTT]): 298-301.

An algorithm is developed for the numerical determination of the roots of the characteristic equation for corrugated and dielectric loaded circular waveguides. The algorithm, based on geometrical properties of the characteristic equation and on the identification of the interval of existence of each root, assures a fast and precise determination of all the roots, real or complex, in a given interval.

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Abstracts

Analytical behavior of the noise resistance and the noise conductance for a network with parallel and series feedback

L. Boglione, R.D. Pollard and V. Postoyalko. "Analytical behavior of the noise resistance and the noise conductance for a network with parallel and series feedback." 1997 Transactions on Microwave Theory and Techniques 45.2 (Feb. 1997 [T-MTT]): 301-304.

An analysis is presented of the changes of the noise parameters of a two-port network when noisy series and parallel feedback immittances are applied. Exact formulas for the noise parameters $R_{sub n}$, $g_{sub n}$, and $|\rho|_{sub n}$ are given as functions of the feedback for a given network. It is proved that $R_{sub n}$ always reaches a minimum when a reactive series feedback is considered. The same results are demonstrated for $g_{sub n}$ since a duality principle is pointed out. The results are valid for a wide range of linear microwave two-port networks, either passive or active, and they are used to confirm the data from previously published work.



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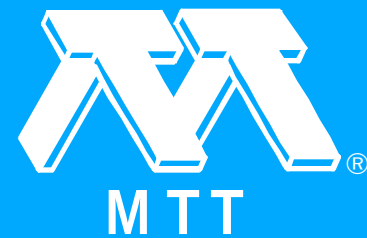


Abstracts

Investigating nonlinear propagation in dielectric slab waveguides

Jian-Guo Ma. "Investigating nonlinear propagation in dielectric slab waveguides." 1997 Transactions on Microwave Theory and Techniques 45.2 (Feb. 1997 [T-MTT]): 304-306.

A numerical method is employed to analyze the TE-wave propagation in Kerr-like nonlinear dielectric waveguides in which a nonlinear film is sandwiched between two linear media. The dispersion curves dependent on the magnitude of the electric field are obtained. All the results can be used in future investigations of devices composed of nonlinear dielectric slab structures.



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Abstracts

A quadrature-hybrid design using a four-port elliptic patch

Kin-Lung Chan, F.A. Alhargan and S.R. Judah. "A quadrature-hybrid design using a four-port elliptic patch." 1997 Transactions on Microwave Theory and Techniques 45.2 (Feb. 1997 [T-MTT]): 307-310.

Available designs of quadrature hybrids have used transmission lines, and recently, circular-disk patches. This paper introduces a four-port quadrature hybrid using a microstrip elliptic patch. It is shown that this configuration has good performance as a quadrature hybrid over a fairly large bandwidth. The performance is improved by the introduction of matching networks. The analysis is carried out using the cavity model Green's function with appropriate corrections for the fringing fields. A comparison of experimental and theoretical results show good agreement.



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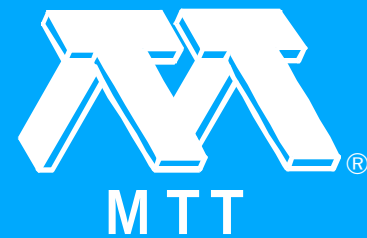


Abstracts

High frequency performance of multilayer capacitors (Comments)

G. Kent, M. Ingalls and F.J. Young. "High frequency performance of multilayer capacitors (Comments)." 1997 Transactions on Microwave Theory and Techniques 45.2 (Feb. 1997 [T-MTT]): 311-313.

For the original paper see *ibid.*, vol.43, no.9, p.2007-15 (1995). The commenters state that are pleased to see this addition to the analysis of high-frequency (HF) capacitors as given in the aforementioned paper. They go on to discuss various points which have arisen in the analysis owing to the use of the transmission-line model. In reply the author clarifies several of the aspects considered.



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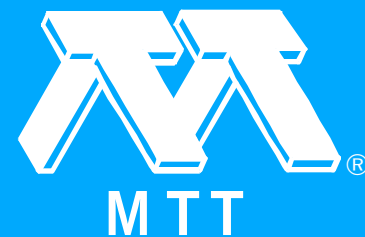


Abstracts

A New Reciprocity Theorem (Comments)

A. Lakhtakia. "A New Reciprocity Theorem (Comments)." 1997 Transactions on Microwave Theory and Techniques 45.2 (Feb. 1997 [T-MTT]): 313-313.

We write this to point out that the result in (28) of the above paper can be derived very easily using a standard identity, thus eliminating the lengthy analysis originally presented. We also note that the factor of $1/2$ in (26) is in error and must be deleted.



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Abstracts

A new reciprocity theorem (Further Comments)

H.T. Anastassiou, J.L. Volakis and J.C. Monzon. "A new reciprocity theorem (Further Comments)." 1997 Transactions on Microwave Theory and Techniques 45.2 (Feb. 1997 [T-MTT]): 313-314.

For the original paper see *ibid.*, vol. 44, no. 1, p. 10-14 (1996). One of the commenters points out that the reciprocity theorem reported in the aforementioned paper is not new. Other commenters show that the result can be derived very easily using a standard identity, thus eliminating the lengthy analysis originally presented. They also point out an error. In reply the author responds to the comments made.



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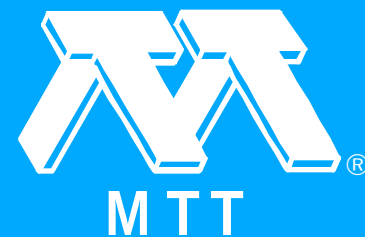


Abstracts

Reconstruction of the Constitutive Parameters for an /spl Omega/ Material in a Rectangular Waveguide (Corrections)

M. Norgren and Sailing He. "Reconstruction of the Constitutive Parameters for an /spl Omega/ Material in a Rectangular Waveguide (Corrections)." 1997 Transactions on Microwave Theory and Techniques 45.2 (Feb. 1997 [T-MTT]): 314-316.

Due to a mistake, certain parts of the analysis in the above paper are incorrect. Here we present the necessary corrections. It is shown that the corrected formalism leads to improved reconstructions.



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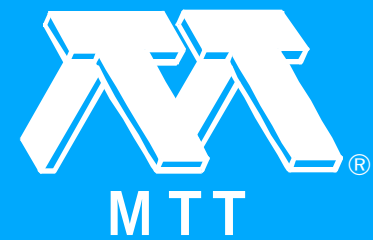
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"Table of Contents (Mar. 1997 [T-MTT])." 1997 Transactions on Microwave Theory and Techniques 45.3 (Mar. 1997 [T-MTT]): 0_1-0_2.



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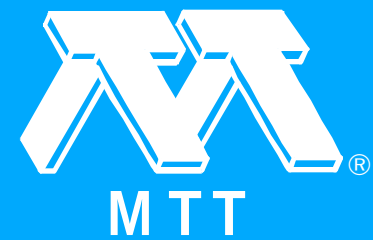
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Abstracts

Inside Cover (Mar. 1997 [T-MTT])

"Inside Cover (Mar. 1997 [T-MTT])." 1997 Transactions on Microwave Theory and Techniques 45.3 (Mar. 1997 [T-MTT]): 0_3-0_4.



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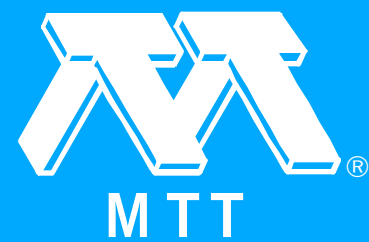
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Input impedance of a probe-excited semi-infinite rectangular waveguide with arbitrary multilayered loads: part II-a full-wave analysis

Le-Wei Li, Pang-Shyan Kooi, Mook-Seng Leong, Tat-Soon Yeo and See-Loke Ho. "Input impedance of a probe-excited semi-infinite rectangular waveguide with arbitrary multilayered loads: part II-a full-wave analysis." 1997 Transactions on Microwave Theory and Techniques 45.3 (Mar. 1997 [T-MTT]): 321-329.

For pt.I see *ibid.*, vol.43, pt.A, pp.1559-66 (July 1995). Utilizing the dyadic Green's functions (DGF's) derived in Part I of this paper, the input impedance of a coaxial probe located inside a semi-infinite rectangular waveguide has been generally formulated. The electromagnetic DGF's for a rectangular cavity with a dielectric load are also obtained from the general expressions given in Part I. Using the full-wave analysis, a dielectric-loaded rectangular cavity is further considered and the input impedance is specified. To improve the computational accuracy, an alternative form of electric DGF's of the second kind is developed and expressed in terms of the guided-wave eigenvalues for the rectangular loaded cavity. The probe-input reactance and the phase of the reflection coefficients are computed using the conventional form of electric DGF and the alternative form of magnetic DGF. Data are obtained from experiments performed on a dielectric-loaded cavity and compared with the numerical results. Agreement of the theoretical and experimental results confirms the applicability of the theoretical analysis given in this paper.



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Modeling planar arbitrarily shaped microstrip elements in multilayered media

Ming-Ju Tsai, F. De Flaviis, O. Fordham and N.G. Alexopoulos. "Modeling planar arbitrarily shaped microstrip elements in multilayered media." 1997 Transactions on Microwave Theory and Techniques 45.3 (Mar. 1997 [T-MTT]): 330-337.

Microstrip elements of arbitrary shape are modeled in multilayered media. The Green's function for the multilayered structure is developed in a form useful for efficient computation for interacting microstrip elements, which may be located at any substrate layer and separated by an arbitrarily large distance. This result is of significant value to a variety of applications in wave propagation besides those discussed in this paper. The mixed-potential integral-equation (MPIE) method is developed in the spatial domain. Examples for regularly/arbitrarily shaped geometries in single and multilayered media are presented. These involve the optimization of an open-end microstrip, a radial-stub microstrip, a five-section overlay-gap-coupled filter, and a circular-patch proximity-coupled microstrip antenna. Very good agreement with measurement and other published data is observed.

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Abstracts

A new calculation approach of transistor noise parameters as a function of gatewidth and bias current

A. Gasmi, B. Huyart, E. Bergeault and L.P. Jallet. "A new calculation approach of transistor noise parameters as a function of gatewidth and bias current." 1997 Transactions on Microwave Theory and Techniques 45.3 (Mar. 1997 [T-MTT]): 338-344.

In this paper a new method to calculate the noise parameters of transistors $T_{i/}$ (MESFET or HEMT) as a function of gatewidth and drain-bias current is presented. This method needs the knowledge of the R, P, and C coefficients. It is based on the measurement of the noise parameters of a reference transistor $T_{r/}$ at two bias points ($I_{ds1/}$ and $I_{ds2/}$), and the equivalent circuit elements' values of all transistors $T_{i/}$. Using this method, the noise parameters ($F_{min/}$, $\Gamma_{opt/}$, $R_{n/}$) for two MESFET's $T_{i/}$ biased at another current $I_{ds3/}$ are obtained. Good agreement between the predicted and measured noise parameters' values is obtained for a broad frequency range (4-20 GHz).



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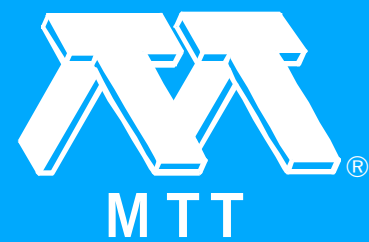
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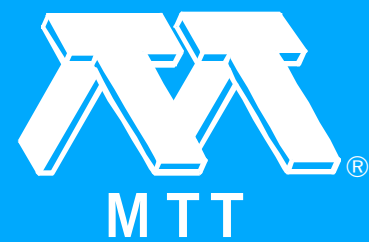
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Eigenvalue approach to the efficient determination of the hybrid and complex spectrum of inhomogeneous, closed waveguide

T. Rozzi, L. Pierantoni and M. Farina. "Eigenvalue approach to the efficient determination of the hybrid and complex spectrum of inhomogeneous, closed waveguide." 1997 Transactions on Microwave Theory and Techniques 45.3 (Mar. 1997 [T-MTT]): 345-353.

Many hybrid modes are required in computing the fields scattered from discontinuities in structures such as finline, coplanar waveguide, or microstrip. The authors present a new analytical method based on an eigenvalue formulation of the generalized telegrapher's equations discretized by using the modes at cutoff as an expanding set. This approach produces a compact theoretical model while providing at the same time an effective algorithm for finding the characteristics of many modes, including their below cutoff and complex behaviour. The theoretical approach gives some direct insights about the appearance of complex modes. Due to the explicit formulation of the eigenvalue equation for the complex propagation constant, the proposed method overcomes some of the typical drawbacks of the currently used algorithms, such as the limited numerical accuracy and efficiency, the numerical degeneracy and appearance of spurious solutions, the inability to trace the characteristics of degenerate modes. Numerical results for ordinary and complex propagation in finline show excellent agreement with existing data.





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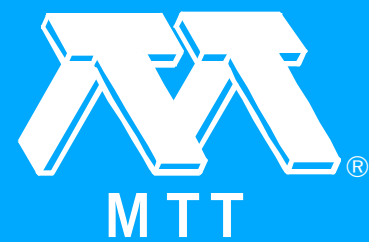
Four-port scattering matrix for dual-polarized wave transmission and reflection network

K. Tomiyasu. "Four-port scattering matrix for dual-polarized wave transmission and reflection network." 1997 Transactions on Microwave Theory and Techniques 45.3 (Mar. 1997 [T-MTT]): 354-358.

Co-directional and bi-directional, co-polarized and cross-polarized characteristics of a lossless, matched four-port transmission network have been examined. For example, an arbitrary-inclined dielectric plate in a circular or square waveguide supporting dual-orthogonal linearly polarized modes has been analyzed, and a coordinate system is defined to apply for co-directional and bi-directional propagating circularly polarized waves. The matrix elements are polarization state and network dependent. Instead of using the terms network reciprocity and matrix symmetry, the matrix elements are discussed in terms of ratios to describe co-directional, bi-directional, co-polarized, cross-polarized, and polarization discrimination properties. Some of the ratios are equal to $1/\sin \theta / \sin 0^\circ$ and others $1/\sin \theta / \sin 180^\circ$. Applications of this analysis are described. If the properties of the four-port network are frequency dependent and integrated over a bandwidth, and/or time dependent and integrated temporally, the scattering matrix formulation is not valid due to the presence of a randomly polarized component; in these cases a Mueller matrix is used to characterize the network.

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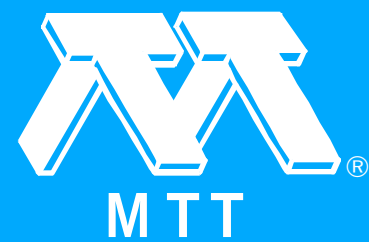
A new approach to estimate complex permittivity of dielectric materials at microwave frequencies using waveguide measurements

M.D. Deshpande, C.J. Reddy, P.I. Tiemsin and R. Cravey. "A new approach to estimate complex permittivity of dielectric materials at microwave frequencies using waveguide measurements." 1997 Transactions on Microwave Theory and Techniques 45.3 (Mar. 1997 [T-MTT]): 359-366.

In this paper, a simple waveguide measurement technique is presented to determine the complex dielectric constant of a dielectric material. The dielectric sample is loaded in a short-circuited rectangular waveguide. Using a network analyzer, the reflection coefficient of the waveguide is measured. Using the finite-element method (FEM) the exact reflection coefficient of this configuration is determined as a function of the dielectric constant. The measured and calculated values of the reflection coefficient are then matched using the Newton-Raphson method to estimate the dielectric constant of a material. A comparison of estimated values of the dielectric constant obtained from simple waveguide modal theory and the FEM approach is presented. Numerical results for dielectric constants of Teflon and Plexiglas measured at the X- and Ku-bands are presented. Numerical inaccuracies in the estimate of the dielectric constant due to: 1) the presence of airgaps between sample and sample holder waveguide surfaces and 2) inaccuracy in the sample dimensions are also discussed.

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Numerical analysis of near-infrared wave propagation characteristics in dielectric-coated parallel planar microstructural waveguides

W.E.A. Van Petegem, C.R. James, F.E. Vermeulen and A.M. Robinson. "Numerical analysis of near-infrared wave propagation characteristics in dielectric-coated parallel planar microstructural waveguides." 1997 Transactions on Microwave Theory and Techniques 45.3 (Mar. 1997 [T-MTT]): 367-375.

In this paper, the properties of electromagnetic (EM) wave propagation in layered planar microstructural waveguides are investigated. Analytical and numerical results are presented on the propagation of a 1- μm EM wave in a parallel planar waveguide. Its walls are made of Au or Si, coated with a thin layer of SiO₂ and separated by a fluid. The propagation characteristics of even and odd TE and TM modes are described as a function of the coating thickness. It is shown that the propagation of TE modes exhibits a sudden shift in power flow distribution from the fluid to the coating when the coating thickness exceeds a critical value. This property may be exploited for micromachined sensor applications. TM modes do not exhibit this behaviour.

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Abstracts

Full wave network representation for rectangular, circular, and elliptical to elliptical waveguide junctions

B. Gimeno and M. Guglielmi. "Full wave network representation for rectangular, circular, and elliptical to elliptical waveguide junctions." 1997 Transactions on Microwave Theory and Techniques 45.3 (Mar. 1997 [T-MTT]): 376-384.

In this paper, two contributions to the study of the elliptical waveguides are given: an efficient technique to obtain the modal spectrum for elliptical waveguides and the analysis of the junctions between rectangular, circular, or elliptical to elliptical waveguides. In addition to theoretical results, experimental results are also presented finding good agreement between prediction and measurement.



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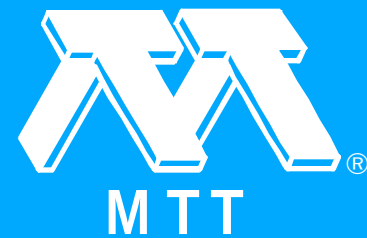


Abstracts

Nonlinear time-domain modeling by multiresolution time domain (MRTD)

M. Krumpholz, H.G. Winful and L.P.B. Katehi. "Nonlinear time-domain modeling by multiresolution time domain (MRTD)." 1997 Transactions on Microwave Theory and Techniques 45.3 (Mar. 1997 [T-MTT]): 385-393.

A multiresolution time-domain (MRTD) scheme based on the expansion in scaling functions is applied to the modeling of nonlinear pulse propagation. Appropriate absorbers for the MRTD scheme are presented and their performance is discussed. The differences using pulse functions and nonlocalized basis functions like the Battle-Lemarie scaling functions are demonstrated by deriving time-domain schemes for both sets of orthonormal basis functions.



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Symmetry of microwave devices with gyrotropic media-complete solution and applications

V.A. Dmitriyev. "Symmetry of microwave devices with gyrotropic media-complete solution and applications." 1997 Transactions on Microwave Theory and Techniques 45.3 (Mar. 1997 [T-MTT]): 394-401.

In this paper, a general procedure for constructing all the possible solutions for symmetrical devices and components with gyrotropic medias is suggested. Using the theory of symmetry and crystallographic principles, all the color groups and corresponding matrices $[S]$, $[Z]$, and $[Y]$ of the devices can be obtained. With this approach, it is possible to select those symmetrical structures and magnetic fields, which can be considered as candidates in the process of synthesis of microwave devices and components. In order to illustrate the procedure, some examples are given.

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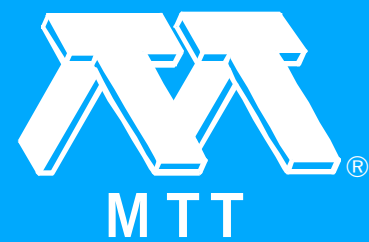
Optimum noise-source reflection-coefficient design with feedback amplifiers

L. Boglione, R.D. Pollard and V. Postoyalko. "Optimum noise-source reflection-coefficient design with feedback amplifiers." 1997 Transactions on Microwave Theory and Techniques 45.3 (Mar. 1997 [T-MTT]): 402-407.

The issue of designing a low-noise microwave feedback amplifier for a given optimum noise-source coefficient Γ_{Sopt} is addressed and a set of original formulas is presented. These expressions define a new procedure which does not rely on computer optimization in order to get the required noise performance of the low-noise amplifier stage. The technique permits the design of a circuit which is simultaneously noise and power matched at its input port without an input matching circuit. This method can be used to screen devices for an optimum noise performance and it provides the essential mathematical tool for designing the core of a feedback amplifier.

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Line network network (LNN): an alternative in-fixture calibration procedure

H. Henermann and B. Schiek. "Line network network (LNN): an alternative in-fixture calibration procedure." 1997 Transactions on Microwave Theory and Techniques 45.3 (Mar. 1997 [T-MTT]): 408-413.

An alternative method for a network analyzer calibration is evaluated. This line network network (LNN) method avoids de-embedding of the device under test (DUT) and it allows the characterization of an unknown two-port inserted between an arbitrary number of cascaded unknown two-ports. An unknown obstacle must be moved on a transmission line into three positions. The LNN calibration technique delivers the electrical wavelength or the relative dielectric constant of the transmission line and the scattering parameters of the obstacle. Since the connectors do not have to be exchanged, nonreproducibilities of the connectors are only a minor problem. Additionally, a double-calibration technique is presented. The double-calibration technique is used to employ the LNN method on both sides of the two-port DUT in order to perform an error-corrected measurement. Experimental results compare the LNN method with the tru-reflect-line (TRL) method particularly for an in-fixture calibration.

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The higher order modal characteristics of circular-rectangular coaxial waveguides

Haiyin Wang, Ke-Li Wu and J. Litva. "The higher order modal characteristics of circular-rectangular coaxial waveguides." 1997 Transactions on Microwave Theory and Techniques 45.3 (Mar. 1997 [T-MTT]): 414-419.

A rigorous analysis combining the orthogonal expansion method and Galerkin method for the higher order eigenmodes in a circular-rectangular (C-R) waveguide is presented in this paper. The Bessel-Fourier series is employed to merge the circular and rectangular coordinate systems used in the analysis. The cutoff frequencies of the higher order modes are determined with the singular value decomposition (SVD) technique. The computed results are in excellent agreement with results obtained using the finite element method. Because of its analytic form, the solution will be useful in the rigorous analysis of many practical microwave components and circuits.

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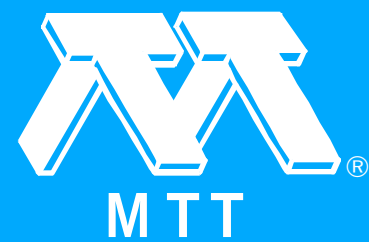
A microwave model for high electron mobility transistors

V. Kasemsuwan and M.A. El Nokali. "A microwave model for high electron mobility transistors." 1997 Transactions on Microwave Theory and Techniques 45.3 (Mar. 1997 [T-MTT]): 420-427.

In this paper, the authors present a high-frequency model for the high electron mobility transistor (HEMT). The model includes the distributed effects in the channel of the device through two newly developed wave equations in the linear and saturation regimes. The equations are solved taking into account the electric fields along and perpendicular to the flow of the current. The Y and S parameters are derived and the theoretical predictions of the model are compared with the experimental data and shown to be in good agreement over a wide range of frequencies.

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Characteristics of guided and leaky waves on multilayer thin-film structures with planar material gratings

H.Y.D. Yang. "Characteristics of guided and leaky waves on multilayer thin-film structures with planar material gratings." 1997 Transactions on Microwave Theory and Techniques 45.3 (Mar. 1997 [T-MTT]): 428-435.

This paper presents the characteristics of guided (surface) waves and leaky waves on multilayer structures with planar implanted periodic dielectric blocks. A three-dimensional (3-D) integral-equation formulation in conjunction with the method of moments (MoM's) is used to find the propagation constants of the surface-wave and leaky-wave modes. The analysis deals with layered structures with irregular implants. Photonic band-gaps of both guided waves and leaky waves for rectangular air-implants are identified. Anisotropic properties of the surface waves and leaky waves are investigated. The design of leaky-wave antennas with the information of mode characteristics is discussed. The analysis is validated through the comparison with a low-frequency effective-medium approach and results for linear gratings.

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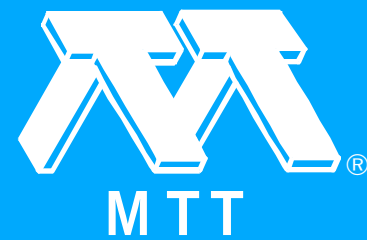


Abstracts

On the evaluation of the double surface integrals arising in the application of the boundary integral method to 3-D problems

P. Arcioni, M. Bressan and L. Perregrini. "On the evaluation of the double surface integrals arising in the application of the boundary integral method to 3-D problems." 1997 Transactions on Microwave Theory and Techniques 45.3 (Mar. 1997 [T-MTT]): 436-439.

In this paper, the authors discuss how to minimize the computing time for the evaluation of the double surface integrals arising in the application of the boundary integral method (BIM) to three-dimensional (3-D) problems. The integrals considered refer to the Green's functions for the scalar and vector potentials and to uniform or linear basis and test functions defined over triangular sub-domains. The authors report original analytical formulas for the double surface integrals over coincident triangles involving the singular terms of the Green's functions and present a criterion for obtaining a good compromise between accuracy and computing time in numerical integration.



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Precise computations of resonant frequencies and quality factors for dielectric resonators in MICs with tuning elements

Jenn-Ming Guan and Ching-Chuan Su. "Precise computations of resonant frequencies and quality factors for dielectric resonators in MICs with tuning elements." 1997 Transactions on Microwave Theory and Techniques 45.3 (Mar. 1997 [T-MTT]): 439-442.

In this paper, the highly accurate results of resonant frequencies, field distributions, and quality factors of the TE/sub 01/spl delta// mode for the cylindrical shielded dielectric resonator (DR) in microwave integrated circuits (MIC's) with a practical tuning element, such as the metallic tuning screw and the dielectric tuning device, are presented. By using the newly developed FD-SIC method, numerical results can be calculated accurately and efficiently. The DR structures with tuning elements can be more easily modeled by the present approach than the other methods using approximate solutions or the mode-matching (MM) methods. Numerical results in the literature are compared to the present FD-SIC results for the DR without tuning elements and detailed discussions on these results are given. In addition, design curves are also presented for the DR with the metallic tuning screw and with the dielectric tuning device. These design curves are helpful for designing DR systems with tuning elements in MIC applications.

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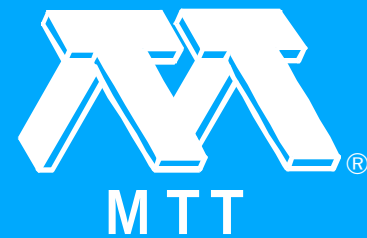


Abstracts

A waveguide-to-microstrip transition with a DC-IF return path and an offset probe

S.C. Shi and J. Inatani. "A waveguide-to-microstrip transition with a DC-IF return path and an offset probe." 1997 Transactions on Microwave Theory and Techniques 45.3 (Mar. 1997 [T-MTT]): 442-446.

This paper describes a type of waveguide-to-microstrip transition incorporated with a "built-in" DC/IF return and an offset probe which is proposed for the applications of submillimeter-wave superconductor-insulator-superconductor (SIS) mixers. The effects of the DC/IF return and the probe location and orientation are understood by simulating a 100-GHz transition using the finite element method (FEM). The simulation results are compared to the experimental results of a Ka-band scale model for the simulated transition. The performance of a 100-GHz SIS mixer employing such a transition is finally presented.



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Analysis of general lossy inhomogeneous and anisotropic waveguides by the finite-element method (FEM) using edge elements

L. Nuno, J.V. Balbastre and H. Castane. "Analysis of general lossy inhomogeneous and anisotropic waveguides by the finite-element method (FEM) using edge elements." 1997 Transactions on Microwave Theory and Techniques 45.3 (Mar. 1997 [T-MTT]): 446-449.

Several finite element formulations based on edge elements have been developed in recent years, avoiding the appearance of spurious modes in waveguides. However, no formulation of this kind dealing with general lossy inhomogeneous and anisotropic waveguides has been found in the literature. In this paper, a new finite element scheme for the most general linear waveguides has been derived from vector wave equations via a Galerkin procedure. In this formulation, triangular and quadrilateral edge elements have been used in order to avoid the spurious solutions. Furthermore, the final eigensystem involves only very sparse matrices, thus allowing important savings in time and memory.

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Abstracts

Some characteristics of ridge-trough waveguide

D. Guha and P.K. Saha. "Some characteristics of ridge-trough waveguide." 1997 Transactions on Microwave Theory and Techniques 45.3 (Mar. 1997 [T-MTT]): 449-453.

A single-ridged waveguide with a symmetrical longitudinal trough below the ridge, designated as a ridge-trough waveguide (RTW) has been recently proposed as a wafer probe. The authors have theoretically calculated the cutoff, bandwidth, and impedance characteristics of this modified single-ridged waveguide in two different configurations using the Ritz-Galerkin technique and different domain decompositions. The results indicate that a RTW can be a low impedance broad-band structure.



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Modal scattering matrix of the general step discontinuity in elliptical waveguides

P. Matras, R. Bunger and F. Arndt. "Modal scattering matrix of the general step discontinuity in elliptical waveguides." 1997 Transactions on Microwave Theory and Techniques 45.3 (Mar. 1997 [T-MTT]): 453-458.

In this paper, a direct mode-matching technique is proposed for the calculation of the modal scattering matrix of nonconfocal, twisted, and/or displaced step discontinuities in elliptical waveguides of different cross sections. For the convenient treatment of the Mathieu functions, an efficient trigonometric series expansion technique is used. As examples, the scattering parameters are calculated for typical step discontinuities demonstrating the flexibility of the method.



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Dispersion characteristics of open microstrip lines using closed-form asymptotic extraction

Seong-Ook Park and C.A. Balanis. "Dispersion characteristics of open microstrip lines using closed-form asymptotic extraction." 1997 Transactions on Microwave Theory and Techniques 45.3 (Mar. 1997 [T-MTT]): 458-460.

A full-wave spectral-domain method with an asymptotic extraction technique is formulated for multilayer microstrip lines. This formulation provides a simple closed-form representation of the asymptotic part of the impedance matrix by using Chebyshev polynomial basis functions with the square-root edge condition and the asymptotic behaviour of the Green's function. The formulation is applied to open microstrip lines. Numerical results, in the form of the effective dielectric constants, are presented for the dominant mode. It is shown that the proposed method significantly reduces the computational time and improves the accuracy over the conventional spectral-domain approach (SDA).

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Abstracts

Characteristics of asymmetrical coupled lines of a conductor-backed coplanar type

K.-K.M. Cheng. "Characteristics of asymmetrical coupled lines of a conductor-backed coplanar type." 1997 Transactions on Microwave Theory and Techniques 45.3 (Mar. 1997 [T-MTT]): 460-463.

This paper presents for the first time a computer-aided design-oriented (CAD) analytical formula for the determination of the characteristic parameters of asymmetrical coupled lines of a conductor-backed coplanar type. Closed-form expressions are developed for evaluating the self and mutual static capacitances based on a sequence of conformal transformations. The derived formulas show excellent accuracy compared to the results produced by a spectral-domain approach.



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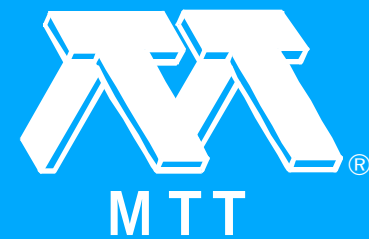
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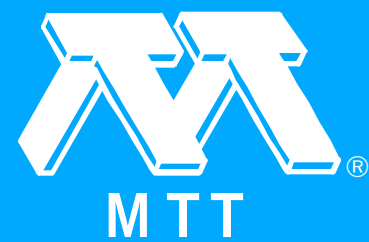
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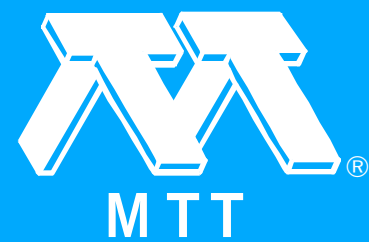


Microwave imaging-Location and shape reconstruction from multifrequency scattering data

K. Belkebir, R.E. Kleinman and C. Pichot. "Microwave imaging-Location and shape reconstruction from multifrequency scattering data." 1997 Transactions on Microwave Theory and Techniques 45.4 (Apr. 1997 [T-MTT]): 469-476.

The problem of determining the shape and location of an object embedded in a homogeneous dissipative medium from measurements of the field scattered by the object is considered in this paper. The object is assumed to be an infinite cylinder of known cross section illuminated by a TM plane wave and the scattered field is measured on a line segment perpendicular to the direction of incidence. Measurement data are carried out at three different frequencies for a homogeneous cylinder of known dielectric constant. The location and contour shape are determined using two different reconstruction algorithms, a Newton-Kantorovich (NK) method and the modified gradient (MG) method whose effectiveness and robustness are compared. Both methods are based on domain integral representations of the field in the body. They involve an iterative minimization of the defect between an integral representation of the field measured on the line and the actual measured data. The NK method involves a linearization of the nonlinear relation between the field and the contrast, as well as the solution of a direct scattering problem at each iteration. The MG method seeks the simultaneous reconstruction of the field and the characteristic function of the support of the scatterer without solving a direct problem at each step. Both methods employed the same initial guess and the a priori information that the characteristic function is nonnegative.

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Analysis of the "Crack characteristic signal" using a generalized scattering matrix representation

C. Huber, H. Abiri, S.I. Ganchev and R. Zoughi. "Analysis of the "Crack characteristic signal" using a generalized scattering matrix representation." 1997 Transactions on Microwave Theory and Techniques 45.4 (Apr. 1997 [T-MTT]): 477-484.

Electromagnetic properties of a system formed by an open-ended rectangular waveguide and a surface crack/slot in a metallic specimen are described in this paper. Scanning a crack on a metal surface changes the reflection coefficient of the incident dominant mode. A model as a function of relative crack location within the waveguide aperture (i.e., crack moving with respect to the waveguide aperture) is desired to describe and optimize practical crack detection applications. Hence, the change in the reflection coefficient for a generalized system encompassing empty, filled, and finite cracks located at an arbitrary position inside the waveguide aperture, is evaluated. A moment solution approach is employed, and a magnetic current density M is introduced over the common aperture formed by the waveguide and the crack. Subsequently, the junction formed by the waveguide and the cracked metallic surface is separated into two systems. A numerical solution employing the method of moments is obtained, and the reflection coefficient at the waveguide aperture is expressed in terms of the generalized scattering matrix. The convergence behavior is studied to determine an optimized set of basis functions and the optimal number of higher order modes for a fast and accurate solution. Numerical results presented in this paper include the evaluation of the field distribution over the waveguide aperture. Finally, the theoretical and measured crack characteristic signals are compared.

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Abstracts

A novel technique for analysis of electromagnetic scattering from microstrip antennas of arbitrary shape

S. Uckun, T.K. Sarkar, S.M. Rao and M. Salazar-Palma. "A novel technique for analysis of electromagnetic scattering from microstrip antennas of arbitrary shape." 1997 Transactions on Microwave Theory and Techniques 45.4 (Apr. 1997 [T-MTT]): 485-491.

A new numerical procedure is developed for the solution of the electric field integral equation (EFIE) for arbitrary-shaped microstrip structures. This approach is superior over conventional EFIE techniques particularly in the low-frequency region or where the structure to be analyzed is electrically small. A pair of new basis functions is presented which are essential to the solution in the entire frequency range of interest. The new basis functions decompose the surface current density into divergenceless and curl-free parts which essentially get decoupled at the very low end of the frequency spectrum. Typical numerical results are presented for certain examples to illustrate the difference in the results between the two methods.



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An HTS narrow bandwidth coplanar shunt inductively coupled microwave bandpass filter on LaAlO/sub 3/

A. Vogt and W. Jutzi. "An HTS narrow bandwidth coplanar shunt inductively coupled microwave bandpass filter on LaAlO/sub 3/." 1997 Transactions on Microwave Theory and Techniques 45.4 (Apr. 1997 [T-MTT]): 492-497.

Coplanar waveguide bandpass filters with shunt inductively coupled resonators using high-temperature superconductors (HTS's) on LaAlO/sub 3/ substrates were developed for high packing density, narrow bandwidth, and low power applications. The computer-aided design and measurements on resonators to test weak end-coupling are described in this paper. A coplanar three-pole Chebychev bandpass filter with 1.8% 3-dB bandwidth at 10 GHz and 1.3-dB insertion loss at 77 K was fabricated and measured. The maximum superconducting current density of the filter is evaluated.



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Capacitance computation for CPW discontinuities with finite metallization thickness by hybrid finite-element method

Chien-Wen Chiu and Ruey-Beei Wu. "Capacitance computation for CPW discontinuities with finite metallization thickness by hybrid finite-element method." 1997 Transactions on Microwave Theory and Techniques 45.4 (Apr. 1997 [T-MTT]): 498-504.

A variational equation is derived for the capacitances of coplanar waveguide (CPW) structures with finite metallization thickness. The equation is expressed in terms of the static potential in the slot region and is solved by applying the hybrid finite-element method (FEM). In the case of small metallization thickness, it is reduced to a perturbation formula for the incremental capacitances. Numerical results for the equivalent capacitances of various discontinuities with finite metallization thickness are presented and compared with measured data. The reasonable agreement between the measured data and the theoretical results validates the present approach. Being simple and computationally efficient, the method is suitable for dealing with extensive CPW discontinuity problems where the metallization thickness is not negligible.

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Optical frequency modulation links: Theory and experiments

B. Cai and A.J. Seeds. "Optical frequency modulation links: Theory and experiments." 1997 Transactions on Microwave Theory and Techniques 45.4 (Apr. 1997 [T-MTT]): 505-511.

In this paper, the first theoretical analysis and experimental realization of an optical frequency modulation coherent detection (FMCD) link working at microwave frequencies is reported. Advantages over conventional optical intensity modulation direct detection (IMDD) links in terms of reduced effects of fiber nonlinearity, facilitation of multichannel operation, and bandwidth/signal-to-noise ratio (SNR) tradeoffs are identified. A detailed theoretical analysis of the SNR of FMCD links is carried out and compared to that for IMDD links. In the experimental FMCD link, a novel source laser tuning technique, based on the quantum confined Stark effect, is used. The experimental results are presented and compared with the predictions of the theoretical analysis.





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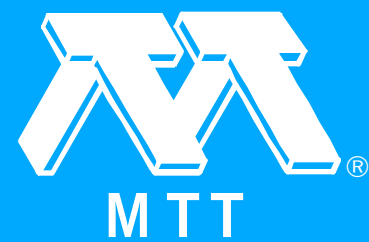
Planar multibarrier 80/240-GHz heterostructure barrier varactor triplers

J.R. Jones, W.L. Bishop, S.H. Jones and G.B. Tait. "Planar multibarrier 80/240-GHz heterostructure barrier varactor triplers." 1997 Transactions on Microwave Theory and Techniques 45.4 (Apr. 1997 [T-MTT]): 512-518.

Prototype planar four barrier GaAs/Al/sub 0.7/Ga/sub 0.3/As heterostructure barrier varactors (HBV's) for frequency tripling from 80 to 240 GHz have been fabricated using a process in which the device surface channel is etched prior to the formation of the contact pad-to-anode air-bridge finger. Formation of the device air-bridge finger after etching the surface channel is facilitated by a trench planarization technique and yields a device with minimal parasitic capacitances. Planar four-barrier HBV triplers with nominal 10- μ m diameter anodes have been tested in a crossed-waveguide tripler block; as much as 2 mW of power has been generated at 252 GHz with a flange to-flange tripling efficiency of 25%. These devices are the first planar or multibarrier HBV triplers reported and their output powers are nearly double that of previous whisker-contacted single-barrier HBVs.

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Computation of propagation characteristics of chiral layered waveguides

G. Plaza, F. Mesa and M. Horno. "Computation of propagation characteristics of chiral layered waveguides." 1997 Transactions on Microwave Theory and Techniques 45.4 (Apr. 1997 [T-MTT]): 519-526.

In this paper the authors present a systematic numerical method to analyze multilayered linear chiral waveguides. The Maxwell's equations are solved inside each layer and the transversal fields at the top and bottom of the whole layered medium are then related. This relation, together with the use of the proper transversal impedance matrices, makes it possible to obtain the dispersion relation of the waveguide. Since this technique is mainly numerical, the whole procedure is practically independent of both the number of layer and linear properties of the materials. In addition to the proper modes, the authors also show the behavior of the improper leaky modes of different chiral waveguides. In all the analyzed cases and for the considered ranges, the authors have found that the presence of chiral material does not substantially change the qualitative behavior of the dispersion relation, although it offers another parameter to control the propagation characteristics of the waveguide.

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Modeling the bias and temperature dependence of a C-class MESFET amplifier

S. Munoz, J.L. Sebastian and J.D. Gallego. "Modeling the bias and temperature dependence of a C-class MESFET amplifier." 1997 Transactions on Microwave Theory and Techniques 45.4 (Apr. 1997 [T-MTT]): 527-533.

In this paper, a complete bias and temperature-dependent large-signal model for a MESFET is determined from experimental S-parameters and dc measurements. This model is used in the analysis of the performance of a C-class amplifier at 4 GHz over a -50/spl deg/ to 100/spl deg/C temperature range and for different bias conditions. The dependencies of the elements of the equivalent circuit, as well as the amplifier gain on the temperature and the operating point, are evaluated. The gain optimization and the analysis as a function of temperature of the MESFET amplifier are done by using the describing function technique. Optimum bias device conditions in the C-class are obtained for maximum gain and also the flattest gain versus input power rate. A comparison between theoretical and measured results over temperature and bias ranges is shown. Experimental results show an excellent agreement with the theoretical analysis.

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Analysis of the large-signal characteristics of power heterojunction bipolar transistors exhibiting self-heating effects

A. Samelis and D. Pavlidis. "Analysis of the large-signal characteristics of power heterojunction bipolar transistors exhibiting self-heating effects." 1997 Transactions on Microwave Theory and Techniques 45.4 (Apr. 1997 [T-MTT]): 534-542.

The large-signal microwave characteristics of AlGaAs/GaAs heterojunction bipolar transistors (HBTs) are modeled using the conventional Gummel-Poon-based bipolar junction transistor (BJT) model and extending it to include self-heating effects. The model is incorporated as a user-defined model in a commercial circuit simulator. The experimental microwave characteristics of HBTs are analyzed using the new model and harmonic balance techniques and the impact of self-heating effects on the device large-signal characteristics is investigated. Use of constant base voltage rather than constant current is more suitable for achieving maximum output power. Self-heating induced by RF drive is reduced under constant base current conditions. Increased thermal capacitance values result in gain enhancement at high power levels.

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Abstracts

Improved planar spiral transformer theory applied to a miniature lumped element quadrature hybrid

J. Hogerheiden, M. Ciminera and G. Jue. "Improved planar spiral transformer theory applied to a miniature lumped element quadrature hybrid." 1997 Transactions on Microwave Theory and Techniques 45.4 (Apr. 1997 [T-MTT]): 543-545.

In this paper, an improved method of determining the primary-to-secondary coupling capacitance for planar spiral transformers (PST's) is presented, which enhances previous work. A more general monolithic microwave integrated circuit (MMIC) compatible lumped element multisection model is also presented based on symmetric-width uniformly coupled transmission lines. These techniques were developed to design a 90/spl deg/ hybrid as a MMIC with a center frequency of 2.5 GHz. The design was frequency scaled to 0.5 GHz and fabricated in the microwave integrated circuit (MIC) for verification. Producibility is enhanced and coupling is effectively increased with the novel use of series capacitors which cancel some of the self-inductance of the transformers. Measured results are presented for both a quadrature hybrid and the individual PST used in the quadrature hybrid. The measured results show excellent agreement with the computer models.



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Abstracts

A simple method for calculating the reflection coefficient of open-ended waveguides

Z. Shen and R.H. MacPhie. "A simple method for calculating the reflection coefficient of open-ended waveguides." 1997 Transactions on Microwave Theory and Techniques 45.4 (Apr. 1997 [T-MTT]): 546-548.

This paper presents a simple but effective method for the analysis of open-ended waveguides. The method begins with the introduction of a large waveguide to approximate the half-space. In order to avoid the convergence problem lossy dielectric is assumed to homogeneously fill the large waveguide. After obtaining a number of convergent data for different values of the loss tangent an extrapolation technique is employed to calculate the solution to the original problem—a waveguide terminated by an infinite conducting range and radiating into a lossless or low-loss half-space. Numerical results are given to show the validity of the proposed method. The behavior of the effect of the loss tangent on the size of the large waveguide and on the final results are also examined.



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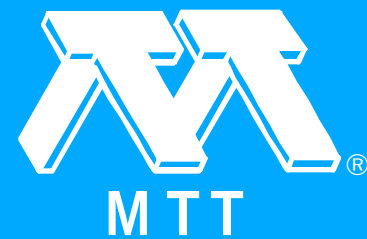


Abstracts

The effect of device modeling on a parameter switching continuation method used in waveform balance simulations

G.J.J. van Zyl. "The effect of device modeling on a parameter switching continuation method used in waveform balance simulations." 1997 Transactions on Microwave Theory and Techniques 45.4 (Apr. 1997 [T-MTT]): 549-551.

The effect of device modeling on a continuation method used to determine the large signal voltage and current waveforms of a nonlinear circuit is investigated. It is found that modeling the nonlinear element in such a way that the resulting waveform balance error function is continuously differentiable greatly enhances the performance of the algorithm.



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Abstracts

Optimization of novel high-power millimeter-wave TM/sub 01/-TE/sub 11/ mode converters

Shiwen Yang and Hongfu Li. "Optimization of novel high-power millimeter-wave TM/sub 01/-TE/sub 11/ mode converters." 1997 Transactions on Microwave Theory and Techniques 45.4 (Apr. 1997 [T-MTT]): 552-554.

In this paper, a numerical study of direct TM/sub 01/-TE/sub 11/ mode converters in highly overmoded, bent smooth, circular waveguides is presented for high-power millimeter waves. The various shapes of bent waveguides are elaborately chosen, and their optimized geometrical dimensions have been achieved with a general optimization code employing the coupled mode theory. The mode converters designed can have high conversion efficiencies over 98% and wide bandwidths of 28%.



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Characteristic impedance of a rectangular double-ridged TEM line

K. Garb and R. Kastner. "Characteristic impedance of a rectangular double-ridged TEM line." 1997 Transactions on Microwave Theory and Techniques 45.4 (Apr. 1997 [T-MTT]): 554-557.

The characteristic impedance of a TEM transmission line, shaped as a double-ridged rectangular coaxial line, is analyzed in this paper as the customary transversal static problem. This type of transmission line is useful, for example, as a part of a cascaded transition between a double-ridged waveguide and a coaxial line. The solution of the transversal problem is achieved by dividing the cross-sectional region into distinct, separable regions, each one being characterized by closed-form Green's functions relating the flux function to the electric field. Surface-type integral equations are then formulated over the boundaries between the regions. Solution of these equations via the method of moments (MoM's) using the Galerkin choice yields the results for the characteristic impedance as a function of cross-sectional dimensions. Convergence of the solution is also studied.





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Propagation characteristics of a dielectric-coated coaxial helical waveguide in a lossy medium

T. Iyama and J.-i. Takada. "Propagation characteristics of a dielectric-coated coaxial helical waveguide in a lossy medium." 1997 Transactions on Microwave Theory and Techniques 45.4 (Apr. 1997 [T-MTT]): 557-559.

In this paper, the authors discuss the propagation characteristics of a dielectric-coated coaxial helical waveguide in a lossy medium. The authors place emphases on the phase constant, propagation modes, magnetic fields distribution, and attenuation constant, when permittivity of the internal region is relatively small, two propagation modes exist and dominant components of their magnetic fields are different. Lastly, the authors discuss the relation between the attenuation constant and permittivities.

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Abstracts

Jet Propulsion Laboratory/NASA Lewis Research Center Space Qualified Hybrid High Temperature Superconducting/semiconducting 7.4 GHz Low-Noise Downconverter for NRL HTSSE-II Program (Corrections)

D.L. Rascoe. "Jet Propulsion Laboratory/NASA Lewis Research Center Space Qualified Hybrid High Temperature Superconducting/semiconducting 7.4 GHz Low-Noise Downconverter for NRL HTSSE-II Program (Corrections)." 1997 Transactions on Microwave Theory and Techniques 45.4 (Apr. 1997 [T-MTT]): 560-560.

In order to give all coauthors the proper credit that they deserve, and acknowledge more completely their contributions to the above paper, several people are indicated in the biographical profiles below who should be added as co-authors. As senior manager of this project at the Jet Propulsion Laboratory, I accept responsibility for this error in both judgment and careful editing. I also wish to apologize, publicly, to the group for any embarrassment or difficulty that this exclusion has caused them, personally.



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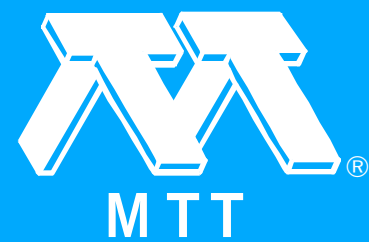
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The Eigenfunction Expansion of Dyadic Green's Functions for Chirowaveguides (Corrections)

H.T. Hui and E.K.N. Yung. "The Eigenfunction Expansion of Dyadic Green's Functions for Chirowaveguides (Corrections)." 1997 Transactions on Microwave Theory and Techniques 45.4 (Apr. 1997 [T-MTT]): 561-561.

In the above paper, two errors need to be corrected as follows:

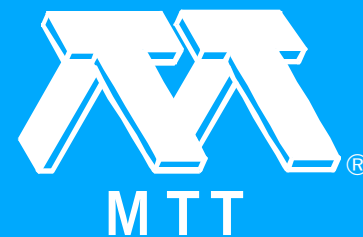
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Table of Contents (May 1997, Part I [T-MTT])

"Table of Contents (May 1997, Part I [T-MTT])." 1997 Transactions on Microwave Theory and Techniques 45.5 (May 1997, Part I [T-MTT]): 0_1-0_2.



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"Inside Cover (May 1997, Part I [T-MTT])." 1997 Transactions on Microwave Theory and Techniques 45.5 (May 1997, Part I [T-MTT]): 0_3-0_4.



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Abstracts

SPICE-compatible models for multiconductor transmission lines in Laplace-transform domain

A.R. Djordjevic. "SPICE-compatible models for multiconductor transmission lines in Laplace-transform domain." 1997 Transactions on Microwave Theory and Techniques 45.5 (May 1997, Part I [T-MTT]): 569-579.

Two models for multiconductor transmission lines are presented that are compatible with SPICE. One model is based on a Thevenin equivalent circuit and the other model is based on mode decoupling. The models contain controlled generators in the Laplace-transform domain and are able to handle lossy lines with frequency-dependent parameters.



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Optimum noise measure configurations for transistor negative resistance amplifiers

P. Gardner and D.K. Paul. "Optimum noise measure configurations for transistor negative resistance amplifiers." 1997 Transactions on Microwave Theory and Techniques 45.5 (May 1997, Part I [T-MTT]): 580-586.

A new method, using the noise matrix approach, has been developed for determining the optimum reactive terminations for a transistor employed as a low-noise negative-resistance element in a reflection-mode amplifier. This new method corroborates the less efficient graphical method the authors reported earlier. It is established theoretically and demonstrated numerically that the optimum noise measure of a transistor used in a reflection-mode amplifier is independent of the choice of active terminal and is identical to the optimum noise measure of the same transistor when used in a conventional transmission-mode amplifier.

[Click on title for a complete paper.](#)



Abstracts

Parallel computation for microwave circuit simulation

D.L. Rhodes and B.S. Perlman. "Parallel computation for microwave circuit simulation." 1997 Transactions on Microwave Theory and Techniques 45.5 (May 1997, Part I [T-MTT]): 587-592.

In this paper, the results of implementing a harmonic balance simulator, AGILE, on a variety of massively parallel computers (MPCs) is given. Descriptions of the computer hardware, which includes both shared-memory and message-passing implementations, and algorithms used to parallelize the computations are presented. The computers used include the CM-5, KSR-1, and a networked set of nonheterogeneous workstations using UNIX RPC. A key aspect is the description of the variety of algorithms used for each computer and the results obtained.



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Efficient use of closed-form Green's functions for the analysis of planar geometries with vertical connections

N. Kinayman and M.I. Aksun. "Efficient use of closed-form Green's functions for the analysis of planar geometries with vertical connections." 1997 Transactions on Microwave Theory and Techniques 45.5 (May 1997, Part I [T-MTT]): 593-603.

An efficient and rigorous method for the analysis of planarly layered geometries with vertical metallizations is presented. The method is based on the use of the closed-form spatial-domain Green's functions in conjunction with the method of moments (MoM). It has already been demonstrated that the introduction of the closed-form Green's functions into the MoM formulation results in significant computational improvement for the analysis of planar geometries. However, in cases of vertical metallizations, such as shorting pin's, via holes, etc., there are some difficulties in incorporating the closed-form Green's functions into the MoM formulation. In this paper, these difficulties are discussed and their remedies are proposed. The proposed approach is compared to traditional approaches from a theoretical point of view, and the numerical implementation is demonstrated through some examples. The results are also compared to those obtained from the commercial software em by SONNET.

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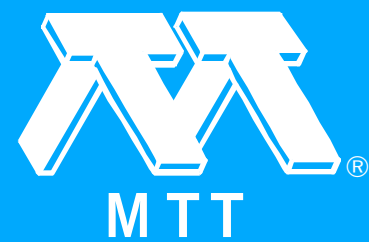


Phase noise in coupled oscillators: theory and experiment

Heng-Chia Chang, Xudong Cao, U.K. Mishra and R.A. York. "Phase noise in coupled oscillators: theory and experiment." 1997 Transactions on Microwave Theory and Techniques 45.5 (May 1997, Part I [T-MTT]): 604-615.

Phase noise in mutually synchronized oscillator systems is analyzed for arbitrary coupling and injection-locking topologies, neglecting amplitude noise, and amplitude modulation (AM) to phase modulation (PM) conversion. When the coupling phase is chosen properly (depending on the oscillator model), the near-carrier phase noise is reduced to $1/N$ that of a single oscillator, provided the coupling network is reciprocal. This is proved in general, and illustrated with specific cases of globally coupled and nearest-neighbor coupled oscillator chains. A slight noise degradation is found for unilaterally coupled (nonreciprocal) chains. The $1/N$ reduction for reciprocal coupling applies over nearly the entire range of free-running frequency distributions required for beam-scanning, and is verified experimentally using a linear chain of coupled GaAs MESFET voltage-controlled oscillators (VCOs) operating at X-band. The effect of a nonoptimum coupling phase on the phase noise of the system is also studied. As the coupling phase deviates from the optimum value, the phase noise increases significantly near the locking range edge for noise offset frequency near the carrier.





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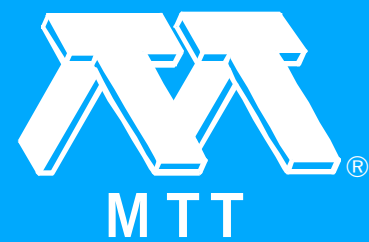
A Wiener-Hopf-type analysis of uniaxial substrate-superstrate microstrip structures

G.A. Kyriacou and J.N. Sahalos. "A Wiener-Hopf-type analysis of uniaxial substrate-superstrate microstrip structures." 1997 Transactions on Microwave Theory and Techniques 45.5 (May 1997, Part I [T-MTT]): 616-629.

A Wiener-Hopf-type technique in conjunction with the hybrid-mode analysis and a space-domain Fourier transform pair was employed for the solution of the canonical problem of a TEM wave obliquely incident upon the edge and defined by a semi-infinite plate conductor lying at the interface of two uniaxial dielectrics, forming an otherwise grounded double-layer geometry. The single-cover layer and double-layer surface-wave modes' characteristic equations are examined and their cutoff conditions, along with safe conditions avoiding longitudinal-section magnetic (LSM) modes are given. The scattered field components and the TEM-wave reflection coefficient are given analytically in the form of Sommerfeld-type integrals. A thin layers approximation and a numerical integration scheme were adopted for the evaluation of the reflection coefficient. Its expression can be directly used for the analysis of wide microstrip lines and patch antennas printed in a substrate/superstrate geometry. The whole analysis gives a clear physical insight into the problem. Furthermore, a twofold theoretical verification was adopted by either forcing the absence of the superstrate or considering both layers to be isotropic. Numerical parametric Investigations show the effects of either the presence of the superstrate or both layers' dielectric anisotropy.

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Micromachined microwave transmission lines in CMOS technology

V. Milanovic, M. Gaitan, E.D. Bowen and M.E. Zaghloul. "Micromachined microwave transmission lines in CMOS technology." 1997 Transactions on Microwave Theory and Techniques 45.5 (May 1997, Part I [T-MTT]): 630-635.

Coplanar waveguides were designed and fabricated through a commercial CMOS process with post-processing micromachining. The transmission-line layouts were designed with commercial computer-aided design (CAD) tools. Integrated circuits (ICs) were fabricated through the MOSIS service, and subsequently suspended by top-side etching. The absence of the lossy silicon substrate after etching results in significantly improved insertion-loss characteristics, dispersion characteristics, and phase velocity. Two types of layout are presented for different ranges of characteristic impedance. Measurements of the waveguides both before and after micromachining were performed at frequencies from 1 to 40 GHz using a vector network analyzer and de-embedding techniques, showing improvement of loss characteristics of orders of magnitude. For the entire range of frequencies, for the 50- Ω layout, losses do not exceed 4 dB/cm. These losses are mainly due to the small width and thickness of the metal strips. Before etching, losses are as high as 38 dB/cm due to currents in the underlying substrate. Phase velocity in the micromachined transmission lines is close to that in free space.

Click on title for a complete paper.



Design of compact waveguide twists

P.I. Alonso-Juaristi, J. Esteban and J.M. Rebollar. "Design of compact waveguide twists." 1997 Transactions on Microwave Theory and Techniques 45.5 (May 1997, Part I [T-MTT]): 636-639.

A new geometry for compact twist components composed of rectangular and circular waveguide sections is presented. The proposed twist geometry presents several advantages: 1) It can be designed for any rotation angle; 2) it is extremely short and, therefore, well suited for satellite communication applications; 3) its electrical behaviour is excellent for either narrow or broad frequency bands; and 4) a very accurate and efficient full-wave mode-matching method can be used to analyze these twists. A software package has been developed to design the proposed compact twist structure in a full-wave method.





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Discontinuities in planar chirowaveguides

Xinzhang Wu and D.L. Jaggard. "Discontinuities in planar chirowaveguides." 1997 *Transactions on Microwave Theory and Techniques* 45.5 (May 1997, Part I [T-MTT]): 640-647.

In this paper, we propose, develop, and implement an exact method to analyze the effect of discontinuities in open planar chirowaveguides. The method combines the building-block approach of multimode network theory with a rigorous mode-matching procedure. Both the scattering of discrete spectra surface-wave modes and the continuous spectra radiation and evanescent modes are discussed in this paper. The introduction of equivalent transmission-line networks brings new physical insight into the overall behaviour of the discontinuities. Features such as symmetrical properties of the structure are also investigated. Based on the analysis, numerical results are displayed to demonstrate the usefulness of this approach and to discuss mode conversion and radiation characteristics of discontinuities.



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Inherently matched Y-junction stripline circulator

S.A. Ivanov. "Inherently matched Y-junction stripline circulator." 1997 Transactions on Microwave Theory and Techniques 45.5 (May 1997, Part I [T-MTT]): 648-652.

An operation principle based on the field-effect displacement phenomenon of the perpendicularly magnetized ferrite striplines constituting the Y-junction circulator is proposed. The experimental results are in agreement with the idea that the striplines of the junction act as half-wavelength transformers ensuring 5%-8% bandwidth of the investigated circulators in the S-band without external matching.





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Fixed-tuned submillimeter wavelength waveguide mixers using planar Schottky-barrier diodes

J.L. Hesler, W.R. Hall, T.W. Crowe, R.M. Weikle, B.S. Deaver, R.F. Bradley and Shing-Kuo Pan. "Fixed-tuned submillimeter wavelength waveguide mixers using planar Schottky-barrier diodes." 1997 Transactions on Microwave Theory and Techniques 45.5 (May 1997, Part I [T-MTT]): 653-658.

The design, construction, and evaluation of fixed-tuned submillimeter wavelength waveguide mixers using planar Schottky diodes are presented in this paper. Electromagnetic fields within the planar diode package were analyzed using the finite-element method (FEM). Mixers using the University of Virginia SCIT5 planar diode were designed at both 585 and 690 GHz. A double sideband (DSB) system noise temperature of 2380 K was measured at 585 GHz using 1.16 mW of local oscillator (LO) power, and a system noise temperature of 2970 K DSB was measured at 690 GHz using 1.04 mW of LO power. In addition, the 585 GHz mixer was cooled to both 77 K and 4.2 K, with measured system noise temperatures of 1240 and 880-K DSB using LO powers of 0.47 and 0.14 mW, respectively. The modeling techniques were found to predict the measured conversion loss to within 1 dB. The performance of planar diode mixers is now within a factor of 1.5 of the best whisker-contacted Schottky diode mixers in this frequency range.

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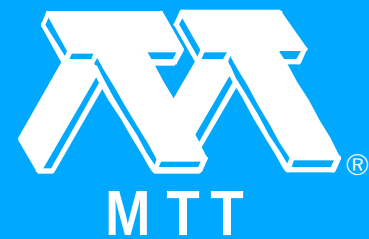
An MMIC V-band phase-locked oscillator using a GaAs MMIC sampling phase detector

A. Kanda, T. Nakagawa, T. Hirota, H. Okazaki and M. Nakamae. "An MMIC V-band phase-locked oscillator using a GaAs MMIC sampling phase detector." 1997 Transactions on Microwave Theory and Techniques 45.5 (May 1997, Part I [T-MTT]): 659-665.

A V-band full-monolithic phase-locked oscillator (PLO) has been developed. All the circuits are integrated into three monolithic microwave integrated circuit (MMIC) chips. One is a highly integrated multifunction MMIC for 15-GHz voltage-controlled oscillation and 15-30-GHz frequency doubling. The second is for 30-60-GHz frequency doubling. The third is a sampling phase detector (SPD) chip, which operates up to 20 GHz and can be driven at 0-dBm power. Each circuit is greatly reduced in size by using a uniplanar structure; the oscillator area is only 5.5 mm/sup 2/ and the SPD area is 3.0 mm/sup 2/. The PLO exhibits output power of 3.5 dBm with single-sideband (SSB) phase noise in the phase-locked state of -64 dBc/Hz at 10 kHz offset from 60.0 GHz in spite of the low Q full-monolithic oscillator circuitry.

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Analysis of finite grid structures with lenses in quasi-optical systems

T.W. Nuteson, Huan-Sheng Hwang, M.B. Steer, K. Naishadham, J. Harvey and J.W. Mink. "Analysis of finite grid structures with lenses in quasi-optical systems." 1997 Transactions on Microwave Theory and Techniques 45.5 (May 1997, Part I [T-MTT]): 666-672.

A full-wave moment-method technique developed for the analysis of quasi-optical (QO) systems is used to model finite grid structures in a lens system. This technique incorporates an electric-field dyadic Green's function for a grid centered between two lenses. This is derived by separately considering paraxial and nonparaxial fields. Results for the driving point reflection coefficient of a $3/\text{spl times } 3$ and $5/\text{spl times } 5$ grid in the lens system are computed and compared with measurements.

[Click on title for a complete paper.](#)



Abstracts

Sub-cellular technique for finite-difference time-domain method

S. Kapoor. "Sub-cellular technique for finite-difference time-domain method." 1997 Transactions on Microwave Theory and Techniques 45.5 (May 1997, Part I [T-MTT]): 673-677.

The most frequently encountered problem with the finite-difference time-domain (FDTD) method, for the analysis of microstrip line and many other structures, is that the structure generally has important structural features that are very small as compared to the main body in at least one dimension. Thus, to accurately analyze such structures, very small mesh is considered which makes the analysis very expensive, time consuming, and sometimes even impossible due to the computer limitations. In this paper, a new sub-cellular technique has been proposed which takes care of such problems as well as many other problems, such as curved surfaces (in which interfaces are not parallel to one of the coordinate planes and stair-step approximation is considered).



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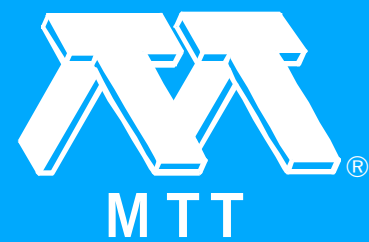
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An improved multigrid technique for quasi-TEM analysis of a microstrip embedded in an inhomogeneous anisotropic medium

Ching-Long Tsai and Way-Seen Wang. "An improved multigrid technique for quasi-TEM analysis of a microstrip embedded in an inhomogeneous anisotropic medium." 1997 *Transactions on Microwave Theory and Techniques* 45.5 (May 1997, Part I [T-MTT]): 678-686.

An improved multigrid technique for the quasi-TEM analysis of a microstrip line embedded in an inhomogeneous anisotropic dielectric medium is presented. A general finite-difference form for the inhomogeneous anisotropic medium is derived by the finite-volume discretization of Gauss's theorem. By the analogy between the quasi-TEM and the steady current problems, this general form can be interpreted by Kirchhoff's current law. Then, the electric potential distribution in this complicated dielectric structure can be regarded as that on a resistive network, which makes the formulation easier. The resulting matrix equation for the potential distribution on the finest grid is solved by the improved multigrid iteration, where the coarse-grid operator is derived directly from the finest grid operator by the help of an equivalent resistive network. Three numerical examples show that the convergence rate is hardly dependent of the number of unknowns and the complexity of the dielectric media. Moreover, the numerical results are in good agreement with those by the other method when special cases are considered.

Click on title for a complete paper.



Wave propagation in heterogeneous anisotropic magnetic materials

K. Berthou-Pichavant, F. Liorzou and P. Gelin. "Wave propagation in heterogeneous anisotropic magnetic materials." 1997 Transactions on Microwave Theory and Techniques 45.5 (May 1997, Part I [T-MTT]): 687-690.

In order to examine guided wave propagation in unsaturated magnetized materials, it seems reasonable to consider an alternation of layers with antiparallel magnetization in a rectangular waveguide. This approach is coherent with Schlomann's model which considers partially magnetized ferrites as an alternation of antiparallel coaxial cylinders. The finite-difference time-domain (FDTD) method had been used in the case of an homogeneously filled rectangular waveguide. It is adapted here to a guide partially filled with two antiparallel magnetization layers. The modification of the FDTD algorithm at the air/ferrite and ferrite/ferrite interfaces is presented. Results are compared with the ones obtained by a mode-matching technique.





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HBT's RF noise parameter determination by means of an efficient method based on noise analysis of linear amplifier networks

P. Rouquette, D. Gasquet, T. Holden and J. Moul. "HBT's RF noise parameter determination by means of an efficient method based on noise analysis of linear amplifier networks." 1997 Transactions on Microwave Theory and Techniques 45.5 (May 1997, Part I [T-MTT]): 690-694.

A method for the evaluation of the RF noise figure of heterojunction bipolar transistors (HBTs) is presented. The noise analysis is based on the use of the correlation matrices. The two-port device is described as an interconnection of basic two-port devices whose noise behaviour is known. The circuit theory of linear noisy networks allows that any two-port device can be replaced by a noise equivalent circuit which consists of the original two-port assumed to be noiseless and possess two additional noise sources. The purpose of this paper is to obtain the four noise parameters of the device, taking into account the excess resistances and inductances. The calculations presented show good agreement with measurements, and as a consequence, they permit a good estimation of the noise performance of the structure without neglecting any parasitic elements of the equivalent circuit.

Click on title for a complete paper.



Abstracts

Explicit expressions of the reflection and transmission for two coupled identical exponential lines

Sailing He. "Explicit expressions of the reflection and transmission for two coupled identical exponential lines." 1997 Transactions on Microwave Theory and Techniques 45.5 (May 1997, Part I [T-MTT]): 695-698.

The reflection and transmission problem of two coupled identical exponential lines is considered in this paper. The exact and explicit expressions for the co- and cross-line reflection and transmission coefficients are derived. The explicit expressions are validated by an independent numerical solution.



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Operation of new type field displacement isolator in ridged waveguide

Wen Junding, Wenquan Che, Yongzhing Xiong and Yongwu Wen. "Operation of new type field displacement isolator in ridged waveguide." 1997 Transactions on Microwave Theory and Techniques 45.5 (May 1997, Part I [T-MTT]): 698-700.

A new type ridged-waveguide field-displacement isolator is analyzed in this paper. Experimental result have been obtained for the isolation, insert loss, and voltage standing wave ratio (VSWR) in C- and X-band. The isolation and bandwidth are found to increase obviously.

Click on title for a complete paper.

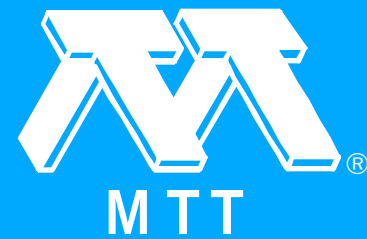


Abstracts

An accurately scaled small-signal model for interdigitated power P-HEMT up to 50 GHz

Shen-Whan Chen, O. Aina, Weiqi Li, L. Phelps and T. Lee. "An accurately scaled small-signal model for interdigitated power P-HEMT up to 50 GHz." 1997 Transactions on Microwave Theory and Techniques 45.5 (May 1997, Part I [T-MTT]): 700-703.

In this paper, the authors report an approach for constructing scalable small-signal models for interdigitated power pseudomorphic high-electron-mobility transistors (P-HEMTs). By using cold-FET and Yang-Long measurement, as well as direct extraction procedures, scaling rules for extrinsic components were established that allow accurate models over a broad frequency range. These models have been used to design ultrawide-band monolithic microwave integrated circuits (MMICs) up to 50 GHz.



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Abstracts

Constraints To The Optimum Performance And Bandwidth Limitations Of Diplexers Employing Three-port Junctions (Correction)

A. Morini. "Constraints To The Optimum Performance And Bandwidth Limitations Of Diplexers Employing Three-port Junctions (Correction)." 1997 Transactions on Microwave Theory and Techniques 45.5 (May 1997, Part I [T-MTT]): 704-704.

The above paper contains some oversights. The first oversight is that $s_{11} = s_{22}$ for both E-plane and H-plane three-port junctions that have one symmetry plane.



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Abstracts

The Relationship Between Dual Mode Cavity Cross-coupling And Waveguide Polarizers (Correction)

R. Levy. "The Relationship Between Dual Mode Cavity Cross-coupling And Waveguide Polarizers (Correction)." 1997 Transactions on Microwave Theory and Techniques 45.5 (May 1997, Part I [T-MTT]): 704-705.

The author of the above paper is grateful to Prof. Harry E. Green of The University of South Australia, for pointing out that a more accurate finite difference solution for the circular waveguide with flats was presented in the following reference, which should be added as the final reference to the above paper:



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Input Impedance Of A Coaxial Probe Located Inside A Rectangular Cavity: Theory And Experiment (Correction)

M.S. Leong, L.W. Li, P.S. Kooi, T.S. Yeo and S.L. Ho. "Input Impedance Of A Coaxial Probe Located Inside A Rectangular Cavity: Theory And Experiment (Correction)." 1997 Transactions on Microwave Theory and Techniques 45.5 (May 1997, Part I [T-MTT]): 705-705.
In the above paper, (7c) should have read as follows:



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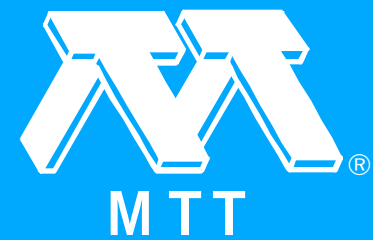
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Guest Editorial (May 1997, Part I [T-MTT])

J.W. Bandler. "Guest Editorial (May 1997, Part I [T-MTT])." 1997 Transactions on Microwave Theory and Techniques 45.5 (May 1997, Part II [T-MTT]): 709-711.

Recent advances in microwave computer-aided design (CAD) technology, the availability of powerful PC's, workstations, and massively parallel systems, suggest the feasibility of interfacing electromagnetic (EM) simulations into optimization systems or CAD frameworks for direct application of powerful optimizers. With fast, robust, commercial EM simulators increasingly available, microwave engineers are already pushing the frontiers beyond traditional uses of EM simulators. The new thrust is to integrate EM simulations directly into the linear/nonlinear circuit design process in a manner transparent to the designer.



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Abstracts

The application of neural networks to EM-based simulation and optimization of interconnects in high-speed VLSI circuits

A. Veluswami, M.S. Nakhla and Qi-Jun Zhang. "The application of neural networks to EM-based simulation and optimization of interconnects in high-speed VLSI circuits." 1997 *Transactions on Microwave Theory and Techniques* 45.5 (May 1997, Part II [T-MTT]): 712-723.

In this paper, a neural network based approach to the electromagnetic (EM) simulation and optimization of high-speed interconnects is discussed. Traditional techniques used to model interconnects in high-speed very large scale integration (VLSI) circuits are based on EM-field simulation, and are thus highly demanding on central processing unit (CPU) resources. This limits their suitability for computer-aided design (CAD) and optimization techniques which are, in general, iterative in nature. Neural networks can be used to map the complex relationship between the physical and electrical parameters of interconnect structures in an efficient manner. The models, once developed, operate with minimal on-line CPU resources and are thus ideally suited for use in iterative CAD and optimization routines.



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Methods of using commercial electromagnetic simulators for microwave and millimeter-wave circuit design and optimization

N. Jain and P. Onno. "Methods of using commercial electromagnetic simulators for microwave and millimeter-wave circuit design and optimization." 1997 Transactions on Microwave Theory and Techniques 45.5 (May 1997, Part II [T-MTT]): 724-746.

Efficient utilization of commercial electromagnetic (EM) simulators for design and optimization of microwave (MW) and millimeter-wave (MMW) circuits is achieved by classifying design problems into three categories-characterization of circuit elements, optimization of circuit elements, and creation of circuit element libraries such as scalable libraries. Practical aspects of the methods are illustrated by several examples. An equivalent circuit extraction technique suitable for n-port coupled structures is provided. The derived equivalent circuit is useful for extrapolating data, optimization, and deriving scalable models.



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Automated design of waveguide components using hybrid mode-matching/numerical EM building-blocks in optimization-oriented CAD frameworks-state of the art and recent advances

F. Arndt, R. Beyer, J.M. Reiter, T. Sieverding and T. Wolf. "Automated design of waveguide components using hybrid mode-matching/numerical EM building-blocks in optimization-oriented CAD frameworks-state of the art and recent advances." 1997 Transactions on Microwave Theory and Techniques 45.5 (May 1997, Part II [T-MTT]): 747-760.

Fast hybrid mode-matching/boundary-contour (MM/BC) and mode-matching/finite-element (MM/FE) waveguide building blocks are described for the optimization-oriented use in powerful circuit computer-aided design (CAD) tools and the automated design of waveguide components. The efficient electromagnetic (EM) CAD technique allows the accurate design of a comprehensive class of rectangular and circular waveguide components including realistic structures of higher complexity. The efficiency and flexibility of the hybrid CAD method is demonstrated at advanced EM design examples, such as broad-band circular-to-rectangular waveguide transitions including octagonal cross sections, waveguide resonator filters with rounded corners, optimum-shaped bends, dual-mode filters with coupling sections without tuning screws, ridged waveguide filters with rounded corners, and multiplexers. The designed components are directly amenable to cost-efficient fabrication techniques like computer-controlled milling methods. The theory is verified by available measurements.



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Design optimization of interdigital filters using aggressive space mapping and decomposition

J.W. Bandler, R.M. Biernacki, Shao Hua Chen and Ya Fei Huang. "Design optimization of interdigital filters using aggressive space mapping and decomposition." 1997 Transactions on Microwave Theory and Techniques 45.5 (May 1997, Part II [T-MTT]): 761-769.

This paper presents a new electromagnetic (EM) design methodology which combines two powerful techniques in a coherent strategy: space mapping (SM) and decomposition. An accurate but computationally intensive fine-resolution EM model is used sparingly only to calibrate a less accurate, but computationally much more efficient "coarse model." Applying this new approach to interdigital filter design, the authors exploit structural decomposition to construct a highly efficient coarse model using a combination of EM models with a coarse grid and empirical models for the noncritical substructures. The authors employ the aggressive SM optimization technique to obtain a rapidly improved design after each fine-model simulation while the bulk of the computation is carried out using the coarse model. To avoid possible oscillation in the iterative process, a penalty function is introduced. Fast and stable convergence to a desirable interdigital filter design is achieved after only three EM fine-model simulations.

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Electromagnetic optimization of 3-D structures

J.W. Bandler, R.M. Biernacki, Shao Hua Chen, L.W. Hendrick and D. Omeragic.

"Electromagnetic optimization of 3-D structures." 1997 Transactions on Microwave Theory and Techniques 45.5 (May 1997, Part II [T-MTT]): 770-779.

This paper discusses novel techniques and methodologies suitable for automated electromagnetic (EM) design of arbitrary three-dimensional (3-D) structures. In the context of parameterization of arbitrary 3-D structures, the authors outline the concept of the geometry capture technique. The authors present efficient response interpolation with respect to optimizable parameters-the key to effective automation. The authors' formulation is based on the maximally flat quadratic interpolation (MFQI) technique and provides gradient estimation essential to efficient optimization. The authors address the issue of storing the results of expensive EM simulations in a dynamically updated database, integrated with the interpolation technique. The automated EM optimization process is illustrated by the design of waveguide mitered bends. The authors also apply the aggressive space mapping (SM) technique to the optimization of multistep waveguide transformers.

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An innovative CAD technique for microstrip filter design

Shen Ye and R.R. Mansour. "An innovative CAD technique for microstrip filter design." 1997 Transactions on Microwave Theory and Techniques 45.5 (May 1997, Part II [T-MTT]): 780-786.

An innovative computer-aided design (CAD) technique for efficient and accurate microstrip filter design is presented in this paper. The technique utilizes full-wave electromagnetic (EM) simulation for the individual circuit elements, while interactions between nonadjacent elements are emulated by introducing circuit components to form extra signal paths. Designs can be accomplished with the accuracy of complete circuit EM simulation while keeping the computational efforts at a cascading simulation level which is crucial for design optimization. The technique has clear physical interpretations and is easy to implement. The authors have successfully applied this technique to design several microstrip filters. Very good filter performance was achieved with good correlation between predicted and measured results.





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Automated design of corrugated feeds by the adjoint network method

M. Mongiardo and R. Ravanelli. "Automated design of corrugated feeds by the adjoint network method." 1997 Transactions on Microwave Theory and Techniques 45.5 (May 1997, Part II [T-MTT]): 787-793.

Automated full-wave design of corrugated feeds is generally accomplished by repeated numerical analysis of different feed geometries as obtained by slightly varying the geometrical dimensions of the corrugations. Since a corrugated feed contains hundreds of discontinuities, the above procedure is very time-consuming. In order to reduce the numerical effort, the adjoint network method (ANM) has been applied to the design and sensitivity analysis of circular corrugated feeds radiating into free space. By using the ANM, the return loss sensitivities with respect to variations of all geometrical dimensions are obtained with just one analysis of the entire feed. When a geometrical parameter is varied, only the discontinuity containing that parameter needs to be analyzed; the overall sensitivities being computed by means of a simple formula. Corrugated feeds with more than 100 corrugations have been designed by using the ANM. They have been built and measured demonstrating the efficiency of the proposed approach.

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Artificial neural networks for fast and accurate EM-CAD of microwave circuits

G.L. Creech, B.J. Paul, C.D. Lesniak, T.J. Jenkins and M.C. Calcaterra. "Artificial neural networks for fast and accurate EM-CAD of microwave circuits." 1997 Transactions on Microwave Theory and Techniques 45.5 (May 1997, Part II [T-MTT]): 794-802.

A novel approach for achieving fast and accurate computer-aided design (CAD) of microwave circuits is described. The proposed approach enhances the ability to utilize electromagnetic (EM) analysis techniques in an interactive CAD environment through the application of neurocomputing technology. Specifically, a multilayer perceptron neural network (MLPNN) is implemented to model monolithic microwave integrated circuit (MMIC) passive elements using the element's physical parameters. The strength of this approach is that only a minimum number of EM simulations of these passive elements are required to capture critical input-output relationships. The technique used to describe the data set required for model development is based on a statistical design of experiment (DoE) approach. Data generated from EM simulations are used to train the MLPNN which, once trained, is capable of modeling passive elements not included in the training set. The results presented indicate that the MLPNN can predict the s-parameters of these passive elements to nearly the same degree of accuracy as that afforded by EM simulation. The correlations between the MLPNN-computed and EM-simulated results are greater than 0.98 for each modeled parameter.

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A systematic optimum design of waveguide-to-microstrip transition

Hong-bae Lee and T. Itoh. "A systematic optimum design of waveguide-to-microstrip transition." 1997 Transactions on Microwave Theory and Techniques 45.5 (May 1997, Part II [T-MTT]): 803-809.

In this paper, a systematic optimum design method is introduced, which consists of the finite-element method (FEM), design sensitivity analysis (DSA), and the steepest descent algorithm. A waveguide-to-microstrip (W/G-to-M/S) probe-type transition is designed by using the proposed method. In the FEM as a full-wave analyzer, eigenvalue and eigenvector calculations in the two-dimensional (2-D) FEM precede the three-dimensional (3-D) FEM, in order to terminate the W/G-to-MIS transition model into an electrically small model. The analysis results of this approach are compared with ones of a commercial FEM software high-frequency structure simulator (HFSS). The total derivative required in the steepest descent algorithm is calculated numerically by the DSA based on the FEM. The additional time needed for this proposed method is only one more calculation of a sparse matrix equation. The return loss is chosen as the objective function to be minimized, and the backshort length and probe length are selected as the design variables in the transition design. The proposed method gives a good convergence characteristic and the optimized results show its usefulness.

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Microwave filter analysis using a new 3-D finite-element modal frequency method

J.R. Brauer and G.C. Lizalek. "Microwave filter analysis using a new 3-D finite-element modal frequency method." 1997 Transactions on Microwave Theory and Techniques 45.5 (May 1997, Part II [T-MTT]): 810-818.

A new finite element modal frequency method is presented and shown to be advantageous for the analysis of microwave filters. The method analyzes a finite-element model of a filter by first computing the eigenmodes of the three-dimensional (3-D) structure. The computed eigenvalues are shown to reliably determine all of the resonant frequencies in a frequency range; the filter design can be changed until the desired resonant frequencies are computed. Finally, the eigenvectors are used as basis functions to compute the frequency response of the filter, thereby achieving a speedup that increases with the number of frequencies analyzed. Two filters analyzed in this paper show speedups ranging from 1.39 to 4.01, and their computed S-parameters agree closely with measurements.

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Abstracts

Full-wave analysis of packaged microwave circuits with active and nonlinear devices: an FDTD approach

Chien-Nan Kuo, B. Houshmand and T. Itoh. "Full-wave analysis of packaged microwave circuits with active and nonlinear devices: an FDTD approach." 1997 Transactions on Microwave Theory and Techniques 45.5 (May 1997, Part II [T-MTT]): 819-826.

This paper presents a comprehensive full-wave analysis of packaged nonlinear active microwave circuits by applying the extended finite-difference time-domain (FDTD) method. Based on the approach of using equivalent sources, the device-wave interaction is characterized and incorporated into the FDTD time-marching scheme. As a consequence, analysis of linear and nonlinear properties, including harmonic generation and intermodulation, can be accomplished by employing a large-signal device circuit model. The implementation is first validated by comparing results of FDTD and HP MDS simulation of the circuit without the packaging structure. The analysis then goes beyond the capability of the circuit simulator to include the packaging effect. This analysis is useful in circuit design involving electromagnetic compatibility/electromagnetic interference (EMC/EMI) problems.



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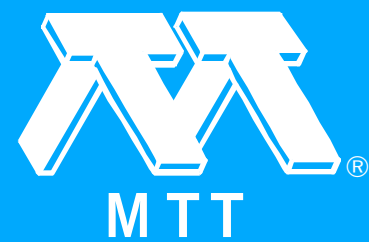
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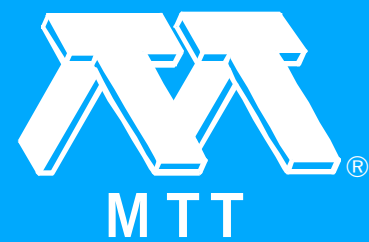
Subjects

Fast parameter extraction of general interconnects using geometry independent measured equation of invariance

W. Sun, W. Wei-Ming Dai and Wei Hong. "Fast parameter extraction of general interconnects using geometry independent measured equation of invariance." 1997 Transactions on Microwave Theory and Techniques 45.5 (May 1997, Part II [T-MTT]): 827-836.

The measured equation of invariance (MEI) is a new concept in computational electromagnetics. It has been demonstrated that the MEI technique can be used to terminate the meshes very close to the object boundary and still strictly preserves the sparsity of the finite-difference (FD) equations. Therefore, the final system matrix encountered by the MEI is a sparse matrix with a size similar to that of integral equation methods. However complicated the Green's function, disagreeable Sommerfeld integrals, and very difficult umbilical meshes for multiconductors make the traditional MEI very difficult (if not impossible) to be applied to analyze multilayer and multiconductor interconnects. In this paper, the authors propose the geometry independent MEI (GIMEI) which substantially improves the original MEI method. The authors use GIMEI for capacitance extraction of general two-dimensional (2-D) and three-dimensional (3-D) very large scale integration (VLSI) interconnect. numerical results are in good agreement with published data and those obtained by using FASTCAP from Massachusetts Institute of Technology (MIT) and some other commercial tools, while GIMEIs are generally an order of magnitude faster than FASTCAP with much less memory usage.





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Application of the Cauchy method for extrapolating/interpolating narrowband system responses

R.S. Adve, T.K. Sarkar, S.M. Rao, E.K. Miller and D.R. Pflug. "Application of the Cauchy method for extrapolating/interpolating narrowband system responses." 1997 Transactions on Microwave Theory and Techniques 45.5 (May 1997, Part II [T-MTT]): 837-845.

In this paper, it is shown that Cauchy's method can be used effectively to interpolate/extrapolate narrow-band system responses. The given information can either be theoretical datapoints or measured experimental data over a band. For theoretical data extrapolation or interpolation, the sampled values of the function and, optionally, a few of its derivatives have been used to reconstruct the function. For measured data, only measured values of the parameter are used to create broadband information from limited data as derivative information is too noisy. Cauchy's method assumes that the parameter to be extrapolated/interpolated, as a function of frequency, is a ratio of two polynomials. The problem is to determine the order of the polynomials and the coefficients therein. The method of total least squares (TLS) has been used to solve the resulting matrix equation involving the coefficients of the polynomials. Typical numerical results have been presented to show that reliable interpolation/extrapolation can be done for various system responses.

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Physics-based large-signal sensitivity analysis of microwave circuits using technological parametric sensitivity from multidimensional semiconductor device models

F. Bonani, S.D. Guerrieri, F. Filicori, G. Ghione and M. Pirola. "Physics-based large-signal sensitivity analysis of microwave circuits using technological parametric sensitivity from multidimensional semiconductor device models." 1997 Transactions on Microwave Theory and Techniques 45.5 (May 1997, Part II [T-MTT]): 846-855.

The authors present an efficient approach to evaluate the large-signal (LS) parametric sensitivity of active semiconductor devices under quasi-periodic operation through accurate, multidimensional physics-based models. The proposed technique exploits efficient intermediate mathematical models to perform the link between physics-based analysis and circuit-oriented simulations, and only requires the evaluation of dc and ac small-signal (dc charge) sensitivities under general quasi-static conditions. To illustrate the technique, the authors discuss examples of sensitivity evaluation, statistical analysis, and doping profile optimization of an implanted MESFET to minimize intermodulation which makes use of LS parametric sensitivities under two-tone excitation.



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Simple and effective EM-based optimization procedure for microwave filters

J.T. Alos and M. Guglielmi. "Simple and effective EM-based optimization procedure for microwave filters." 1997 Transactions on Microwave Theory and Techniques 45.5 (May 1997, Part II [T-MTT]): 856-858.

A simple and effective computerized optimization procedure for microwave filters is discussed. The basic idea is to integrate a fast and accurate electromagnetic (EM) solver, a filter design strategy, and two different optimization algorithms. The structural parameters to be modified are then chosen with the objective of improving the interaction between the EM solver and the optimization process. A simple example is discussed in detail indicating how the procedure is very simple and effective.

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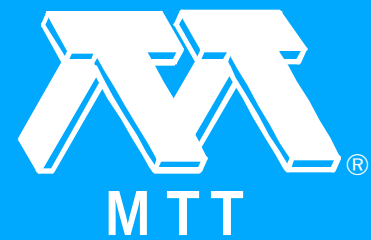


Abstracts

Improved design of passive coaxial components using electromagnetic 2-D solver in an optimization loop

P. Miazga and W. Gwarek. "Improved design of passive coaxial components using electromagnetic 2-D solver in an optimization loop." 1997 Transactions on Microwave Theory and Techniques 45.5 (May 1997, Part II [T-MTT]): 858-861.

In this paper a new approach to the design of passive coaxial components, based on finite-difference time-domain (FDTD) electromagnetic (EM) analysis in an optimization loop is presented. A specialized coaxial EM solver has been modified for combined use with three optimization methods. Algorithms proved to be accurate and effective producing significantly improved circuits designs in a reasonable computing time. Practical examples illustrate advantages of the present approach.



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Automated optimization of a waveguide-microstrip transition using an EM optimization driver

Min Zhang and T. Weiland. "Automated optimization of a waveguide-microstrip transition using an EM optimization driver." 1997 Transactions on Microwave Theory and Techniques 45.5 (May 1997, Part II [T-MTT]): 861-864.

An electromagnetic (EM) optimization driver is introduced which makes optimization of electromagnetic components fully automatic. The driver is composed of an EM simulator and an optimizer. As a test example, an optimum design of a waveguide-microstrip transition using the driver is demonstrated. The numerical design is verified by the measurement.



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Spiral super-quadric generatrix and bodies of two generatrices in automated parameterization of 3-D geometries

B.M. Kolundzija and A.R. Djordjevic. "Spiral super-quadric generatrix and bodies of two generatrices in automated parameterization of 3-D geometries." 1997 Transactions on Microwave Theory and Techniques 45.5 (May 1997, Part II [T-MTT]): 864-866.

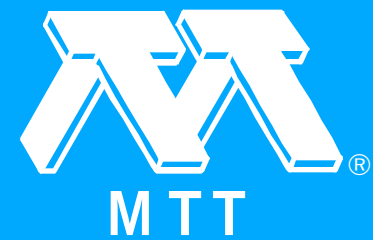
Most of the methods that solve the surface integral equation (SIE) by the method of moments (MoM) use triangles and flat quadrilaterals for geometrical modeling. Many complex structures can be easily modeled by quadrilaterals combining spiral super-quadric generatrices and the concept of the body of two generatrices (BoTG). A BoTG is any body that can be obtained from two generatrices by applying a certain rule. Four simple rules for obtaining BoTG's are: (1) generalized rotation; (2) translation; (3) constant cut; and (4) connected generatrices. Spiral super-quadric generatrices enable efficient modeling of circles, arcs, ellipses, squares, rectangles, spirals, etc. Thus, a simple but fairly general algorithm for geometrical modeling is obtained, convenient for implementation in electromagnetic-field solvers.



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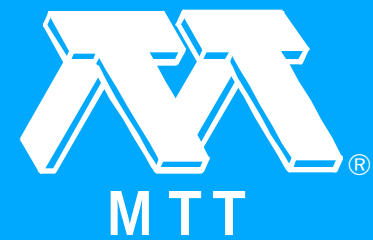
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Equivalent network representation of boundary conditions involving generalized trial quantities-application to lossy transmission lines with finite metallization thickness

F. Bouzidi, H. Aubert, D. Bajon and H. Baudrand. "Equivalent network representation of boundary conditions involving generalized trial quantities-application to lossy transmission lines with finite metallization thickness." 1997 Transactions on Microwave Theory and Techniques 45.6 (Jun. 1997 [T-MTT]): 869-876.

The derivation of integral equations for solving boundary conditions by mere application of analog Kirchhoff's and Ohm's laws is used. Generalized trial quantities are introduced as virtual adjustable sources in the equivalent network representation of boundary conditions. The lossy conductor domain of a planar transmission line is represented by a particular two-port. Thus, metallic losses can be evaluated for any metallization thickness without restricting the conductor modeling to a simple surface impedance approximation. In this paper, this two-port model is discussed and numerical results relative to a lossy coplanar waveguide (CPW) are presented. These results are in very good agreement with those obtained from the mode-matching technique and with other experimental data available in the literature. The size of matrices involved in the calculation of losses is twice as large as that in the lossless case. Moreover, the authors' formulation can be easily applied to superconducting planar transmission lines.

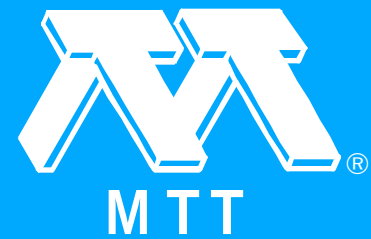
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Solving microstrip discontinuities by the measured equation of invariance

M.D. Prouty, K.K. Mei, S.E. Schwarz, R. Pous and Yau-wu Liu. "Solving microstrip discontinuities by the measured equation of invariance." 1997 Transactions on Microwave Theory and Techniques 45.6 (Jun. 1997 [T-MTT]): 877-885.

The measured equation of invariance (MEI) is a newly developed computational method which allows finite-difference (FD) or finite-element (FE) mesh to be terminated very closely to objects of interest. In this paper, the authors show how the MEI method may be applied to microstrip antennas and discontinuity problems. The authors demonstrate its use in general full-wave three-dimensional (3-D) microstrip problems, and give results for open-ended microstrip lines and microstrip bends.



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DC to high-frequency HBT-model parameter evaluation using impedance block conditioned optimization

A. Samelis and D. Pavlidis. "DC to high-frequency HBT-model parameter evaluation using impedance block conditioned optimization." 1997 Transactions on Microwave Theory and Techniques 45.6 (Jun. 1997 [T-MTT]): 886-897.

A new heterojunction bipolar transistor (HBT) small-signal equivalent-circuit parameter-extraction procedure employing multibias S-parameter data is presented. The algorithm combines analytical and empirical parameter evaluation techniques and results in a bias-dependent HBT model. To minimize the risk of nonphysical parameter estimation, elements such as the DC transport factor, $/spl \alpha /sub o /$, and the emitter-base conductance are evaluated from the device DC characteristics, and the frequency dispersion of $/spl \alpha /$ is related to the RC time-constant of the emitter-base junction. Moreover, initial values for the extrinsic device parasitics are obtained from "hot" as well as "cold" S-parameter data. The method results in excellent fit between measured and modeled S-parameter data in the frequency range DC-40 GHz and for a wide range of bias operating points.

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A modified Chebyshev bandpass filter with attenuation poles in the stopband

Jeong-Soo Lim and Dong Chul Park. "A modified Chebyshev bandpass filter with attenuation poles in the stopband." 1997 Transactions on Microwave Theory and Techniques 45.6 (Jun. 1997 [T-MTT]): 898-904.

This paper describes a design method of a modified Chebyshev bandpass filter with attenuation poles in the stopband. The insertion of attenuation poles into resonators in the authors' bandpass-filter design is accomplished by connecting a lumped inductor or capacitor in series with a shunt-type coaxial transmission-line resonator. The inserted poles which are distributed over the stopband can be chosen such that the insertion loss of the filter has equiripple characteristic and maximum attenuation in the stopband with the given number of attenuation poles. The modified Chebyshev bandpass filter designed by this method can be effectively used in diplexer design.

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Enhanced spatial network method for the analysis of open microstrip discontinuities

D.M. Bica and B. Beker. "Enhanced spatial network method for the analysis of open microstrip discontinuities." 1997 Transactions on Microwave Theory and Techniques 45.6 (Jun. 1997 [T-MTT]): 905-910.

In this paper, a new technique is presented for the numerical analysis of open boundary three-dimensional (3-D) vias embedded in multilayered strata. This approach is based on an enhanced spatial network method (SNM) algorithm, and leads to speed-up factors of 10-12 over the standard SNM implementation. Absorbing boundary conditions, based on the perfect matching layer (PML) concept, are implemented for open boundary truncation. Unlike the standard PML's, the proposed absorbing boundary conditions (ABC's) do not require introduction of additional variables.



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Millimeter-wave amplitude-phase modulator

A.E. Martynyuk, N.A. Martynyuk, S.N. Khotiaintsev and V.S. Vountesmeri. "Millimeter-wave amplitude-phase modulator." 1997 Transactions on Microwave Theory and Techniques 45.6 (Jun. 1997 [T-MTT]): 911-917.

A millimeter-wave amplitude-phase modulator, using Fox's (polarization) principle of phase changing has been developed. Using this modulator, it is possible to perform the following types of phase modulation: binary phase-shift keying (BPSK), quadrature phase-shift keying (QPSK), differential QPSK (DQPSK), $\pi/4$ -DQPSK with peak phase error 5° (rms error: 2°), and peak amplitude error 2% (rms error: 1%) in the frequency range of 36-37.5 GHz. The achievable switching time is less than 35 ns. A low level of insertion loss (1 dB) is achieved. The modulator is able to switch up to 25 dBm of RF power. This modulator can also be used for changing the amplitude of the output wave from 0 to -6 dB with an accompanying phase modulation less than 3° . The modulator is suitable for use in high-speed millimeter-wave communication systems.





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Inductance and quality-factor evaluation of planar lumped inductors in a multilayer configuration

S.F. Mahmoud and E. Beyne. "Inductance and quality-factor evaluation of planar lumped inductors in a multilayer configuration." 1997 Transactions on Microwave Theory and Techniques 45.6 (Jun. 1997 [T-MTT]): 918-923.

Integral representations for the self and mutual inductance of planar loops on a multilayered structure are derived. The integrals are of the Sommerfeld type and can be easily evaluated under the quasi-static approximation which is validated by the small dimensions relative to a wavelength. Enhancement of loop inductance by inclusion of a magnetic layer is investigated. It is shown that such a layer can increase the inductance by a percentage which has the upper limit of $[(\mu_r - 1)/(\mu_r + 1)] \times 100\%$, where μ_r is the relative permeability of the layer. A study is also made on the inductor quality factor (Q) as affected by losses caused by finite electrical conductivity of the magnetic layer and the underlying substrate.

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Nonlinear surface waves on the interface of two non-Kerr-like nonlinear media

Jian-Guo Ma and Zhizhang Chen. "Nonlinear surface waves on the interface of two non-Kerr-like nonlinear media." 1997 Transactions on Microwave Theory and Techniques 45.6 (Jun. 1997 [T-MTT]): 924-930.

In recent years, there has been growing interest in studying nonlinear guided-wave propagation as they present potential, yet not fully-explored, applications for high-speed optical signal processing and transmission. In this paper, analytical solutions for nonlinear surface waves on the interface of two nonlinear non-Kerr-like media are derived. The dispersion relations and their relations to the transmission power and initial field distributions are calculated. Several observations are made on the behaviors of the surface waves and their potential applications.

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Quasi-static design technique for MM-wave micromachined filters with lumped elements and series stubs

T.M. Weller, K.J. Herrick and L.P.B. Katehi. "Quasi-static design technique for MM-wave micromachined filters with lumped elements and series stubs." 1997 Transactions on Microwave Theory and Techniques 45.6 (Jun. 1997 [T-MTT]): 931-938.

This paper describes micromachined, membrane-supported low-pass and bandpass filters which are suitable for microwave and millimeter-wave (MM-wave) application. The designs are realized in coplanar-waveguide (CPW) form using short- and open-end series stubs with integrated metal-insulator-metal (MIM) capacitors, and are compact in lateral and longitudinal dimensions. A computationally efficient analysis has been developed for the design and characterization of the filters. The technique is based on a quasi-static coupled-line (CL) treatment of the series stubs, and uses normal mode impedance parameters, which are calculated with the spectral-domain approach (SDA). Due to the broad TEM-bandwidth of the membrane-supported transmission lines, the method can accurately predict filter responses well into the rejection band. To demonstrate the above claims, the measured and simulated S-parameters of a 0.3 mm /spl times/2.2 mm low-pass filter with a cutoff frequency at 17 GHz, and a second passband at 115 GHz, are presented. The new approach is also used in the design of bandpass filters which exhibit 1.5-2-dB insertion loss and bandwidths around 10%.

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Abstracts

Characteristics of coplanar transmission lines on multilayer substrates: modeling and experiments

E. Chen and S.Y. Chou. "Characteristics of coplanar transmission lines on multilayer substrates: modeling and experiments." 1997 Transactions on Microwave Theory and Techniques 45.6 (Jun. 1997 [T-MTT]): 939-945.

Characteristics of coplanar transmission lines on multilayer substrates expressed in analytic formulas have been obtained using conformal mapping. The accuracy of these formulas has been verified experimentally on a variety of coplanar transmission lines using differential electro-optic (DEOS) sampling. For coplanar waveguides, the theory differs from the experiment by less than 3%; for coplanar striplines, the differences are less than 6%.



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Hybrid integration technology of planar circuits and NRD-guide for cost-effective microwave and millimeter-wave applications

K. Wu and Liang Han. "Hybrid integration technology of planar circuits and NRD-guide for cost-effective microwave and millimeter-wave applications." 1997 Transactions on Microwave Theory and Techniques 45.6 (Jun. 1997 [T-MTT]): 946-954.

An architecture called the hybrid planar/non-radiative-dielectric (NRD) waveguide integrated technology is proposed as a building block for constructing microwave and millimeter-wave circuits. This hybrid approach of integration offers a unique possibility of exploiting inherent complementary advantages of planar structures and NRD waveguides for low-cost wireless applications while eliminating the potential drawbacks associated with both dissimilar structures. Compared to the existing NRD-guide related technology, the proposed framework consists of relocated planar structures on the top and/or the bottom plates of an NRD-guide, sharing the common ground planes. Such a hybrid scheme is particularly suitable for millimeter-wave systems in which active devices can be made with the planar-line technique while passive components can be made with the NRD-guide technique. The two subsets of a complete functional system are interconnected through a class of aperture-based transitions which can be designed to have wide-band performance. In addition, the multichip module (MCM) technique is readily achieved under this proposed scheme. Experimental prototypes, including passive-component and active-device, based on the new hybrid technology presented in this paper, show that the novel hybrid technology promises to be useful in the design of future microwave and millimeter-wave circuits and systems.

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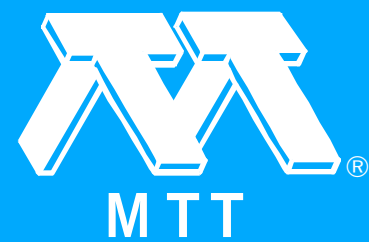
A high-performance W-band uniplanar subharmonic mixer

S. Raman, F. Rucky and G.M. Rebeiz. "A high-performance W-band uniplanar subharmonic mixer." 1997 Transactions on Microwave Theory and Techniques 45.6 (Jun. 1997 [T-MTT]): 955-962.

A uniplanar subharmonic mixer has been implemented in coplanar waveguide (CPW) technology. The circuit is designed to operate at RF frequencies of 92-96 GHz, IF frequencies of 2-4 GHz, and LO frequencies of 45-46 GHz. Total circuit size excluding probe pads and transitions is less than 0.8 mm /spl times/1.5 mm. The measured minimum single-sideband (SSB) conversion loss is 7.0 dB at an RF of 94 GHz, and represents state-of-the-art performance for a planar W-band subharmonic mixer. The mixer is broad-band with a SSB conversion loss of less than 10 dB over the 83-97-GHz measurement band. The measured LO-RF isolation is better than -40 dB for LO frequencies of 45-46 GHz. The double-sideband (DSB) noise temperature measured using the Y-factor method is 725 K at an LO frequency of 45.5 GHz and an IF frequency of 1.4 GHz. The measured data agrees well with the predicted performance using harmonic-balance analysis (HBA). Potential applications are millimeter-wave receivers for smart munition seekers and automotive-collision-avoidance radars.

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Planar microwave integrated phase-shifter design with high purity ferroelectric material

F. De Flaviis, N.G. Alexopoulos and O.M. Stafsudd. "Planar microwave integrated phase-shifter design with high purity ferroelectric material." 1997 Transactions on Microwave Theory and Techniques 45.6 (Jun. 1997 [T-MTT]): 963-969.

Ferroelectric materials (FEM's) are very attractive because their dielectric constant can be modulated under the effect of an externally applied electric field perpendicular to the direction of propagation of a microwave signal. FEM may be particularly useful for the development of a new family of planar phase shifters which operate up to X-band. The use of FEM in the microwave frequency range has been limited in the past due to the high losses of these materials; $\tan \delta = 0.3$ at 3 GHz is typical for commercial BaTiO₃ (BTO) and due to the high electric field necessary to bias the structure in order to obtain substantial dielectric constant change. In this paper, a significant reduction in material losses is demonstrated. This is achieved by using a new sol-gel technique to produce barium modified strontium titanium oxide [Ba_{1-x}Sr_xTiO₃ (BST)], which has ferroelectric properties at room temperature. Also demonstrated is how the use of thin ceramics reduces the required bias voltage below 250 V, with almost no power consumption required to induce a change in the dielectric constant. A phase shift of 165° was obtained at 2.4 GHz, with an insertion loss below 3 dB by using a bias voltage of 250 V. Due to the planar geometry and light weight of the device, it can be fully integrated in planar microwave structures.

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Open- and short-circuit terminated series stubs in finite-width coplanar waveguide on silicon

G.E. Ponchak and L.P.B. Katehi. "Open- and short-circuit terminated series stubs in finite-width coplanar waveguide on silicon." 1997 Transactions on Microwave Theory and Techniques 45.6 (Jun. 1997 [T-MTT]): 970-976.

Open- and short-circuit terminated series stubs in finite-width coplanar waveguide (FCPW) fabricated on high-resistivity Si are experimentally characterized over the frequency range of 2-40 GHz. In coplanar waveguide (CPW), these stubs are typically placed in the center conductor, but in FCPW, the stubs may also be placed in the ground planes resulting in novel circuit elements with characteristics that make the stubs useful for matching circuits and filters. Equivalent circuit models for the stubs are presented, and it is shown that when the stub is in the ground plane the resonant frequency is equal, the inductance and resistance is halved, and the capacitance is double the values of the same stub in the center conductor. Furthermore, it is shown that by varying the stub position in the ground plane, higher Q stubs can be obtained.





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Investigation and modeling of impact ionization with regard to the RF and noise behavior of HFET

R. Reuter, M. Agethen, U. Auer, S. van Waasen, D. Peters, W. Brockerhoff and F.-J. Tegude. "Investigation and modeling of impact ionization with regard to the RF and noise behavior of HFET." 1997 Transactions on Microwave Theory and Techniques 45.6 (Jun. 1997 [T-MTT]): 977-983.

A new small-signal and noise-equivalent circuit for heterostructure field-effect transistors (HFET's), including the influence of impact-ionization and gate-leakage current on the electronic properties, is presented. The capability of the new model is demonstrated by bias-dependent investigations of the high-frequency (HF) (45 MHz up to 40 GHz) and noise behavior (2 GHz up to 18 GHz) of the InAlAs/InGaAs/InP HFET. Furthermore, based on these results, the bias-dependence of the newly implemented small-signal equivalent elements and the equivalent intrinsic noise sources, are discussed.

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Finite-difference approach to the solution of time-domain integral equations for layered structures

N. Georgieva and E. Yamashita. "Finite-difference approach to the solution of time-domain integral equations for layered structures." 1997 Transactions on Microwave Theory and Techniques 45.6 (Jun. 1997 [T-MTT]): 984-990.

A numerical algorithm for the analysis of transient electromagnetic fields in planar structures is proposed based on the time-domain magnetic-field integral equation (MFIE), electric-field integral equation (EFIE), and the marching-on-in-time approach. The field vectors are represented in terms of vector potential functions which are calculated either by integration or by the three-dimensional (3-D) wave equation according to the geometry of the structure. Thus, the algorithm combines the advantages of integral equation techniques and finite-difference schemes. While this approach is applicable to any geometries, it is especially suitable for multilayered planar structures and is competitive to the finite-difference time-domain (FDTD) method in the case of open and radiating problems. Theoretical results are verified by the analysis of a pulse propagation in a homogeneous open-end microstrip line.

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Abstracts

A high-accuracy realization of the Yee algorithm using non-standard finite differences

J.B. Cole. "A high-accuracy realization of the Yee algorithm using non-standard finite differences." 1997 Transactions on Microwave Theory and Techniques 45.6 (Jun. 1997 [T-MTT]): 991-996.

New nonstandard second-order finite differences (FD's) are introduced, which when substituted into the Yee algorithm, reduce the solution error by a factor of $10/\sup -4/$ on a coarse computational grid. Using $/spl \lambda/h$ (grid spacings per wavelength)=8, one achieves the same accuracy as the standard Yee algorithm does at $/spl \lambda/h=1140$. In addition, greater algorithmic stability allows a reduction in the number of iterations needed to solve a problem.



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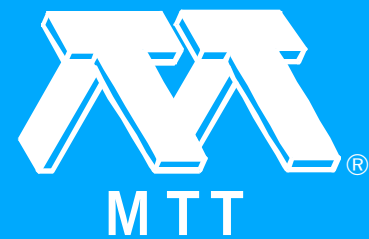
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Analysis and measurement of mode polarizers in square waveguide

W.R. Gaiewski, L.P. Dunleavy and A. Castro. "Analysis and measurement of mode polarizers in square waveguide." 1997 Transactions on Microwave Theory and Techniques 45.6 (Jun. 1997 [T-MTT]): 997-1000.

A general analysis approach for strip metallization structures enclosed in rectangular or square waveguide is presented. The technique involves the novel application of a commercially available 2.5-dimensional (2.5-D) method-of-moments-based (MoM) electromagnetic (EM) analysis tool to a three-dimensional (3-D) waveguide problem. Very good agreement is demonstrated between computed and measured results for several printed strip linear polarizers embedded within a square waveguide environment. This paper, to the authors' knowledge, represents the first such comparison of phase and magnitude between computed and measured data for strip grid polarizers in a waveguide environment. The developed approach involves construction of a theoretical waveguide "test fixture" and an associated theoretical de-embedding procedure. Computational advantages are expected over the alternative approach of using a finite-element-based fully 3-D analysis approach. The polarizer results have potential application to shielded versions of quasi-optic array components that have been demonstrated in open geometries, as well as to multimode antenna feeds, waveguide filters, and matching networks.

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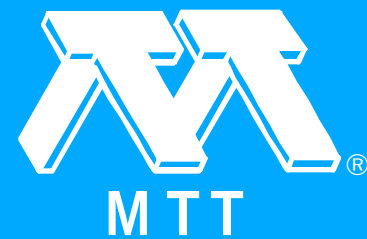


Abstracts

Study of a combined millimeter-wave resonator

M.A. Shapiro and S.N. Vlasov. "Study of a combined millimeter-wave resonator." 1997 Transactions on Microwave Theory and Techniques 45.6 (Jun. 1997 [T-MTT]): 1000-1002.

We present a theoretical investigation and measurements of a multielement open resonator composed of corrugated waveguides and plane semitransparent reflectors. A periodic-transmission-line model is used to analyze the transverse mode structure and the diffraction Q-factor of the proposed resonator. The setup containing the resonator (equipped with Bragg reflectors), mode converters, and an elliptical mirror is employed for measurements in Ka-band. Two- and three-waveguide-section resonators have been studied. The proposed resonators demonstrate good mode selectivity that permits one to utilize them in high-power millimeter-wave sources.



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A wide-band microwave photonic phase and frequency shifter

S.T. Winnall, A.C. Lindsay and G.A. Knight. "A wide-band microwave photonic phase and frequency shifter." 1997 Transactions on Microwave Theory and Techniques 45.6 (Jun. 1997 [T-MTT]): 1003-1006.

Advanced radar deception systems require wide-band devices which perform microwave processing of frequency and phase information. A wide-band microwave photonic phase shifter was constructed which is capable of imposing greater than $2/\text{spl pi/}$ phase shift to microwave signals in the 2-18-GHz frequency range. The maximum standard deviation from the phase setting was $10/\text{spl deg/}$ ($7/\text{spl deg/}$ typical). The phase shifter was then incorporated into a frequency translation architecture. The carrier suppression obtained was 50 dB with a spurious harmonic suppression of 23 dB.



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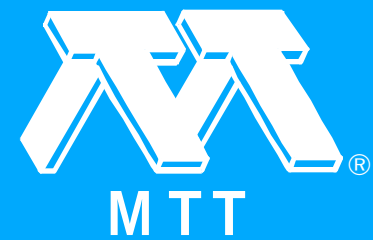
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An efficient high-order mixed-edge rectangular-element method for lossy anisotropic dielectric waveguides

Xin-Qing Sheng and Shanjia Xu. "An efficient high-order mixed-edge rectangular-element method for lossy anisotropic dielectric waveguides." 1997 Transactions on Microwave Theory and Techniques 45.7 (Jul. 1997 [T-MTT]): 1009-1013.

A new efficient high-order mixed-edge rectangular element method is proposed for the analysis of lossy anisotropic dielectric waveguides. The space construction of the high-order mixed-edge rectangular element is investigated and the explicit form of the shape function is given. The high-order mixed-edge element yields higher accuracy and faster convergence than the lowest order mixed-edge rectangular elements without spurious solutions, and is more efficient compared to the high-order covariant projection element. The computations of the propagation constants in the rectangular waveguide and the slab loaded waveguide show that the accuracy of this high-order mixed-edge element is about one order higher than that of the lowest order one, and the nodes used in the calculation are only two-thirds as many as those used in the high-order covariant projection element having the same accuracy. The calculations of the dispersion curves for the dominant mode in the waveguide loaded with the lossy anisotropic dielectric block verify the accuracy and efficiency of the present method.

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Abstracts

A novel 3.5-GHz microwave counter using an opto-electronic harmonic heterodyne technique

C.S. Chang and H.F. Chiu. "A novel 3.5-GHz microwave counter using an opto-electronic harmonic heterodyne technique." 1997 Transactions on Microwave Theory and Techniques 45.7 (Jul. 1997 [T-MTT]): 1014-1017.

A novel 3.5-GHz microwave counter using an optoelectronic harmonic heterodyne technique has been demonstrated. The system's performance has been discussed and evaluated, and is viewed as good, in comparison with today's microwave-counting systems. It is believed that this novel device has potential for measuring signals above 100 GHz.



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Very high-frequency small-signal equivalent circuit for short gate-length InP HEMTs

A. Miras and E. Legros. "Very high-frequency small-signal equivalent circuit for short gate-length InP HEMTs." 1997 Transactions on Microwave Theory and Techniques 45.7 (Jul. 1997 [T-MTT]): 1018-1026.

A small-signal equivalent circuit for short gate-length InP high electron-mobility transistors (HEMTs) operating at very high frequency (HF) is proposed. First, the extrinsic parameters of the equivalent circuit are determined using a cold HEMT, but without forward gate bias. Then the intrinsic parameters of the equivalent circuit are extracted, including the frequency dependence of some of them. A fast and accurate method based on least-squares regressions is presented to obtain the extrinsic and intrinsic parameters from measured S-parameters. The improved equivalent circuit accurately fits the S-parameters of 0.25- μm InP HEMTs over the 500-MHz up to 40-GHz measurement bandwidth, for all gate-to-source and drain-to-source voltages.





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An improved sliding-load calibration procedure using a semiparametric circle-fitting procedure

G. Vandersteen, Y. Rolain, J. Schoukens and A. Verschueren. "An improved sliding-load calibration procedure using a semiparametric circle-fitting procedure." 1997 Transactions on Microwave Theory and Techniques 45.7 (Jul. 1997 [T-MTT]): 1027-1033.

Circle-fitting problems often occur in microwave engineering when dealing with variable delays, e.g., during calibration using a sliding load. This paper proposes an efficient semiparametric circle-fitting procedure, which takes into account the phase relationships over the frequencies. It produces more accurate results than the standard sliding-load calibration, requires only three positions on the sliding load for the whole frequency band, and is more robust to the settings of the positions of the sliding load. The proposed method also has the ability to detect whether or not the sliding load is defective or out of its specifications. This can be done by using only three positions on the sliding load. Optimal-position settings are then proposed. The performance of the proposed method is illustrated on sliding-load measurements up to 50 GHz, demonstrating the ability of detecting modeling errors and showing that the accuracy of the proposed method using three positions is comparable to the standard method with six positions.

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Mode-matching CAD of rectangular or circular multiaperture narrow-wall couplers

T. Sieverding, U. Papziner and F. Arndt. "Mode-matching CAD of rectangular or circular multiaperture narrow-wall couplers." 1997 Transactions on Microwave Theory and Techniques 45.7 (Jul. 1997 [T-MTT]): 1034-1040.

A rigorous and efficient mode-matching computer-aided design (CAD) method for rectangular waveguide H-plane couplers is presented. The couplers employ multiple large rectangular or circular apertures of different sizes and nonuniform distance. The decomposition of the coupler structure into adequate mode-matching key-building blocks, i.e., the T-junction, double-plane step discontinuity, and rectangular-to-circular waveguide transition, together with the homogeneous intermediate waveguide sections of finite lengths yield the desired high flexibility. Both the finite wall thickness and the higher order mode interaction between all discontinuities are accurately taken into account by the combination of the individual building blocks of the generalized scattering matrix technique. Design examples for rectangular and circular aperture provide coupling values of -10.7, -10, -8.1, -5.3, -4.7, -3, -2.6, and -2.3 dB in Ku-band (12-18 GHz), thus demonstrating the flexibility and the efficiency of the method. The theory is verified by excellent agreement with measurements.

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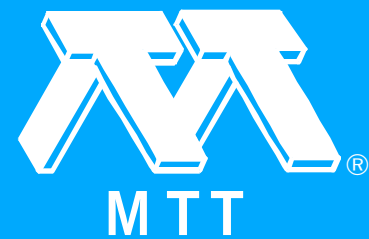


LMR 16-a self-calibration procedure for a leaky network analyzer

K. Silvonen. "LMR 16-a self-calibration procedure for a leaky network analyzer." 1997 Transactions on Microwave Theory and Techniques 45.7 (Jul. 1997 [T-MTT]): 1041-1049.

A thru-match-reflect/line-match-reflect (TMR/LMR) self-calibration procedure based on the 16-term error model is shown. The error model takes into account all the leakage paths of a wafer prober, test fixture, and network analyzer. Simple closed-form calibration equations are presented. The method is very robust-zero leakage paths and symmetrical or matched-error networks can be handled equally well as more general cases. The algorithm is suitable for nonleaky network analyzers as well. The calibration is comprised of two-port measurement of the following standards: T(L), M-M, R-R, R-M, M-R. Two matched loads (M) are the only standards that have to be known in addition to the thru (T) or line (L). The reflection coefficient of the two identical reflection standards (R) is found in addition to the error parameters as in the normal TMR method. Experimental measurements with the LMR 16 have been made. All the possible combinations of five calibration standards for the 16-term error model are tabulated. The limitations of the super-thru-short-delay algorithm are defined for the first time.





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Nonlinear time-domain analysis of injection-locked microwave MESFET oscillators

J. Dixon, E. Bradley and Z.B. Popovic. "Nonlinear time-domain analysis of injection-locked microwave MESFET oscillators." 1997 Transactions on Microwave Theory and Techniques 45.7 (Jul. 1997 [T-MTT]): 1050-1057.

In this paper, injection-locked MESFET oscillators are analyzed using several numerical models. The injection-locking behavior of the van der Pol equation and of a more complex representation using the Curtice-Cubic MESFET model are investigated. Analysis and experimental results are compared for an NE71083 transistor oscillator operating at 0.5 GHz. The deficiencies of using a van der Pol oscillator model are pointed out. Time-domain results from the complex model exhibiting multicycle and apparently chaotic behaviors are also examined, and point to problems with common nonlinear simulation techniques for these circuits.

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An AlGaAs/InGaAs pseudomorphic HEMT modulator driver IC with low power dissipation for 10-Gb/s optical transmission systems

M. Miyashita, N. Yoshida, Y. Kojima, T. Kitano, N. Higashisaka, J. Nakagawa, T. Takagi and M. Otsubo. "An AlGaAs/InGaAs pseudomorphic HEMT modulator driver IC with low power dissipation for 10-Gb/s optical transmission systems." 1997 Transactions on Microwave Theory and Techniques 45.7 (Jul. 1997 [T-MTT]): 1058-1064.

An optical modulator driver integrated circuit (IC) has been developed for 10-Gb/s optical communication systems. To achieve both high-frequency (HF) operation and low power dissipation, 0.2- μm T-shaped gate AlGaAs/InGaAs pseudomorphic high electron-mobility transistors (HEMTs) have been employed for their large transconductance g_m of 610 mS/mm and high cutoff frequency f_T of 67.5 GHz. In addition, optimizing input logic swing, switching transistor size in the output driver, and using cascode-current mirror circuits with small output conductance enable power dissipation as low as 1 W to be achieved at a 10-Gb/s nonreturn-to-zero (NRZ) signal output with 3 V/ $p-p$. This is the lowest value ever reported for power dissipation. As an additional function, the output-voltage swing can be controlled in the range from 2 to 3.3 V/ $p-p$ by the current mirror circuit for the purpose of adjusting the optical-output-signal duty factor through an optical modulator.

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Abstracts

A closed-form CAD-oriented model for the high-frequency conductor attenuation of symmetrical coupled coplanar waveguides

G. Ghione and M. Goano. "A closed-form CAD-oriented model for the high-frequency conductor attenuation of symmetrical coupled coplanar waveguides." 1997 Transactions on Microwave Theory and Techniques 45.7 (Jul. 1997 [T-MTT]): 1065-1070.

Closed-form CAD-oriented conformal-mapping approximations are presented for the HF attenuation of two-conductor symmetrical coupled coplanar waveguides (CCPWs). The expressions are compared with the results obtained from a full-wave electromagnetic (EM) simulator and found to yield acceptable agreement. A modified form is also presented, which partly overcomes the low-frequency limitations of the skin-effect approximation.



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Pure-mode network analyzer for on-wafer measurements of mixed-mode S-parameters of differential circuits

D.E. Bockelman and W.R. Eisenstadt. "Pure-mode network analyzer for on-wafer measurements of mixed-mode S-parameters of differential circuits." 1997 Transactions on Microwave Theory and Techniques 45.7 (Jul. 1997 [T-MTT]): 1071-1077.

A practical measurement system is introduced for measurement of combined differential and common-mode (mixed-mode) scattering parameters, and its operation is discussed. A pure-mode system measures network parameters of a differential circuit in the fundamental modes of operation, and has improved accuracy over a traditional network analyzer for the measurement of such circuits. The system is suitable for on-wafer measurements of differential circuits. The transformation between standard S-parameters and mixed-mode S-parameters is developed. Example microwave differential structures are measured with the pure-mode vector-network analyzer (PMVNA), and the corrected data is presented. These structures are simulated, and the simulated mixed-mode S-parameters correlate well with the measured data.

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Geometrical structures and fundamental characteristics of microwave stepped-impedance resonators

M. Sagawa, M. Makimoto and S. Yamashita. "Geometrical structures and fundamental characteristics of microwave stepped-impedance resonators." 1997 Transactions on Microwave Theory and Techniques 45.7 (Jul. 1997 [T-MTT]): 1078-1085.

$\lambda/4$ -, $\lambda/2$ -, and λ -type transmission-line stepped-impedance resonators (SIRs) have been proposed and various practical applications have been reported on the basis of the analysis related to each resonator. This paper standardizes these three types of SIRs and systematically summarizes their fundamental characteristics, such as resonance conditions, resonator length, spurious (higher order) responses, and equivalent circuits. Practical applications which employ features of three types of SIRs are investigated with demonstrations of specific structures. Original design formulas with respect to λ -type dual-mode resonators are analytically derived. Advanced SIR's using composite material and multisteps are also introduced and their availability is discussed.

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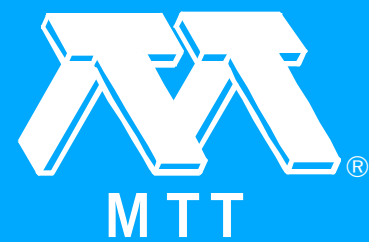
Theory of distributed mixing and amplification in a superconducting quasi-particle nonlinear transmission line

C.-Y.E. Tong, L. Chen and R. Blundell. "Theory of distributed mixing and amplification in a superconducting quasi-particle nonlinear transmission line." 1997 Transactions on Microwave Theory and Techniques 45.7 (Jul. 1997 [T-MTT]): 1086-1092.

An analysis is presented for the behavior of the superconducting quasi-particle nonlinear transmission line driven by a high-frequency local oscillator (LO). The theory developed includes a large-signal nonlinear analysis, a small-signal analysis, and a noise analysis. This model is used to simulate the conversion loss and noise temperature of distributed quasi-particle mixers based on the nonlinear transmission line. The numerical results are compared to an experimental mixer at 460 GHz. The theory also predicts that the nonlinear transmission line will provide parametric amplification when the idler frequency is inductively tuned. This new phenomenon may present new opportunities to low-noise receiver systems at submillimeter wavelengths.

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Multitone power and intermodulation load-pull characterization of microwave transistors suitable for linear SSPA's design

R. Hajji, F. Beaugerard and F.M. Ghannouchi. "Multitone power and intermodulation load-pull characterization of microwave transistors suitable for linear SSPA's design." 1997 Transactions on Microwave Theory and Techniques 45.7 (Jul. 1997 [T-MTT]): 1093-1099.

In this paper, an experimental load-pull characterization of microwave transistors operated under N-tone-excitations ($2/\text{spl les/N/spl les/32}$) is presented. Such characterization is very useful to investigate the linearity of high-power amplifiers via intermodulation distortion analysis. All the measurements were carried out using a newly developed multiline measurement system which uses an arbitrary waveform generator (AWG) to generate the spectrum of any N desired tones and a microwave transition analyzer (MTA) as a vector receiver. The measured intermodulation rejection (IMR) behavior, as the number of tones increases, is compared with previously published theoretical results. Constant output power contours and IMR contours in the $/\text{spl Gamma//sub L/(f/sub 0/}$ plane for different number of tones are presented and discussed. The dependency of the IMR on the biasing conditions and the carriers' phase distribution is also investigated.

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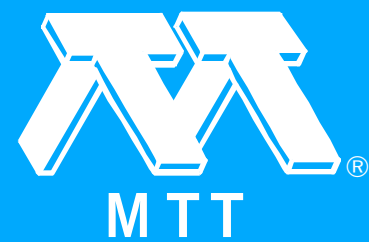
A capacitively loaded half-wavelength tapped-stub resonator

J.M. Drozd and W.T. Joines. "A capacitively loaded half-wavelength tapped-stub resonator." 1997 Transactions on Microwave Theory and Techniques 45.7 (Jul. 1997 [T-MTT]): 1100-1104.

This paper examines a new resonator which is created by adding capacitive loading to a half-wavelength tapped-stub resonator. This capacitively loaded resonator has the property that both the Q and the resonant frequency can be set independently. This property is important because it allows this resonator to be used as either a tracking filter which maintains a constant bandwidth or as a filter which can vary its Q while maintaining a fixed resonant frequency. In this paper, equations are derived for choosing capacitance values that yield a desired resonant frequency and value of Q . Examples of using this resonator as both a fixed-frequency variable- Q filter and a constant-bandwidth tracking filter are provided. Theoretical results are verified by measurements.

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3-D FEM/BEM-hybrid approach based on a general formulation of Huygens' principle for planar layered media

T.F. Eibert and V. Hansen. "3-D FEM/BEM-hybrid approach based on a general formulation of Huygens' principle for planar layered media." 1997 Transactions on Microwave Theory and Techniques 45.7 (Jul. 1997 [T-MTT]): 1105-1112.

Huygens' principle is used to exclude inhomogeneous regions and ideal conducting regions from planar layered structures. The fields in the inhomogeneous regions are modeled by the finite-element method (FEM) with tetrahedral edge elements in terms of the electric-field strength $E/\text{spl I.oarr/}$. The fields in the layered structure are described by an integral representation of the electric-field strength $E/\text{spl I.oarr/}$ in terms of equivalent electric and magnetic Huygens' surface current densities for the inhomogeneous regions, and in terms of electric Huygens' surface current densities for ideal conducting regions. It is formulated with the help of electromagnetic (EM) potentials resulting in low-order singular integral kernels to facilitate the numerical handling of the integral representation. A general formulation of the integral representation is given for observation points lying in the Huygens' surface. As compared to the homogeneous-space case, additional terms in the integral representation have to be considered if parts of the Huygens' surface lie in an interface of layers with different material properties. An integral equation is formulated and discretized by a Galerkin testing procedure (boundary-element method), together with the finite-element (FE) system resulting in an unequivocal discretized description of the entire field problem. The method is validated with the help of a canonical test problem. Further numerical results are presented for dielectric resonators coupled to microstrip circuits.



Abstracts

Numerically determining the dispersion relations of nonlinear TE slab-guided waves in non-Kerr-like media

Jian-Guo Ma and Zhizhang Chen. "Numerically determining the dispersion relations of nonlinear TE slab-guided waves in non-Kerr-like media." 1997 Transactions on Microwave Theory and Techniques 45.7 (Jul. 1997 [T-MTT]): 1113-1117.

Dispersion relations are calculated numerically for nonlinear slab guides with a nonlinear core and linear claddings by using the transfer matrix method (TMM). The core can have any nonlinearities while high computation efficiency can still be achieved. As a result, a simple numerical calculation tool without spurious roots is presented for general nonlinear slab-guided structures.



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Fast frequency sweep technique for the efficient analysis of dielectric waveguides

S.V. Polstyanko, R. Dyezij-Edlinger and Jin-Fa Lee. "Fast frequency sweep technique for the efficient analysis of dielectric waveguides." 1997 Transactions on Microwave Theory and Techniques 45.7 (Jul. 1997 [T-MTT]): 1118-1126.

This paper describes a new approach to spectral response computations of an arbitrary two-dimensional (2-D) waveguide. This technique is based on the tangential-vector finite-element method (TVFEM) in conjunction with the asymptotic waveform evaluation (AWE) technique. The former is used to obtain modes characteristics for a central frequency, whereas the latter employs an efficient algorithm to compute frequency moments for each mode. These moments are then matched via Pade approximation to a reduced-order rational polynomial, which can be used to interpolate each mode over a frequency band with a high degree of accuracy. Furthermore, the moments computations and subsequent interpolation for a given set of frequency points can be done much more rapidly than just simple simulations for each frequency point.

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Analysis of slot-coupled transitions from microstrip-to-microstrip and microstrip-to-waveguides

A.A. Omar and N.I. Dib. "Analysis of slot-coupled transitions from microstrip-to-microstrip and microstrip-to-waveguides." 1997 Transactions on Microwave Theory and Techniques 45.7 (Jul. 1997 [T-MTT]): 1127-1132.

This paper provides an accurate, versatile, and computationally efficient method for the analysis of slot-coupled transitions from microstrip-to-microstrip, and microstrip-to-rectangular and parallel-plate waveguides. The accuracy of this method is ensured by satisfying all the boundary conditions through a mixed electric-magnetic current integral equation formulation, combined with the moment method. Computational efficiency is achieved by limiting the discretization to only the strips and apertures and by using the accurate and rapidly convergent complex images. To verify the accuracy of this method, the transitions are analyzed using the finite-difference time-domain (FDTD) method. Experimental results are also obtained for some structures. Close agreement is found between the complex image results, the FDTD results, and experiment over a wide frequency range.



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Effect of conductor backing on the line-to-line coupling between parallel coplanar lines

K.-K.M. Cheng. "Effect of conductor backing on the line-to-line coupling between parallel coplanar lines." 1997 Transactions on Microwave Theory and Techniques 45.7 (Jul. 1997 [T-MTT]): 1132-1134.

A good estimate of the coupling effect between parallel coplanar waveguide (CPW) lines is important, especially for monolithic microwave integrated circuit (MMIC) applications where unnecessary crosstalk between conductors could be a serious problem. This paper shows how these coupling parameters may be analytically obtained in the presence of the back-face metallization. Closed-form formulas are developed for evaluating the quasi-TEM characteristic parameters based upon the conformal-mapping method (CMM). Very good agreement is observed between the values produced by these formulas and by a spectral-domain method (SDM).

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Abstracts

Harmonic and two-tone intermodulation distortion analyses of the inverted InGa/InAlAs/InP HBT

Bin Li and S. Prasad. "Harmonic and two-tone intermodulation distortion analyses of the inverted InGa/InAlAs/InP HBT." 1997 Transactions on Microwave Theory and Techniques 45.7 (Jul. 1997 [T-MTT]): 1135-1137.

Harmonic and two-tone intermodulation distortion analyses of the InGaAs/InAlAs/InP collector-up heterojunction bipolar transistor (HBT) are performed by a simple Ebers-Moll model. The parasitic elements of the equivalent circuit are extracted at zero bias by numerical optimization. A semianalytical approach is used to extract the intrinsic parameters of the small-signal equivalent circuit at nonzero bias points. Appropriate equations given by device physics are fitted to the bias variation of intrinsic parameters so that the Ebers-Moll model parameters can be extracted. Agreement between simulation and measurement of harmonic and intermodulation distortion is achieved.



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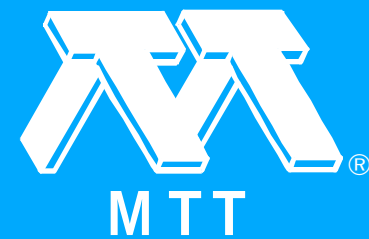
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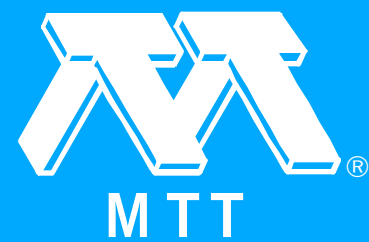
Efficient MPIE approach for the analysis of three-dimensional microstrip structures in layered media

R. Bunger and F. Arndt. "Efficient MPIE approach for the analysis of three-dimensional microstrip structures in layered media." 1997 Transactions on Microwave Theory and Techniques 45.8 (Aug. 1997, Part I [T-MTT]): 1141-1153.

A full-wave space-domain method is presented for the rigorous and fast investigation of printed circuit structures of arbitrary shape on uniaxial anisotropic layered substrates including three dimensional (3-D) metallizations. The electromagnetic (EM) fields are described in terms of a mixed-potential-integral-equation (MPIE) formulation. Two different techniques-the matrix pencil (MP) technique and a cross-sectional eigenvalue (CSEV) approach-are employed to extract the S-parameters of the circuit under consideration. The usage of a triangular mesh allows the convenient modeling of arbitrarily shaped structures. Therefore, the main advantage of this method is its generality, which allows a large variety of printed circuit structures to be characterized. The flexibility of the method is demonstrated for the example of spiral inductors including air-bridges with finite-metallization thickness.

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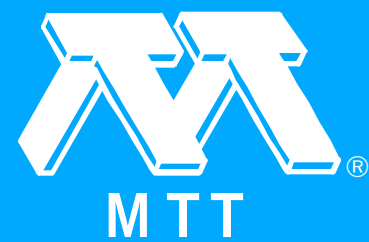
Dielectric and geometric dependence of electric field and power distribution in a waveguide heterogeneously filled with lossy dielectrics

L. Outifa, M. Delmotte and H. Jullien. "Dielectric and geometric dependence of electric field and power distribution in a waveguide heterogeneously filled with lossy dielectrics." 1997 Transactions on Microwave Theory and Techniques 45.8 (Aug. 1997, Part I [T-MTT]): 1154-1161.

In microwave processing of dielectric materials which completely fill a waveguide, the distribution of the electric field within the material needs to be known. This paper presents the theoretical conditions for the microwave cure of large pieces, the size of which is more than the wavelength. The mathematical description of heterogeneously multilayer-filled waveguides presents certain difficulties because of the involved transcendental equations. A computer treatment to determine the electric-field spatial distribution is developed. The influence of the dielectric constants and the thickness of the dielectric materials on the spatial distribution of the electric field and power flow in each layer is studied. In particular, the field strength is enhanced in the dielectric with the highest permittivity. A numerical resolution of the transcendental equations defining the cutoff frequencies of propagation modes allows one to enumerate the modes, which can successively appear in a dielectric-loaded waveguide as functions of dielectric and geometric parameters. The attenuation constant and the microwave power dissipated in each material are determined. A balance sheet of energy is established.

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Reflection analysis of FDTD boundary conditions. I. Time-space absorbing boundaries

N.V. Shuley and D.T. Prescott. "Reflection analysis of FDTD boundary conditions. I. Time-space absorbing boundaries." 1997 Transactions on Microwave Theory and Techniques 45.8 (Aug. 1997, Part I [T-MTT]): 1162-1170.

Time-space absorbing-boundary conditions (ABCs) are employed to truncate finite-difference time-domain (FDTD) computational domains and are predominantly used because of their simplicity. Their implementation requires only the calculation of a boundary-field value as a function of the local fields and their recent time history. A general method is described, which enables highly accurate calculation of the reflection properties of these boundary conditions for plane-wave incidence. A number of commonly used time-space ABCs are studied, and the technique is verified by way of FDTD simulation. It is demonstrated that the performance of time-space ABCs is substantially degraded by the influence of the finite-mesh discretizations. A technique is described, which enables these discretization inaccuracies to be overcome by correctly choosing the relevant ABC weighting parameters, thus enabling the various boundary conditions to perform precisely as desired. Solutions for these weighting parameters are provided for a number of common boundary conditions such that their absorption characteristics may be precisely configured to suit any level of mesh discretization. As a consequence, a performance equivalence is established amongst all time-space ABCs of the same order.

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Reflection analysis of FDTD boundary conditions. II. Berenger's PML absorbing layers

D.T. Prescott and N.V. Shuley. "Reflection analysis of FDTD boundary conditions. II. Berenger's PML absorbing layers." 1997 Transactions on Microwave Theory and Techniques 45.8 (Aug. 1997, Part I [T-MTT]): 1171-1178.

For pt. I see *ibid.*, vol. 45, no. 8, Aug. 1997. This paper presents an in-depth analysis of Berenger's perfectly matched layer (PML) boundary truncation technique. The impedance and dispersion relationships for the fields within the PML media are derived to gain a better understanding of the nature of field propagation within such regions. The mechanisms which contribute toward reflection from a PML region are then described. Using this knowledge of the PML absorbing layers, a numerical method is developed, which allows the reflection from such layers to be calculated exactly.

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Abstracts

An efficient algorithm for the parameter extraction of 3-D interconnect structures in the VLSI circuits: domain-decomposition method

Zhenhai Zhu, Hao Ji and Wei Hong. "An efficient algorithm for the parameter extraction of 3-D interconnect structures in the VLSI circuits: domain-decomposition method." 1997 *Transactions on Microwave Theory and Techniques* 45.8 (Aug. 1997, Part I [T-MTT]): 1179-1184.

In this paper, the domain-decomposition method (DDM) has been used to extract the capacitance matrices of multilayered three-dimensional (3-D) interconnects in very-large-scale integration (VLSI) circuits. Different subdomains are analyzed separately, so the most efficient method can be chosen for every subdomain. Therefore, the DDM can greatly reduce the algorithm complexity and provide a good platform for the development of combining methods. Numerical results show that the computing time and memory size used by the DDM are more than ten times less than those used by Ansoft's Maxwell SpiceLink-and more importantly, they are unrelated to the thickness of the pure dielectric layers.



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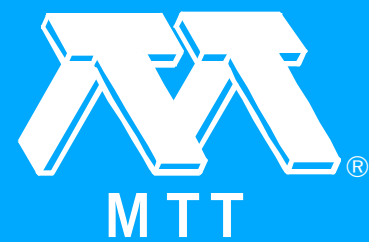
New consistent model for ferrite permeability tensor with arbitrary magnetization state

P. Gelin and K. Berthou-Pichavant. "New consistent model for ferrite permeability tensor with arbitrary magnetization state." 1997 Transactions on Microwave Theory and Techniques 45.8 (Aug. 1997, Part I [T-MTT]): 1185-1192.

Partially magnetized ferrites play an important role in a large class of microwave devices. For instance, when the optimal design of circulators, which operate with ferrite in the low magnetic field region, and other ferrite devices (phase shifters, isolators, etc.) are considered, permeability tensor is required for arbitrary magnetization. The existing models do not simultaneously provide all tensor components, and their validity domain is limited. The proposed model provides integral expressions for all permeability tensor components, which can be treated numerically without difficulties. The physical nature of the model enforces the causal aspect that is required when numerical time-domain methods (such as finite-difference time domain (FDTD), transmission-line matrix (TLM), time-domain finite-element method (TDFEM), etc.) are used. Finally, the comparison with measurements or specific cases, which can be treated by available models, demonstrates the validity of the proposed approach.

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Rigorous coupled-wave-theory analysis of dipole scattering from a three-dimensional, inhomogeneous, spherical dielectric, and permeable system

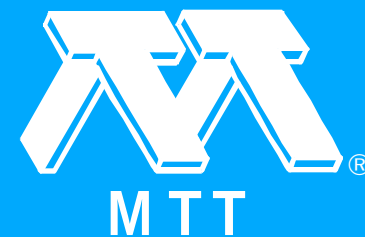
J.M. Jarem. "Rigorous coupled-wave-theory analysis of dipole scattering from a three-dimensional, inhomogeneous, spherical dielectric, and permeable system." 1997 Transactions on Microwave Theory and Techniques 45.8 (Aug. 1997, Part I [T-MTT]): 1193-1203.

This paper presents a rigorous coupled-wave-theory analysis (RCWT) of the electromagnetic (EM) radiation, which occurs when a centered electric dipole excites power and energy in a general three-dimensional (3-D) inhomogeneous spherical system. The formulation of this paper consists of a multilayer state-variable (SV) analysis of Maxwell's equations in spherical coordinates (the SV analysis used transverse-to- ϕ spherical EM field components), as well as a presentation of the EM fields which exist in the interior and exterior regions (which bound the inhomogeneous spherical system). A detailed description of the matrix processing which is involved with finding the final EM fields of the overall system is given. Three numerical examples of the RCWT method are studied. The first example presents EM scattering when a centered dipole radiates through a uniform material shell. In this example, numerical results of the RCWT algorithm are compared with numerical results as obtained by a Bessel-function matching algorithm, and excellent agreement was found between the two methods. The second example presents centered dipole radiation when the spherical system is a dielectric shell, which is inhomogeneous in the θ , ρ directions, and the third example presents centered dipole radiation when the spherical system is inhomogeneous in the ϕ , θ , ρ directions. Several examples and plots of the power diffracted into higher order modes by the inhomogeneity profiles are given. As the thickness of the inhomogeneous dielectric shell is increased, it is observed that, through diffraction, power is increasingly depleted from lower order modes into higher modes. The depletion of power from lower to higher order spherical modes with increasing shell thickness is noted to be very similar to the variation of diffraction-order power efficiency, which is observed when the layer thickness of a planar transmission diffraction grating is increased.

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A monopole-probe-based quasi-optical amplifier array

N.J. Koliás and R.C. Compton. "A monopole-probe-based quasi-optical amplifier array." 1997 Transactions on Microwave Theory and Techniques 45.8 (Aug. 1997, Part I [T-MTT]): 1204-1207.

A quasi-optical amplifier array designed for Ku-band operation is presented. Orthogonal monopole-probe antennas are used to couple the power into, and out from, an array of microstrip-based amplifiers. The array has a gain of 5.4 dB at 16.4 GHz using packaged high electron mobility transistors (HEMT's). This gain is 3.5 dB below the maximum stable gain for this device at this frequency.



A novel active inductor and its application to inductance-controlled oscillator

Yong-ho Cho, Song-cheol Hong and Young-se Kwon. "A novel active inductor and its application to inductance-controlled oscillator." 1997 Transactions on Microwave Theory and Techniques 45.8 (Aug. 1997, Part I [T-MTT]): 1208-1213.

This paper describes a novel active inductor using a common-source cascode FET with an inductive feedback. A compact lossy active inductor, which consists of a common-source FET and a feedback resistor, was used as the feedback inductor to achieve high Q-factor and tunability, as well as reduce the chip size. The fabricated active inductor achieved more than 100 Q-factors with the maximum value of 3400 over the frequency range of 200 MHz, in the vicinity of 1.7 GHz. Inductance was tuned from 9.6 to 56 nH at 1.7 GHz by the variation of the feedback resistance of the lossy active inductor. Using this active inductor (as a frequency-selective element in the resonator), a monolithic inductance-controlled FET oscillator was fabricated, which demonstrated an 18% frequency-tuning range from 1.73 to 2.07 GHz, with an output power range from -9.3 to -6.3 dBm.

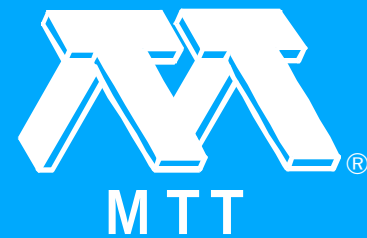


Abstracts

Hilbert-transform-derived relative group delay

P. Perry and T.J. Brazil. "Hilbert-transform-derived relative group delay." 1997 Transactions on Microwave Theory and Techniques 45.8 (Aug. 1997, Part I [T-MTT]): 1214-1225.

Many common types of microwave circuits, particularly filters, are required to meet a group delay ripple specification. This is normally measured using a vector network analyzer (VNA) or some specialized test configuration. A new method of assessing the group delay ripple of a broad class of microwave circuits is presented, which uses a scalar network analyzer and a form of the Hilbert transform. Experimental results illustrating the usefulness of the technique are shown for a series of examples and the principal sources of error are analyzed.



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Hairpin-comb filters for HTS and other narrow-band applications

G.L. Matthaei, N.O. Fenzi, R.J. Forse and S.M. Rohlfing. "Hairpin-comb filters for HTS and other narrow-band applications." 1997 Transactions on Microwave Theory and Techniques 45.8 (Aug. 1997, Part I [T-MTT]): 1226-1231.

The folded half-wavelength resonators in hairpin-comb filters all have the same orientation, whereas the orientations of the resonators in conventional hairpin-filters alternates. Hairpin-comb filters are shown to have attractive properties for design of compact, narrow-band filters such as are often desired for high-temperature-superconductivity (HTS) and other applications. The results obtained from two- and four-resonator trial HTS-filter designs are discussed. The filters are seen to have very strong stopbands, and their computed and measured performance are found to be in very good agreement.

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Abstracts

Influence of the oscillator equivalent circuit on the stable modes of parallel-coupled oscillators

Heng-Chia Chang, E.S. Shapiro and R.A. York. "Influence of the oscillator equivalent circuit on the stable modes of parallel-coupled oscillators." 1997 Transactions on Microwave Theory and Techniques 45.8 (Aug. 1997, Part I [T-MTT]): 1232-1239.

This paper addresses a deficiency in the authors' previous work on coupled-oscillator theory, involving the nature of the resonance in the oscillator equivalent circuit and its influence on the stable modes of the, coupled-oscillator system. The authors show that series and parallel oscillators with identical free-running characteristics nevertheless behave differently when coupled by the same coupling network. The analysis focuses on parallel-coupling networks, which are most practical at microwave frequencies, and specifically on nearest-neighbor coupling topologies. The theory is verified using four small active-patch arrays operating at 10 GHz.



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Dual-mode conductor-loaded cavity filters

Chi Wang, K.A. Zaki and A.E. Atia. "Dual-mode conductor-loaded cavity filters." 1997 Transactions on Microwave Theory and Techniques 45.8 (Aug. 1997, Part I [T-MTT]): 1240-1246.

A new class of dual-mode filters consisting of cylindrical-waveguide cavities loaded with perfect conducting cylindrical disks is presented. Resonant frequencies, fields, and the unloaded Q of the resonator are rigorously analyzed by mode-matching techniques. A complete set of data for filter design is given. The results show that the resonator has high unloaded and good spurious performance. The accuracy of the computed results are confirmed by comparison with the experimental data. An eight-pole elliptic-function filter for PCS applications was designed, constructed, and tested; excellent frequency response of the filter with wide spurious-free performance was obtained, which verifies the theory.

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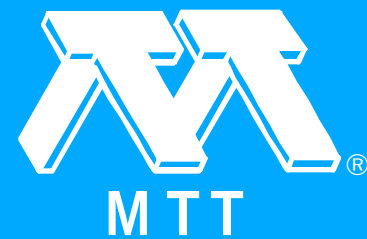


Abstracts

Fast and accurate extraction of capacitance parameters for the Statz MESFET model

S. Van den Bosch and L. Martens. "Fast and accurate extraction of capacitance parameters for the Statz MESFET model." 1997 Transactions on Microwave Theory and Techniques 45.8 (Aug. 1997, Part I [T-MTT]): 1247-1249.

A modified approach to S-parameter fitting of measured MESFET data to the Statz's model equations is presented. The technique only requires one sweep of measured S-parameters versus frequency at a single bias point. In addition, there is a reduced need for optimization during the extraction procedure. The additional information in the data-fitting code reduces problems with measurement noise and calibration error. The presented method was developed and tested in HP-ICCAP, a software tool for parameter extraction. All measurements are controlled by this software.



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Abstracts

A novel ultrawideband microwave differential phase shifter

F.V. Minnaar, J.C. Coetzee and J. Joubert. "A novel ultrawideband microwave differential phase shifter." 1997 Transactions on Microwave Theory and Techniques 45.8 (Aug. 1997, Part I [T-MTT]): 1249-1252.

Wideband microwave phase shifters are usually constructed using cascaded coupled-fine sections connected together at their far ends. By utilizing the unique frequency-independent quadrature property of symmetric couplers, a new class of phase shifter is proposed. The use of ultrawideband couplers in its realization results in a device which offers greater freedom with respect to bandwidth and ripple. The tendency of symmetrical networks to cancel small errors due to manufacturing tolerances is also exploited in order to improve its high-frequency performance.



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Abstracts

A simple and accurate MESFET channel-current model including bias-dependent dispersion and thermal phenomena

Tae Moon Roh, Youngsik Kim, Youngsuk Suh, Wee Sang Park and Bumman Kim. "A simple and accurate MESFET channel-current model including bias-dependent dispersion and thermal phenomena." 1997 Transactions on Microwave Theory and Techniques 45.8 (Aug. 1997, Part I [T-MTT]): 1252-1255.

A new channel-current model of GaAs MESFET suitable for applications to microwave computer-aided design (CAD) has been developed. This model includes the frequency-dispersion effects due to traps and thermal effects. The model parameters are extracted from pulsed I-V measurements at several ambient temperature and quiescent bias points. This model is verified by simulating nonlinear circuits, such as a power amplifier and a mixer.



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Two-port scattering at an elliptic-waveguide junction

Kin-Lung Chan and S.R. Judah. "Two-port scattering at an elliptic-waveguide junction." 1997 Transactions on Microwave Theory and Techniques 45.8 (Aug. 1997, Part I [T-MTT]): 1255-1262.

A concentric waveguide junction consisting of an elliptic waveguide has been formulated using the mode-matching method. The formulation is a generalized solution of the problem such that the second waveguide, which forms the junction, can be any regular shape in cross section. Exact closed-form expressions for computing the coupling integrals have been obtained from the generalized formulation. As a special case of the general solution, the expressions for evaluating the coupling integrals of rectangular-to-elliptic, circular-to-elliptic, and elliptic-to-elliptic waveguide junction are given. Theoretical results compare well with the experimental and published results.

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Numerical implementations of PML boundary conditions in the TLM-based SCN FDTD grid

Jian Xu, Zhizhang Chen and Jimmy Chuang. "Numerical implementations of PML boundary conditions in the TLM-based SCN FDTD grid." 1997 Transactions on Microwave Theory and Techniques 45.8 (Aug. 1997, Part I [T-MTT]): 1263-1267.

The recently developed perfectly matched layer (PML) absorbing scheme and its improvement, the modified PML (MPML), have been shown to be very effective in absorbing numerical electromagnetic (EM) waves in the conventional finite-difference time-domain (FDTD) method. However, the implementation of PML in the transmission-line-matrix (TLM) method is not straightforward. An alternative and easy way is to use the recently introduced TLM-based symmetrical condensed node (SCN) FDTD method. In this paper, the implementation of the PML and MPML schemes in the TLM-based SCN FDTD method and the extension of the MPML to three dimensions are presented. The computation amount is found to increase by a maximum of 1/3, and the MPML is shown to be effective and efficient in absorbing both the evanescent and propagating modes.

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Abstracts

Hybrid FDTD large-signal modeling of three-terminal active devices

Qiang Chen and V.F. Fusco. "Hybrid FDTD large-signal modeling of three-terminal active devices." 1997 Transactions on Microwave Theory and Techniques 45.8 (Aug. 1997, Part I [T-MTT]): 1267-1270.

A general algorithm for including large-signal active three-terminal models into the finite-difference time-domain (FDTD) method is presented. A dynamic interface between the active device and the FDTD lattice is used to simulate the prominent nonlinear time-dependant behavior of the three-terminal active device, which is connected across multiple FDTD cells. A technique for introducing an internal electromagnetic (EM) field absorber into the FDTD three-terminal active device model in order to eliminate undesired current coupling is discussed. Numerical comparison shows this method is accurate and expected to have general utility for other complicated hybrid lumped-circuit FDTD modeling situations.



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Resonance in a cylindrical-triangular microstrip structure

Kin-Lu Wong and Shan-Cheng Pan. "Resonance in a cylindrical-triangular microstrip structure." 1997 Transactions on Microwave Theory and Techniques 45.8 (Aug. 1997, Part I [T-MTT]): 1270-1272.

Full-wave solutions for the complex-resonant frequency of a triangular microstrip patch printed on a cylindrical substrate are presented. Curvature effects on the complex-resonant frequency, as well as the quality factor of the cylindrical-triangular microstrip structure, are analyzed. Measured resonant frequencies are also shown for comparison. Good agreement between measured and theoretical results is obtained.

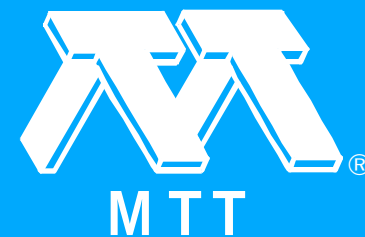
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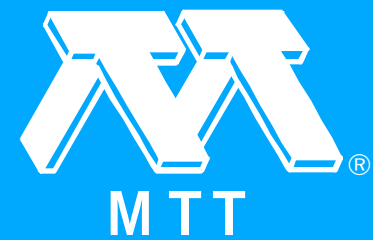
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Inside Cover (Aug. 1997, Part II [T-MTT])

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Abstracts

Introduction to the Special Issue on Microwave and Millimeter-Wave Photonics

A.J. Seeds and R.D. Esman. "Introduction to the Special Issue on Microwave and Millimeter-Wave Photonics." 1997 Transactions on Microwave Theory and Techniques 45.8 (Aug. 1997, Part II [T-MTT]): 1277-1278.

Welcome to this third Joint Special Issue of the IEEE TRANSACTIONS ON MICROWAVE THEORY AND TECHNIQUES and JOURNAL OF LIGHTWAVE TECHNOLOGY devoted to microwave and millimeter-wave photonics. Microwave photonics can be defined as the study of photonic devices operating at microwave frequencies and their applications in microwave systems. From pioneering experiments in the late 1970's, the field has expanded to produce a number of applications of commercial importance. These include the remoting of antennas for cellular and micro-cellular radio using analog fiber links, the distribution of cable-television signals, signal processing using optical techniques for phased-array antenna beam forming, and opto-electronic probing of microwave and millimeter-wave monolithic integrated circuits.



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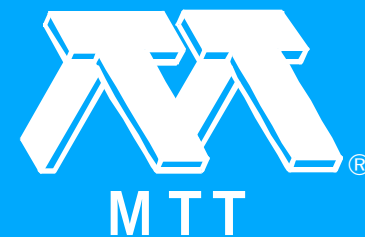


Abstracts

In Memoriam, Brian Hendrickson

"In Memoriam, Brian Hendrickson." 1997 Transactions on Microwave Theory and Techniques 45.8 (Aug. 1997, Part II [T-MTT]): 1279-1279.

This Special Issue of the IEEE TRANSACTIONS ON MICROWAVE THEORY AND TECHNIQUES recognizes, with appreciation, the work and contributions of Brian Hendrickson (S'65-M'66-SM'90). Brian was dedicated to the concept of photonics-his favorite picture showed Albert Einstein looking at his shadow, with a quote, "For the rest of my life I want to reflect on what light is." Brian had a keen knowledge of photonics and of basic research in materials and devices. He knew where the hurdles were and how to invest efforts wisely, so that the promises of optical signal processing, optical memory, and RF photonics could become practical realities. He enlisted and supported hundreds of researchers throughout the U.S., helping to mold a synergistic thrust which continues to propel photonics from the spark-gap era into the future. He asked the right questions, so that others could pursue the right answers.



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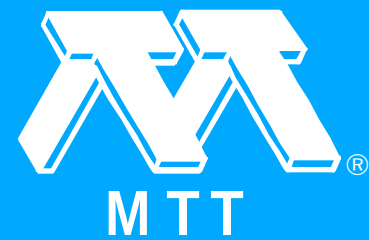


Abstracts

Semiconductor laser sources for externally modulated microwave analog links

G.E. Betts, J.P. Donnelly, J.N. Walpole, S.H. Groves, F.J. O'Donnell, L.J. Missaggia, R.J. Bailey and A. Napoleone. "Semiconductor laser sources for externally modulated microwave analog links." 1997 Transactions on Microwave Theory and Techniques 45.8 (Aug. 1997, Part II [T-MTT]): 1280-1287.

High-performance semiconductor continuous-wave (CW) sources are demonstrated in this paper, which include a Fabry-Perot (FP) laser oscillator (LO) with relative intensity noise (RIN) < -165 dB/Hz at frequencies above 500 MHz, and a tapered semiconductor optical amplifier with 35-dB gain, a maximum output power of 820 mW, and RIN/spl ap/-155 dB/Hz at microwave frequencies. These are used in suboctave-bandwidth analog links to demonstrate link performance comparable to that available with solid-state laser sources.



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Dynamic response of long optical-cavity laser diode for Ka-band communication satellites

A.S. Daryoush, K. Sato, K. Horikawa and H. Ogawa. "Dynamic response of long optical-cavity laser diode for Ka-band communication satellites." 1997 Transactions on Microwave Theory and Techniques 45.8 (Aug. 1997, Part II [T-MTT]): 1288-1295.

This paper presents the performance of a novel Fabry-Perot (FP) laser diode. The laser is composed of a long gain section, and a multiple-quantum-well (MQW) electroabsorption (E/A) modulator. The laser diode is mode locked using the integrated E/A modulator at 19.3 GHz. Sub-carrier data signals at S-band and a frequency reference of 19.3 GHz are simultaneously distributed using modulation of the gain and E/A sections of the laser, respectively. This paper also compares performance of this laser diode at various operation points in terms of pulsewidth, pulse-to-pulse coherency, phase-noise degradation of the frequency reference, and two-tone spurious-free dynamic range. Implication of this laser's performance as an optical transmitter is also evaluated for a fiber-optic (FO) distribution network in Ka-band phased-array antennas for satellite communications.

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Optical generation of a megahertz-linewidth microwave signal using semiconductor lasers and a discriminator-aided phase-locked loop

Z.F. Fan and M. Dagenais. "Optical generation of a megahertz-linewidth microwave signal using semiconductor lasers and a discriminator-aided phase-locked loop." 1997 Transactions on Microwave Theory and Techniques 45.8 (Aug. 1997, Part II [T-MTT]): 1296-1300.

A discriminator-aided optical phase-locked loop (OPLL) with significantly enhanced frequency acquisition capability is presented. Its pull-in range is measured to be 300 MHz and can be easily extended further. Two grating-tuned external-cavity semiconductor lasers (ECSLs) were realized with more than 30-dB side-mode suppression ratio. These two lasers were allowed to beat on a fast detector and were offset phase locked. The generated microwave signal was found to be a replica of the reference RF signal close to the carrier. The noise level was measured to be -70 dBc/Hz close to the carrier and less than -100 dBc/Hz at 4 MHz away and beyond from the carrier. The total phase variance is 0.11 rad/sup 2/ over a 500-MHz bandwidth. The linewidth full width at half maximum (FWHM) of the locked signal was directly measured to be of order 1 mHz.

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Highly tunable fiber-coupled photomixers with coherent terahertz output power

S. Verghese, K.A. McIntosh and E.R. Brown. "Highly tunable fiber-coupled photomixers with coherent terahertz output power." 1997 Transactions on Microwave Theory and Techniques 45.8 (Aug. 1997, Part II [T-MTT]): 1301-1309.

Low-temperature-grown (LTG) GaAs is used as an optical-heterodyne converter or photomixer, to generate coherent continuous-wave (CW) output radiation at frequencies up to 5 THz. Photomixers consist of an epitaxial LTG-GaAs layer that is patterned with interdigitated metal electrodes, on which two laser beams are focused with their frequencies offset by the desired difference frequency. The difference-frequency power is coupled out of the photomixer using coplanar waveguide at low frequencies and using log-spiral, dipole, and slot antennas at higher frequencies. Difference-frequency power is limited by the maximum optical-pump power that the photomixer can withstand. Fiber-coupled photomixers were operated at 77 K—a configuration in which they exhibited improved heatsinking and, therefore, withstood higher pump power. Progress has been made in the development of photomixer local oscillators (LOs) for space-based receivers that use superconducting tunnel junctions and hot-electron bolometers as heterodyne detectors.

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Traveling-wave photodetector theory

K.S. Giboney, J.W. Rodwell and J.E. Bowers. "Traveling-wave photodetector theory." 1997 Transactions on Microwave Theory and Techniques 45.8 (Aug. 1997, Part II [T-MTT]): 1310-1319.

Photodetector efficiency decreases as bandwidth increases, Bandwidth-efficiency limitations of traveling-wave photodetectors (TWPDs) are substantially greater than those of lumped-element photodetectors because the velocity-mismatch bandwidth limitation is independent of device length. TWPDs can be long for high efficiency without significantly compromising bandwidth. The TWPD is modeled by a terminated section of transmission line with a position-dependent photocurrent source propagating on it at the optical group velocity. A wave model for the transmission line confirms the accuracy of an equivalent-circuit model for electrical wave propagation. The velocity-mismatch impulse and frequency response are determined by absorption coefficient and wave velocities rather than junction capacitance and load resistance. The velocity-mismatch bandwidth limitations can be written in a simple form which elucidates the factors affecting device response, A discretized periodic TWPD is described by the same equations as the fully distributed version. This more complicated device offers additional degrees of freedom in design and potentially improved performance.

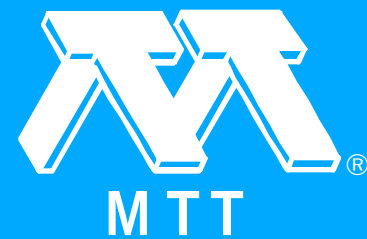


Abstracts

High-power high-speed photodetectors-design, analysis, and experimental demonstration

L.Y. Lin, M.C. Wu, T. Itoh, T.A. Vang, R.E. Muller, D.L. Sivco and A.Y. Cho. "High-power high-speed photodetectors-design, analysis, and experimental demonstration." 1997 Transactions on Microwave Theory and Techniques 45.8 (Aug. 1997, Part II [T-MTT]): 1320-1331.

A novel velocity-matched distributed photodetector (VMDP) is proposed to simultaneously achieve high saturation photocurrent and broad bandwidth. Theoretical analysis on the tradeoff between saturation power and bandwidth shows that the VMDP offers fundamental advantages over conventional photodetectors. A comprehensive theoretical model has been developed for the design and simulation of the VMDP. Experimentally, the VMDP with very high saturation (56-mA) photocurrent and instrument-limited 3-dB bandwidth (49 GHz) has been demonstrated. The theoretical analysis and experimental results show that the VMDP is very attractive for high-performance microwave photonic links and high-power optical microwave applications.



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Theoretical study of p-i-n photodetectors' power limitations from 2.5 to 60 GHz

J. Harari, G. Jin, J.P. Vilcot and D. Decoster. "Theoretical study of p-i-n photodetectors' power limitations from 2.5 to 60 GHz." 1997 Transactions on Microwave Theory and Techniques 45.8 (Aug. 1997, Part II [T-MTT]): 1332-1336.

In this paper, we present a theoretical study and a numerical simulation of various long wavelength top-illuminated p-i-n photodetectors in the frequency range of 2.5-60 GHz under high optical modulated power at 1.55 μm wavelength. The modeling includes a monodimensional drift-diffusion model for the device and takes into account the external circuit. We considered six InP/GaInAs/InP photodetectors especially designed to work at 2.5, 10, 20, 30, 40, and 60 GHz, respectively. For the one with the highest frequency, we intentionally sacrificed the quantum efficiency in order to compare them at the end with the results already obtained in the case of waveguide p-i-n photodetectors. The results show the maximum microwave-output power for each photodetector at its specific working frequency. Additionally, we present the effects of the modulation depth, the back illumination, and the wavelength of 1.3 μm .





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Diluted- and distributed-absorption microwave waveguide photodiodes for high efficiency and high power

S. Jasmin, N. Vodjdani, J.-C. Renaud and A. Enard. "Diluted- and distributed-absorption microwave waveguide photodiodes for high efficiency and high power." 1997 Transactions on Microwave Theory and Techniques 45.8 (Aug. 1997, Part II [T-MTT]): 1337-1341.

We propose a new microwave photodetector with high responsivity, which can handle both high optical power and deliver high microwave-output power. The distributed-absorption waveguide photodiode (DWGPD) is specially designed to equally distribute the photocarriers over the maximum surface area available in order to reduce the nonlinearities of electrical response due to electric-field screening effects. The expected calculated performances of this DWGPD is compared to other types of broad-band photodetectors in terms of linear microwave-output power, quantum efficiency, and thermal behavior. The fabricated DWGPDs have a responsivity of 1 A/W, cutoff frequency of 29 GHz, and linear response up to 8 mA limited in this experiment by contacting electrodes.

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Principles and performance of traveling-wave photodetector arrays

C.L. Goldsmith, G.A. Magel and R.J. Baca. "Principles and performance of traveling-wave photodetector arrays." 1997 Transactions on Microwave Theory and Techniques 45.8 (Aug. 1997, Part II [T-MTT]): 1342-1350.

Analog fiber-optic links are used in a variety of microwave applications, including cable-TV and cellular-telephone distribution, as well as antenna remoting. The RF insertion loss and output power obtainable from externally modulated links is primarily limited by photodetector optical-power handling capabilities. Using traveling-wave concepts similar to those in microwave distributed amplifiers, we demonstrate the principle of traveling-wave detector arrays (TWDAs) in which discrete photodiodes are embedded within an artificial transmission line. By feeding these detectors with suitably time-delayed optical signals, this arrangement coherently combines multiple RF photocurrents into a single output. This paper presents the theory, construction details, and results of two- and four-element TWDA's operating up into the Ku-band. We demonstrate a two-element TWDA yielding a 6-dB improvement in insertion loss and RF output power with 12 GHz of operating bandwidth, and a four-element TWDA yielding 12-dB improvement up to 18 GHz.

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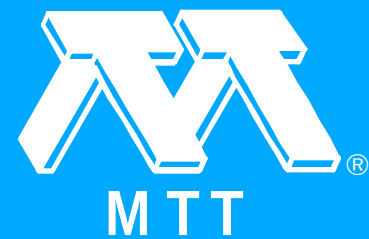
Quasi-static analysis of an optically illuminated directional coupler

A.M.E. Safwat, D.A.M. Khalil, H. Elhennawy and H.F. Ragaie. "Quasi-static analysis of an optically illuminated directional coupler." 1997 Transactions on Microwave Theory and Techniques 45.8 (Aug. 1997, Part II [T-MTT]): 1351-1357.

In this paper, we present the analysis of an optically illuminated directional coupler using a quasi-static technique. Closed-form expressions of the matching conditions in both the dark and illuminated states are developed. The results obtained by our analytical model are in good agreement with the experimental results as well as those obtained by the monolithic microwave integrated circuit analysis and design simulator (MMICAD). A discussion of the effects of the parameter variations are also included.

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On the improvement of the performance of the optically controlled microwave switch

D.A.M. Khalil and A.M.E. Safwat. "On the improvement of the performance of the optically controlled microwave switch." 1997 Transactions on Microwave Theory and Techniques 45.8 (Aug. 1997, Part II [T-MTT]): 1358-1361.

In this paper, a new design for the gap used as an optically controlled microwave switch is proposed. This new design is based on the use of a rib structure in the gap region. The proposed structure is studied using the finite-difference method (PDM). Obtained results show that for small gaplengths, the structure figure of merit, defined as the product of the ON/OFF ratio and the bandwidth, can be improved by about 38 dB*GHz.

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Tunable microwave load based on biased photoinduced plasma in silicon

B. Boyer, J. Haidar, A. Vilcot and M. Bouthinon. "Tunable microwave load based on biased photoinduced plasma in silicon." 1997 Transactions on Microwave Theory and Techniques 45.8 (Aug. 1997, Part II [T-MTT]): 1362-1367.

The frequency tuning of a quarter-wave resonator using an optoelectronic control is reported. Sharp notch characteristics with a small decibel-insertion loss and tunable frequency with matching better than 45 dB are obtained by varying both the optical power and the DC bias. The measured frequency shift is more than 60% below the dark resonant frequency and is carried out without altering the shape of the response. The biased photoinduced plasma (BPP) loading the open terminated microstrip line is then analyzed by comparing microwave simulations and measurements. The deduced complex load equivalent to this biased photoinduced plasma is then confirmed by semiconductor simulations. Results show the great possibilities offered by this BPP load (BPPL), which can be easily and widely tuned by means of a simple optoelectronic control. The frequency bandwidth of tuning is limited by the geometrical parameters and may be extended to millimeter-wave operation.

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Photoresponse of microwave transistors to high-frequency modulated lightwave carrier signal

L.E.M. de Barros, A. Paoletta, M.Y. Frankel, M.J. Romero, P.R. Herczfeld and A. Madjar. "Photoresponse of microwave transistors to high-frequency modulated lightwave carrier signal." 1997 Transactions on Microwave Theory and Techniques 45.8 (Aug. 1997, Part II [T-MTT]): 1368-1374.

Described in this paper are the photoresponse characteristics of microwave transistors, both unipolar [metal-semiconductor FETs (MESFETs) and modulation-doped FETs (MODFETs)] and bipolar [heterojunction bipolar transistors (HBTs)]. Investigation includes time- and frequency-domain measurements. For unipolar device FETs, the two dominant photodetection mechanisms, photoconductive and photovoltaic, are clearly identified within the same device for the first time. It is shown that even high-speed FETs are limited to a photonic bandwidth of a few megahertz, if photodetection and amplification are to be achieved simultaneously. In contrast, bipolar HBTs can provide optical gain up to the millimeter-wave range. It is shown that their bandwidth to a modulated optical input is closely related to the microwave bandwidth, and that parameters such as base-access resistance and base-emitter capacitance are critical to photoresponse optimization.

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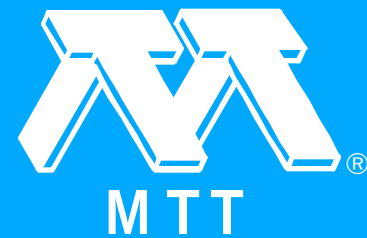


Abstracts

Techniques and performance of intensity-modulation direct-detection analog optical links

C. Cox, E. Ackerman, R. Helkey and G.E. Betts. "Techniques and performance of intensity-modulation direct-detection analog optical links." 1997 Transactions on Microwave Theory and Techniques 45.8 (Aug. 1997, Part II [T-MTT]): 1375-1383.

We review state-of-the-art intensity-modulation direct-detection (IMDD) analog optical links, focusing on advances since 1990. We contrast direct and external modulation with respect to gain, noise figure, and dynamic-range performance.



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Abstracts

Optimizing the ultrawide-band photonic link

L.T. Nichols, K.J. Williams and R.D. Estman. "Optimizing the ultrawide-band photonic link." 1997 Transactions on Microwave Theory and Techniques 45.8 (Aug. 1997, Part II [T-MTT]): 1384-1389.

Performance of wide-band photonic links (PLs) using Mach-Zehnder modulators (MZMs) is reported. Comparison parameters include loss, noise figure, and spur-free dynamic range (SPDR). The feasibility of a 0-dB noise-figure link even with passive matching is given and the advantages of dual-output MZMs are presented. A new figure of merit is introduced to quantitatively optimize link performance with or without a preamplifier.



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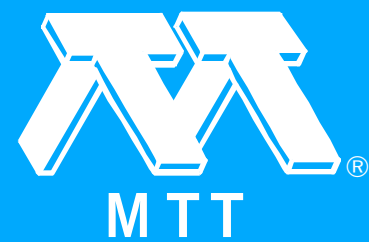
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Dynamic range requirements for microcellular personal communication systems using analog fiber-optic links

J.C. Fan, C.L. Lu and L.G. Kazovsky. "Dynamic range requirements for microcellular personal communication systems using analog fiber-optic links." 1997 Transactions on Microwave Theory and Techniques 45.8 (Aug. 1997, Part II [T-MTT]): 1390-1397.

Fiber infrastructures in future personal communication systems (PCSs) must minimize remote antenna size and cost, and facilitate system maintenance and upgradeability. These goals can be met by a centralized PCS infrastructure using analog fiber-optic links. It is essential that the relationship between optical-link quality in terms of spurious-free dynamic range (SFDR) and PCS quality of service be accurately quantified so that optical device and other infrastructure design requirements can be determined. This paper presents a comprehensive wireless/optical simulation model which combines wireless system characteristics (such as fading, cochannel interference, diversity, and power control) with the noise and nonlinearities of fiber-optic links. Results of the simulation indicate that representative SFDR requirements for fiber infrastructures in PCS systems are in the 72-83 dB/spl middot/Hz/sup 2/3/ range. The impact of varying environmental characteristics as quantified by distance loss and shadowing variance is between 7-10 dB. A larger distance loss or lower shadowing variance result in lower SFDR requirements. The required automatic gain control (AGC) accuracy decreases as the SFDR increases. These results indicate that either distributed feedback (DFB) or Fabry-Perot (FP) semiconductor laser diodes can be used in the implementation of PCS infrastructures.



Abstracts

Impact of interferometric noise on the remote delivery of optically generated millimeter-wave signals

L. Moura, M. Darby, P.M. Lane and J.J. O'Reilly. "Impact of interferometric noise on the remote delivery of optically generated millimeter-wave signals." 1997 Transactions on Microwave Theory and Techniques 45.8 (Aug. 1997, Part II [T-MTT]): 1398-1402.

In this paper, we report for the first time results relating to reflections/multipath induced interferometric noise in millimeter-wave fiber-radio systems for the broadcast of very narrow linewidth wave signals. We use a rigorous formulation based on the modified Chernoff bound which provides an accurate upper bound on the bit-error rate (BER) and power penalty (PP). Simulated results show good agreement with the analytical findings. We conclude that interferometric noise (IN) can be a significant impairment in systems of this type.



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Assessment of the nonlinearity tolerance of different modulation schemes for millimeter-wave fiber-radio systems using MZ modulators

Sen Lin Zhang, P.M. Lane and J.J. O'Reilly. "Assessment of the nonlinearity tolerance of different modulation schemes for millimeter-wave fiber-radio systems using MZ modulators." 1997 Transactions on Microwave Theory and Techniques 45.8 (Aug. 1997, Part II [T-MTT]): 1403-1409.

The nonlinearity tolerance of several higher order modulation schemes, which make efficient use of transmission bandwidth, such as 8-PSK, 16-QAM, and 64-QAM, has been assessed for millimeter-wave fiber-radio systems using a Mach-Zehnder (MZ) modulator for the modulation of an optical carrier. Some other deteriorating factors, such as a bias-point shift in the MZ modulator and optical carrier leakage at the MZ filter, which is used for the separation of the two optical carriers, have also been considered. The assessment was accomplished through computer simulations. It is found that the effect of the nonlinearity of the MZ modulator is less serious for a system using 8-PSK than for a system using 16-QAM or 64-QAM, and that in the latter case, an optimal drive level exists for the modulator to achieve the best system performance. A bias-point shift, required in some deployment scenarios, degrades system performance significantly. A leakage of optical carrier to the wrong port at the MZ filter further degrades the system performance, especially for systems using the 16-QAM or 64-QAM modulation scheme.

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Overcoming chromatic-dispersion effects in fiber-wireless systems incorporating external modulators

G.H. Smith, D. Novak and Z. Ahmed. "Overcoming chromatic-dispersion effects in fiber-wireless systems incorporating external modulators." 1997 Transactions on Microwave Theory and Techniques 45.8 (Aug. 1997, Part II [T-MTT]): 1410-1415.

We demonstrate two techniques to reduce the effects of fiber chromatic dispersion in fiber-wireless systems incorporating external modulators. We theoretically and experimentally show that the achievable link distance can be increased by varying the chirp parameter of the modulator to give large negative chirp using a dual-electrode Mach-Zehnder modulator (MZM) biased at quadrature. In addition, we show that dispersion can be almost totally overcome by implementing a simple method using the dual-electrode MZM to generate an optical carrier with single sideband (SSB) modulation. We demonstrate the transmission of a 51.8-Mb/s pseudorandom bit sequence (PRBS) at 12 GHz over 80 km of standard single-mode fiber using the SSB generator and measure a bit-error-rate (BER) power penalty due to fiber dispersion of less than 0.5 dB for a BER equal to 10^{-9} .

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Novel techniques for high-capacity 60-GHz fiber-radio transmission systems

L. Noel, D. Wake, D.G. Moodie, D.D. Marcenac, L.D. Westbrook and D. Nasset. "Novel techniques for high-capacity 60-GHz fiber-radio transmission systems." 1997 Transactions on Microwave Theory and Techniques 45.8 (Aug. 1997, Part II [T-MTT]): 1416-1423.

A broad-band 60-GHz fiber-radio transmission experiment has been performed using a combination of novel techniques. The 60-GHz carrier signal was generated using a master/slave (M/S) distributed-feedback (DFB) laser configuration, which gave high purity and high power with very wide frequency tunability. The data path was separated in the wavelength domain from the carrier path so that a remote upconversion scheme could be used to provide a fully transparent link. An electroabsorption modulator (EAM) was used as a full duplex transceiver so that bidirectional optical transmission could be implemented without the need for a laser at the remote site. Transmission of a 120-Mb/s QPSK signal over a fiber span of 13 km and a radio path of 5 m was demonstrated. Furthermore, the downstream optical signal contained the 120-Mb/s QPSK signal multiplexed with 20 channels of TV. The upstream optical signal consisted of 120-Mb/s QPSK data only. Good error performance was simultaneously achieved in both directions.

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A mobile broad-band communication system based on mode-locked lasers

C.H. von Helmolt, U. Kruger, K. Kruger and G. Grosskopf. "A mobile broad-band communication system based on mode-locked lasers." 1997 Transactions on Microwave Theory and Techniques 45.8 (Aug. 1997, Part II [T-MTT]): 1424-1430.

A concept is proposed for a pico-cellular network for broad-band mobile communication on a millimeter-wave basis. How microwave optical-signal-processing techniques based on mode-locked lasers (MLLs), optical modulators, and high-speed photo diodes (PD's) can advantageously be applied in the optical feeder lines of a pico-cellular network at 60 GHz is investigated. The external cavity MLL (at 81.25 GHz) used for the experiments showed a single-sideband (SSB) phase noise of -59 dBc/Hz at 100-Hz offset, when actively locked at 6.25 GHz. With the PD, and limited by the V-band mixer equipment, spectral harmonics up to 100 GHz could be detected. For the downlink configuration, a 400-MHz subcarrier is modulated with a 155-Mb/s data signal and upconverted to 62.9 GHz using an MLL and a fast PD. The upconverted sideband at 62.9 GHz was received with an optical power of -14.3-dBm at a bit-error-rate (BER) equal to 10^{-9} without any additional penalty due to transmitting the signal over 3 km of optical fiber. BER measurements at 155 Mb/s down to 10^{-11} were made. For the uplink, the digitally encoded RF signal is downconverted also by optical microwave signal processing. A 155-Mb/s data encoded 19.21-GHz signal is downconverted to 460 MHz using a mode-locked laser, an optical modulator, and a 600-MHz optical receiver front end. A receiver sensitivity of -24.5 dBm (BER equal to 10^{-9}) is demonstrated with the microwave signal being transmitted over a 1-m radio link and 3 km of optical fiber.





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37-GHz fiber-wireless system for distribution of broad-band signals

Z. Ahmed, D. Novak, R.B. Waterhouse and Hai-Feng Liu. "37-GHz fiber-wireless system for distribution of broad-band signals." 1997 Transactions on Microwave Theory and Techniques 45.8 (Aug. 1997, Part II [T-MTT]): 1431-1435.

We present a millimeter (mm)-wave fiber-wireless system suitable for the transport and distribution of broad-band signals. We show transmission over fiber and wireless distribution of subcarrier multiplexed amplitude-modulation vestigial-sideband (AM-VSB) video and a digital data stream at 37 GHz using optical carriers generated by a hybrid mode-locked laser (HMLL). We also present a simple model to characterize the effect of fiber chromatic dispersion on the transport of mm-wave modulated signals over fiber, and calculations show that by using an HMLL, broad-band signals can be transported successfully over fiber lengths greater than 150 km using subcarrier frequencies <1 GHz and more than 50 km for subcarrier frequencies <3 GHz.

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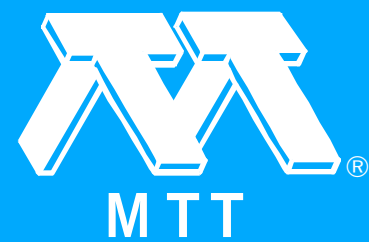
Broad-band external modulation fiber-optic links for antenna-remoting applications

E.I. Ackerman and A.S. Daryoush. "Broad-band external modulation fiber-optic links for antenna-remoting applications." 1997 Transactions on Microwave Theory and Techniques 45.8 (Aug. 1997, Part II [T-MTT]): 1436-1442.

We present a 6-12 GHz external modulation fiber-optic link with a spurious-free dynamic range (SFDR) of 65.5 dB MHz. This result validates an analytical model for external modulation link performance which we have updated from a previously published model to account for the use of a traveling-wave external modulator. Using the revised model, we compare the expected performance of two different link architectures.

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Fiber-optic links supporting baseband data and subcarrier-multiplexed control channels and the impact of MMIC photonic/microwave interfaces

D.J. Blumenthal, J. Laskar, R. Gaudino, Sangwoo Han, M.D. Shell and M.D. Vaughn. "Fiber-optic links supporting baseband data and subcarrier-multiplexed control channels and the impact of MMIC photonic/microwave interfaces." 1997 Transactions on Microwave Theory and Techniques 45.8 (Aug. 1997, Part II [T-MTT]): 1443-1452.

We report experimental and analytical results of a fiber-optic link that supports simultaneous transmission of baseband data and subcarrier multiplexed control-data channels. A novel transmitter design is used to optoelectronically combine baseband and subcarrier channels onto the optical carrier using a differential Mach-Zehnder (MZ) interferometer modulator. Microwave direct detection of the subcarrier data channel simplifies the receiver design and network architecture. An approach to optimize the transmitter parameters for a given transmitter/receiver configuration is presented. A discrete component link is implemented and its performance compared to analytical results and discrete-time simulations. Insertion of monolithic-microwave integrated-circuit (MMIC) technology is investigated by utilizing a MMIC mixer for control-channel upconversion and envelope detection in the link transmitter and receiver, respectively. High signal-to-noise ratio (SNR) of the control channel demonstrates that MMIC technology is a viable approach to integration of subcarrier multiplexed fiber links.



Abstracts

High-speed generalized distributed-amplifier-based transversal-filter topology for optical communication systems

A. Borjak, P.P. Monteiro, J.J. O'Reilly and I. Darwazeh. "High-speed generalized distributed-amplifier-based transversal-filter topology for optical communication systems." 1997 *Transactions on Microwave Theory and Techniques* 45.8 (Aug. 1997, Part II [T-MTT]): 1453-1457.

The use of a distributed-amplifier-based transversal filter as a signal processor for high-rate pulse shaping/filtering is discussed. By showing the analogy between transversal filters and distributed-amplifier topologies, schemes demonstrating practical approaches for the design of such filters are explored. The practicability of one of the different schemes is illustrated via an implemented design. A four-stage 10-Gb/s distributed-amplifier monolithic microwave integrated circuit (MMIC) is constructed using one of the developed schemes and its behavior is discussed.



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Synthesis of all-optical microwave filters using Mach-Zehnder lattices

T.A. Cusick, S. Iezekiel, R.E. Miles, S. Sales and J. Capmany. "Synthesis of all-optical microwave filters using Mach-Zehnder lattices." 1997 Transactions on Microwave Theory and Techniques 45.8 (Aug. 1997, Part II [T-MTT]): 1458-1462.

A synthesis algorithm which generates the set of coupling ratios required to produce a desired time-domain window response using an all-optical Mach-Zehnder lattice network is presented. The analysis assumes incoherent interference of the lightwaves within the structure. The window coefficients are dictated by the coupling ratios of the couplers forming the lattice, leading to a simple structure comprising only passive components. Since its impulse response (IR) is finite, the filter will be stable, and the algorithm is capable of generating a wide range of responses in terms of their extinction ratios and passbands. The theory has been validated by experiment.

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Photonic signal processing of microwave signals using an active-fiber Bragg-grating-pair structure

D.B. Hunter and R.A. Minasian. "Photonic signal processing of microwave signals using an active-fiber Bragg-grating-pair structure." 1997 Transactions on Microwave Theory and Techniques 45.8 (Aug. 1997, Part II [T-MTT]): 1463-1466.

A new active photonic signal processor which achieves a high-Q microwave bandpass response is presented. It comprises active fiber within a pair of fiber Bragg gratings, and produces multiple taps with precise delay-time characteristics. The impulse response has demonstrated well in excess of 270 taps. The filter response demonstrates high resolution, having a narrow-band response with a Q of 325. The processor is also tunable, in both passband width and frequency.

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Optical architectures for programmable filtering and correlation of microwave signals

D. Dolfi, J. Tabourel, O. Durand, V. Laude, J.-P. Huignard and J. Chazelas. "Optical architectures for programmable filtering and correlation of microwave signals." 1997 Transactions on Microwave Theory and Techniques 45.8 (Aug. 1997, Part II [T-MTT]): 1467-1472.

New optoelectronic architectures are presented, based on parallel delay lines, performing programmable filtering of microwave signals. According to current performances of optoelectronic components, they can process optically carried microwave signals over frequency bandwidths as large as 20 GHz, with a time-frequency product up to 10^3 . The operating principle of these structures is detailed and followed by the preliminary experimental demonstration at 1.3 GHz of a 53-dB rejection filter.





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All-optical RF filter using amplitude inversion in a semiconductor optical amplifier

F. Copping, S. Yegnanarayanan, P.D. Trinh and B. Jalali. "All-optical RF filter using amplitude inversion in a semiconductor optical amplifier." 1997 Transactions on Microwave Theory and Techniques 45.8 (Aug. 1997, Part II [T-MTT]): 1473-1477.

We present an all optical delay-line radio-frequency (RF) notch filter. The filter exploits cross-gain modulation in a homogeneously broadened laser medium to obtain a negative tap in an optically incoherent system. Applications including moving-target indication (MTI) in optically controlled radars are discussed.

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Abstracts

Photonic mixers and image-rejection mixers for optical SCM systems

Lu Chao, Chen Wenyue and J.F. Shiang. "Photonic mixers and image-rejection mixers for optical SCM systems." 1997 Transactions on Microwave Theory and Techniques 45.8 (Aug. 1997, Part II [T-MTT]): 1478-1480.

Performances of subcarrier multiplexing (SCM) systems using Mach-Zehnder optical modulators for signal down conversion are studied in this paper. A photonic-image-rejection mixer is proposed to solve the image-frequency problem. The performance of the image-rejection mixer using nonideal system components is evaluated.



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Microwave-frequency conversion methods by optical interferometer and photodiode

G. Maury, A. Hilt, T. Berceli, B. Cabon and A. Vilcot. "Microwave-frequency conversion methods by optical interferometer and photodiode." 1997 Transactions on Microwave Theory and Techniques 45.8 (Aug. 1997, Part II [T-MTT]): 1481-1485.

Frequency conversion in fiber-optic systems like subcarrier multiplexed (SCM) systems is now to be used in many applications for both digital and analog signals. The performance of two different optoelectronic configurations, both used for frequency conversion in the microwave frequency range, are compared here. In the first case, mixing is achieved by a Mach-Zehnder (MZ) interferometer, while in the second case, photodiode mixing is presented. Experimental investigations are presented at the optical wavelength of 1.3 μm . In both cases, promising results have been achieved.

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Active high-power RF pulse compression using optically switched resonant delay lines

S.G. Tantawi, R.D. Ruth, A.E. Vlieks and M. Zolotarev. "Active high-power RF pulse compression using optically switched resonant delay lines." 1997 Transactions on Microwave Theory and Techniques 45.8 (Aug. 1997, Part II [T-MTT]): 1486-1492.

We present the design and a proof of principle experimental results of an optically controlled high-power RF pulse-compression system. In principle, the design should handle a few hundreds of megawatts of power at X-band. The system is based on the switched resonant delay-line theory [1]. It employs resonant delay lines as a means of storing RF energy. The coupling to the lines is optimized for maximum energy storage during the charging phase. To discharge the lines, a high-power microwave switch increases the coupling to the lines just before the start of the output pulse. The high-power microwave switch required for this system is realized using optical excitation of an electron-hole plasma layer on the surface of a pure silicon wafer. The switch is designed to operate in the TE/sub 01/ mode in a circular waveguide to avoid the edge effects present at the interface between the silicon wafer and the supporting waveguide; thus, enhancing its power handling capability.

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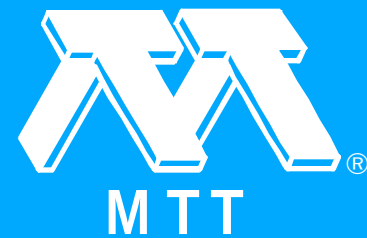


Abstracts

Simulation and implementation of lightwave component characterization using a bilateral electro-optic network

B. Elamaram, R.D. Pollard and S. Iezekiel. "Simulation and implementation of lightwave component characterization using a bilateral electro-optic network." 1997 Transactions on Microwave Theory and Techniques 45.8 (Aug. 1997, Part II [T-MTT]): 1493-1496.

The simulation and implementation of a bilateral electro-optic network has been demonstrated. The advantage of the proposed network is that it can be used as a black box to convert a microwave network analyzer into a two-port lightwave network analyzer. Simulations have been carried out to determine the sensitivity of the bilateral network to optical reflections. Measurement results on one-port optical structures are more accurate than those obtained with commercial lightwave analyzers and indicate the viability of this approach for full two-port lightwave measurements.



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An optically controlled MMW beam-steering antenna based on a novel architecture

V.A. Manasson, L.S. Sadovnik, V.A. Yepishin and D. Marker. "An optically controlled MMW beam-steering antenna based on a novel architecture." 1997 Transactions on Microwave Theory and Techniques 45.8 (Aug. 1997, Part II [T-MTT]): 1497-1500.

Beam-steering millimeter-wave (MMW) antennas using photo-induced plasma gratings (PIPGs) offer a dramatic decrease in fabrication cost compared to their phased-array counterparts. We describe a totally new antenna design which has been tested in both the receiving and the transmitting modes. The new antenna is a compact device with a reconfigurable PIPG in a semiconductor plate as an output aperture. This aperture is fed by a tunnel-coupling dielectric waveguide. We demonstrated the antenna's scanning capability over a $\pm 15^\circ$ range. The new design permits the antenna to operate at various polarizations including linear polarization (either vertical or horizontal) and circular polarization (an ellipticity of only 0.8 dB has been demonstrated).

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Abstracts

Experimental demonstration of optical guided-wave Butler matrices

J.T. Gallo and R. DeSalvo. "Experimental demonstration of optical guided-wave Butler matrices." 1997 Transactions on Microwave Theory and Techniques 45.8 (Aug. 1997, Part II [T-MTT]): 1501-1507.

We report fully functional fiber-optic and integrated-optic Butler matrices, each with four input channels and four output channels. Simulated antenna excitation is modulated onto the four input optical channels to predict these devices' performance when employed with circular antenna arrays for angle-of-arrival applications. Heterodyne detection techniques are employed to recover the RF signal at the optical output of the matrices and for conversion to an intermediate frequency. An RF pilot tone is injected at the input to calibrate the system, and an active feedback loop maintains the proper phasing of the light channels.



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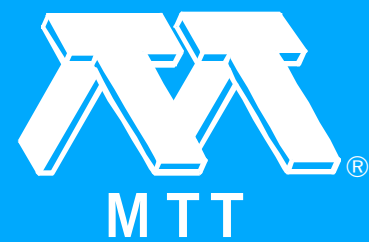


Analog vector modulation-based widely tunable frequency photonic beamformer for phased-array antennas

N.A. Riza. "Analog vector modulation-based widely tunable frequency photonic beamformer for phased-array antennas." 1997 Transactions on Microwave Theory and Techniques 45.8 (Aug. 1997, Part II [T-MTT]): 1508-1512.

A compact free-space/solid optics photonic controller for phased-array antennas/transducers is introduced which uses the principle of in-phase (I) and quadrature (Q) vector modulation via two-dimensional (2-D) spatial light modulators (SLMs). The SLMs are used as distributed optical-gain control devices to implement the vector modulation operation required to generate the desired RF signals with the correct phase and amplitude values.





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Optical-fiber grating-based beamforming network for microwave phased arrays

R.A. Minasian and K.E. Alameh. "Optical-fiber grating-based beamforming network for microwave phased arrays." 1997 Transactions on Microwave Theory and Techniques 45.8 (Aug. 1997, Part II [T-MTT]): 1513-1518.

A new photonic-based beamforming network that can realize a large number of simultaneous and independent beams in a wide-band phased-array antenna, and which eliminates optical beat-noise interference is presented. It is based on discrete and chirped Bragg-grating true-time delay elements and photodetector arrays at each beam port. This achieves a highly parallel delay-processing structure for signal equalization and eliminates the fundamental optical beat-noise limitation to the realization of large array sizes. Results show a very substantial reduction in the number of interconnects required of 98.4% for a 512-beam array and 99.2% for a 1024-beam array, in comparison to conventional beamforming techniques.

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Influence of crosstalk in switchable optical time-delay networks for microwave array antennas

C. Schaffer. "Influence of crosstalk in switchable optical time-delay networks for microwave array antennas." 1997 Transactions on Microwave Theory and Techniques 45.8 (Aug. 1997, Part II [T-MTT]): 1519-1521.

Switchable optical time-delay (TD) networks are used for the phase control of array antennas and for microwave signal processing because of their wide instantaneous bandwidth. In each optical switch, crosstalk signals are generated and its influence on the microwave phase accuracy is investigated. Due to the crosstalk of the switches, each stage forms an interferometer which converts the phase noise of the optical source into amplitude noise whose influence on the microwave phase is analyzed.



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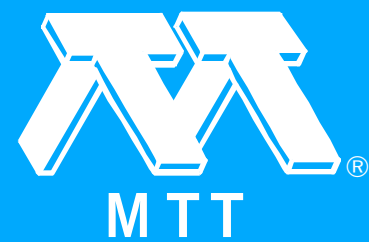
Fiber-optic true time steering of an ultrawide-band receive array

M.Y. Frankel, P.J. Matthews and R.D. Esman. "Fiber-optic true time steering of an ultrawide-band receive array." 1997 Transactions on Microwave Theory and Techniques 45.8 (Aug. 1997, Part II [T-MTT]): 1522-1526.

We report the development and demonstration of the first true time-delay (TTD) fiber-optic beamformer for ultrawideband antenna receive operation. The beamformer is based on a dispersive-fiber prism configuration that properly time delays the signals originating at each receiving element for coherent combining in the microwave domain. The time-steered receive antenna consists of eight spiral elements arranged into a one-dimensional (1-D) sparsely populated array. The receive array shows an instantaneous bandwidth of 6-18 GHz, limited by the available matched microwave amplifiers. The array performance is measured in an anechoic chamber and exhibits unprecedented squint-free steering over an azimuth scan of 120/spl deg/ over the full frequency range.

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Fiber Bragg-grating true time-delay systems: discrete-grating array 3-b delay lines and chirped- grating 6-b delay lines

A. Molony, Lin Zhang, J.A.R. Williams, I. Bennion, C. Edge and J. Fells. "Fiber Bragg-grating true time-delay systems: discrete-grating array 3-b delay lines and chirped-grating 6-b delay lines." 1997 Transactions on Microwave Theory and Techniques 45.8 (Aug. 1997, Part II [T-MTT]): 1527-1530.

We describe wavelength-addressed 3- and 6-b fiber-optic true time-delay (TTD) lines implemented using ultraviolet-inscribed Bragg gratings. The 3-b delay line is fabricated from an array of discrete- and uniform-period Bragg gratings, and a minimum time delay of 9.09 ps is selectable, making it suitable for phased-array antenna (PAA) beamforming control at RF frequencies of up to about 3 GHz with 10/spl deg/ phase resolution. The 6-b delay line is fabricated using a chirped-period Bragg grating, and is suitable for beamforming control at RF frequencies of up to /spl sim/48 GHz, with 10/spl deg/ phase resolution.

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Continuously variable true time-delay optical feeder for phased-array antenna employing chirped fiber grating

J.L. Corral, J. Marti, S. Regidor, J.M. Foster, R. Laming and M.J. Cole. "Continuously variable true time-delay optical feeder for phased-array antenna employing chirped fiber grating." 1997 Transactions on Microwave Theory and Techniques 45.8 (Aug. 1997, Part II [T-MTT]): 1531-1536.

In this paper, we present and demonstrate a novel approach of a true time-delay (TTD) optical feeder for phased-array antennas (PAAs). A continuously variable TTD is achieved by employing tunable lasers and a wide-bandwidth chirped fiber Bragg grating (FBG) as the dispersive element. The results show that a very high resolution performance (equivalent to a 6-b microwave phase shifter) is obtained for an L-band PAA employing narrow-tuning bandwidth lasers with a wavelength stability of 0.005 nm and a 4-nm bandwidth chirped grating with a dispersion of 835 ps/nm.

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"Inside Cover (Sep. 1997 [T-MTT])." 1997 Transactions on Microwave Theory and Techniques 45.9 (Sep. 1997 [T-MTT]): 0_2-0_3.



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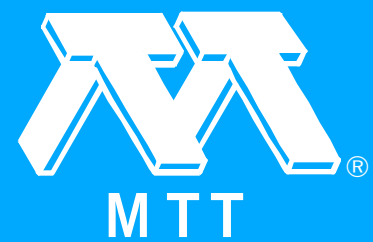
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Lumped- and distributed-element equivalent circuits for some symmetrical multiport signal-separation structures

A.D. Jimenez. "Lumped- and distributed-element equivalent circuits for some symmetrical multiport signal-separation structures." 1997 Transactions on Microwave Theory and Techniques 45.9 (Sep. 1997 [T-MTT]): 1537-1544.

This paper presents an extension to the synthesis of the symmetrical analysis methods for modeling passive n-port junctions. Two approaches are discussed: the electrical one, based on consideration of even- and odd-propagation modes, and the geometrical one, based on space symmetry operators. The convenience of using more complete models for both analysis and synthesis is manifest in the choice of the simplest topological circuits of some well-known signal-separation structures. An example of the synthesis of a lumped quadrature coupler is carried out via the geometrical approach and the results compared to those of a previously reported design performed via the electrical approach. Likewise, a distributed circuit for a ring-style five-port four-way equal-power divider simpler than others exhibiting the same power-division characteristics is presented.

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Application of a point-matching MoM reduced scheme to scattering from finite cylinders

A.G. Papagiannakis. "Application of a point-matching MoM reduced scheme to scattering from finite cylinders." 1997 Transactions on Microwave Theory and Techniques 45.9 (Sep. 1997 [T-MTT]): 1545-1553.

One of the most common methods for the solution of three-dimensional (3-D) scattering problems is the electric-field volume integral equation numerically solved by the application of the method of moments (MoM)-usually the point-matching version. Although simple to formulate, it shows inherent difficulty and complexity because of the 3-D integrals appearing in the interaction matrix elements and of the singularity of the dyadic Green's function (DGF) present in the computation of the self-cell elements. In this paper, a transformation method is presented, which in the case of the point-matching MoM, both reduces the 3-D integrals to two-dimensional (2-D) ones, and also eliminates the need of separate treatment of the singularity while maintaining the same degree of approximation. Comparison to published results is made for the case of scattering by a finite dielectric cylinder. Further examples are presented for scattering by layered dielectric cylinders and lossy cylindrical shells excited by uniform plane waves.

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Full-wave segmentation analysis of arbitrarily shaped planar circuit

Shih-Ping Liu and C.-K.C. Tzuang. "Full-wave segmentation analysis of arbitrarily shaped planar circuit." 1997 Transactions on Microwave Theory and Techniques 45.9 (Sep. 1997 [T-MTT]): 1554-1562.

This paper presents a novel full-wave segmentation method for analyzing a complex and large microwave planar circuit which is divided into several smaller segments with corresponding multiport network parameters. They are obtained by a full-wave space-domain integral-equation technique in connection to a proposed excitation model based on the equivalence principle. The integral equation is solved numerically by Galerkin's procedure resulting in the generalized scattering-matrix (GSM) descriptions of all the subcircuit segments. The combination of these GSM's yields an overall network characterization of the composite circuit. Rigorous convergence studies and extensive validity checks confirm the reliability and accuracy of the proposed method. The novel technique immediately demonstrates its obvious application for quantitative characterization of higher order modes associated with a microwave-circuit discontinuity problem. Finally, very good agreement is obtained in a comparative study of an arbitrary planar structure analyzed by our full-wave method with and without segmentation, respectively.

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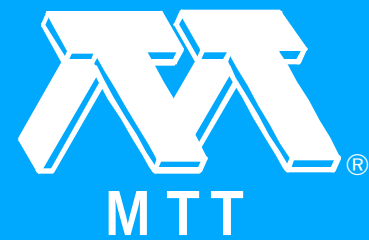


Abstracts

A realistic large-signal MESFET model for SPICE (Sep. 1997 [T-MTT])

A.E. Parker and D.J. Skellern. "A realistic large-signal MESFET model for SPICE (Sep. 1997 [T-MTT])." 1997 Transactions on Microwave Theory and Techniques 45.9 (Sep. 1997 [T-MTT]): 1563-1571.

A comprehensive large-signal MESFET model that provides a realistic description of measured characteristics over all operating regions is presented. It describes subthreshold conduction and breakdown. It has frequency dispersion of both transconductance and drain conductance, and derates with power dissipation. All derivatives are continuous for a realistic description of circuit distortion and intermodulation. The model has improved descriptions of capacitance and bias dependence. It has small-signal S-parameter accuracy extended to a wide range of operating conditions. The model is implemented with new techniques for continuity and dispersion. These provide accurate prediction of circuit performance and also improve simulation speed.



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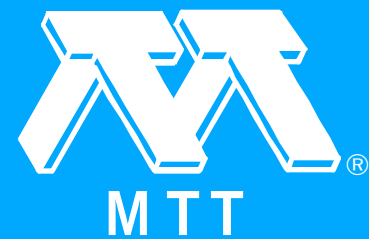


Noise and power optimization of a MMIC quasi-circulator

A. Gasmi, B. Huyart, E. Bergeault and L. Jallet. "Noise and power optimization of a MMIC quasi-circulator." 1997 Transactions on Microwave Theory and Techniques 45.9 (Sep. 1997 [T-MTT]): 1572-1577.

This paper first sums up the power and noise limits of various types of active circulators and quasi-circulators. It then presents the design and measured performances of a narrow-band quasi-circulator module tailored for use in a transmit/receive (T/R) module. Its design implements an active power divider and a combiner, a method to calculate the minimum noise figure is presented for this circuit. At 4 GHz, the device demonstrates a noise figure of 5.5 dB and an output power of 18 dBm with associated gains of 4 and 7.6 dB for the receive and transmit path, respectively. The third-order intercept point (IP3) is equal to 25.6 dBm for the transmit path.





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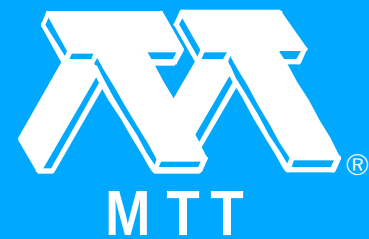
Injection-locked oscillator chain: a possible solution to millimeter-wave MMIC synthesizers (Sep. 1997 [T-MTT])

K. Kamogawa, T. Tokumitsu and M. Aikawa. "Injection-locked oscillator chain: a possible solution to millimeter-wave MMIC synthesizers (Sep. 1997 [T-MTT])." 1997 Transactions on Microwave Theory and Techniques 45.9 (Sep. 1997 [T-MTT]): 1578-1584.

An injection-locked oscillator (ILO) monolithic-microwave integrated-circuit (MMIC) chain—a cascade of low- and high-frequency-band ILOs—is proposed for simple and cost-effective millimeter-wave local oscillators and synthesizers. Primary 5, 20, and 50 GHz-band ILO MMICs are designed and fabricated as an ILO-chain chip set. Improvements made to the active combiner/dividers (A-C/D's), the heart of the MMIC, in the external feedback path for an amplifier to suppress spurs at the output port of 5 and 20 GHz band ILOs, and enhance the loop gain and layout flexibility at millimeter-wave frequencies. Fabricated 5 and 20 GHz-band ILO MMICs are chain-connected to confirm the design techniques. The ILO chain provides a 20 GHz-band output signal for an injection signal of 571 MHz, as well as a very low level of spurs of less than -45 dBc around the output signal. The measured results show that the proposed ILO chain is extremely suitable for developing full millimeter-wave MMIC frequency synthesizers.

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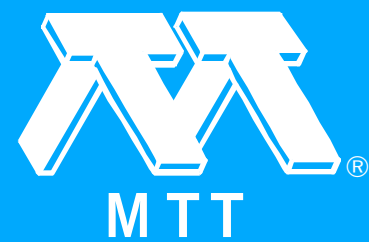
Nonresonant perturbation measurements on dispersion and interaction impedance characteristics of helical slow-wave structures

S.J. Rao, S. Ghosh, P.K. Jain and B.N. Basu. "Nonresonant perturbation measurements on dispersion and interaction impedance characteristics of helical slow-wave structures." 1997 Transactions on Microwave Theory and Techniques 45.9 (Sep. 1997 [T-MTT]): 1585-1593.

A nonresonant perturbation (NRP) theory is developed from first principles for the measurement of dispersion and interaction impedance characteristics of a helical slow-wave structure (SWS). The phase of the reflected signal from a test helical structure varies when a perturber, also in the form of a helix, is moved along the axis of the test structure. The variation of phase with perturber position is interpreted to find the phase velocity of the structure under test. The interaction impedance of the structure is found by measuring the change in the axial phase-propagation constant of the structure as a dielectric rod is placed along the axis of the structure. Measurements are carried out with the help of an automated setup using an HP 8510 vector network analyzer (VNA) and a PC to collect the phase informations for the various precisely controlled positions of the perturber using a stepper motor, which is also interfaced with the PC. The experimental and theoretical values of the phase velocity and the interaction impedance of a typical "cold" experimental helical structure for a wide-band TWT are found to be close within 0.5% and 5%, respectively, in an octave band of 8-16 GHz.

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A novel structure of tightly coupled lines for MMIC/MHMIC couplers and phase shifters

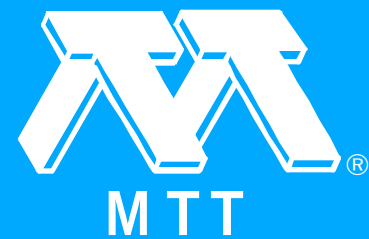
Yansheng Xu and R.G. Bosisio. "A novel structure of tightly coupled lines for MMIC/MHMIC couplers and phase shifters." 1997 Transactions on Microwave Theory and Techniques 45.9 (Sep. 1997 [T-MTT]): 1594-1599.

In this paper, a new structure of tightly coupled lines compatible with monolithic-microwave integrated-circuit/miniature hybrid-microwave integrated-circuit (MMIC/MHMIC) technology is introduced. Different from previous designs, short subsections of two or more different coupled lines are alternatively connected together to achieve the needed performance of a single-section coupler or phase shifter. Theoretical calculations are given and some typical design data are provided. A design example of a wide-band coplanar-waveguide (CPW) quadrature coupler using standard MMIC foundry technology is provided. Only metal-insulator-metal (MIM) capacitors and air-bridges are used to achieve tight coupling-no via holes are necessary. Experimental results are in good agreement with simulations. The proposed structure of coupled lines is very flexible and easily achieves very tight coupling factors.

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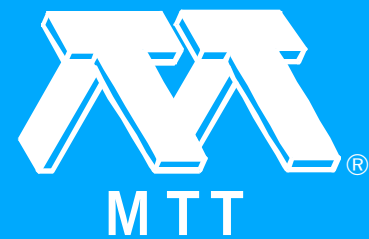
Resonant disk turnstile

R.K. Zimmerman. "Resonant disk turnstile." 1997 Transactions on Microwave Theory and Techniques 45.9 (Sep. 1997 [T-MTT]): 1600-1610.

In this paper, the resonant disk turnstile is introduced and analyzed. The disk turnstile differs from Dicke's full-waveguide turnstile in that four of the six ports are coaxial cable ports, yielding a much more compact turnstile, which is easier to construct. The disk turnstile operation is explained as a superposition of the disk TM/sub 01/ mode (nonradiating) and the disk TM/sub 11/ mode which couples directly to the circular waveguide (dominant) TE/sub 11/ mode. A useful operating fractional bandwidth of 3% is possible as compared to a Dicke turnstile bandwidth of about 6%.

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Fast and accurate analysis of waveguide filters by the coupled-integral-equations technique

S. Amari, J. Bornemann and R. Vahldieck. "Fast and accurate analysis of waveguide filters by the coupled-integral-equations technique." 1997 Transactions on Microwave Theory and Techniques 45.9 (Sep. 1997 [T-MTT]): 1611-1618.

The coupled-integral-equations technique (CIET) is successfully applied to accurately determine the frequency response of waveguide filters in a single step. A four-resonator H-plane filter is analyzed by the mode-matching technique (MMT) and the CIET for comparison and results in a reduction of central-processing-unit (CPU) time of the order of 400. A set of CIE's for the tangential electric fields at the apertures of the discontinuities are derived and solved by the moment method. Basis functions, which include the edge conditions at each of the discontinuities, are used to achieve numerical efficiency. It is shown that 1-4 basis functions, which include the edge conditions, are sufficient over a broad range of frequencies. The inclusion of the edge conditions in the basis functions is shown to have a dramatic effect on the convergence of the CIET, especially for narrow-band filters.

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Quick quasi-TEM analysis of multiconductor transmission lines with rectangular cross section

J. Bernal, F. Medina and M. Horno. "Quick quasi-TEM analysis of multiconductor transmission lines with rectangular cross section." 1997 Transactions on Microwave Theory and Techniques 45.9 (Sep. 1997 [T-MTT]): 1619-1626.

This paper presents an efficient and accurate procedure for computing the quasi-static matrix parameters ($[C]$, $[L]$, $[G]$, and $[R]$) of rectangular-shaped conductors embedded in a multilayered dielectric medium over an infinite ground plane. An additional top ground plane can also be considered. The problem is formulated in terms of the space-domain integral equation for the free-charge distribution on the slab conductor surfaces. The spatial Green's function is computed from its spectral counterpart using system identification techniques [Prony's method or matrix pencil method (MPM)]. The integral equation is solved by means of a Galerkin scheme employing entire domain basis functions. This results in a small matrix size. In addition, the quasi-analytical evaluation of the entries of the Galerkin matrix leads to a very efficient and accurate computer code. A detailed study on the convergence and accuracy of the method has been included.

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A new simultaneous noise and input power matching technique for monolithic LNA's using cascode feedback

Beom Kyu Ko and Kwyro Lee. "A new simultaneous noise and input power matching technique for monolithic LNA's using cascode feedback." 1997 Transactions on Microwave Theory and Techniques 45.9 (Sep. 1997 [T-MTT]): 1627-1629.

In this paper, a new simultaneous impedance-matching technique of Γ_{opt} (optimum noise-match source reflection coefficient) and G_{max} (maximum available power gain-match (MAPG) source reflection coefficient) using cascode feedback (CF) is proposed. A 1.57-GHz single-stage monolithic-microwave Integrated-circuit (MMIC) low-noise amplifier (LNA) designed with this technique has been fabricated using GaAs MESFET technology in order to verify the feasibility of this scheme. The measured response agrees well with the simulated performance. Extensive computer simulation shows that when silicon npn bipolar junction transistor (BJT) is used, this scheme enables us to make both Γ_{opt} and G_{max} points near to 50 Ω , in addition to the simultaneous noise and input power matching. In addition, it has all the advantages of negative feedback such as stability, wider bandwidth, and insensitivity against parameter variation.

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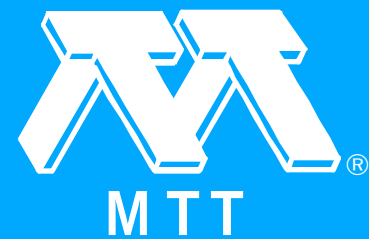


A large-signal characterization of an HEMT using a multilayered neural network

K. Shirakawa, M. Shimiz, N. Okubo and Y. Daido. "A large-signal characterization of an HEMT using a multilayered neural network." 1997 Transactions on Microwave Theory and Techniques 45.9 (Sep. 1997 [T-MTT]): 1630-1633.

We propose an approach to describe the large-signal behavior of a high electron-mobility transistor (HEMT) by using a multilayered neural network. To conveniently implement this in standard circuit simulators, we extracted the HEMT's bias dependent behavior in terms of conventional small-signal equivalent-circuit elements. We successfully represented seven intrinsic elements with a five-layered neural network (composed of 28 neurons) whose inputs are the gate-to source bias (V_{gs}) and drain-to-source bias (V_{ds}). A "well-trained" neural network shows excellent accuracy and generates good extrapolations.





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Novel microstrip-line directional filters

S. Rosloniec and T. Habib. "Novel microstrip-line directional filters." 1997 Transactions on Microwave Theory and Techniques 45.9 (Sep. 1997 [T-MTT]): 1633-1637.

This paper presents two new structures of four-port microwave directional filters incorporating microstrip-line resonators, uniplanar 180/spl deg/ phase-reversal units, and two or four identical p-i-n diodes. These filters provide substantially improved frequency characteristics compared to the conventional constructions. The unique feature of them is that they ensure high-level isolation independent of frequency between opposite ports. Due to this electrical property the proposed filters may be suitable for some pulse-radar applications.

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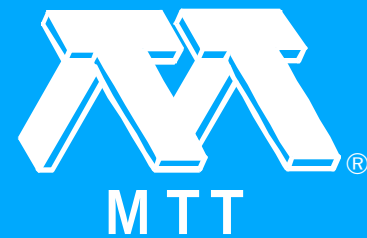


Abstracts

Radiation properties of a planar dielectric waveguide loaded with conducting-strip diffraction grating

A. Bledowski and W. Zakowicz. "Radiation properties of a planar dielectric waveguide loaded with conducting-strip diffraction grating." 1997 Transactions on Microwave Theory and Techniques 45.9 (Sep. 1997 [T-MTT]): 1637-1640.

A dielectric planar waveguide periodically loaded with conducting strips is considered as a possible antenna for millimeter-wave range. We show that separating the grating from the waveguide leads to the reduction of radiative attenuation of the waveguided radiation and substantial narrowing of the angular spread of the diffracted radiation.



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The influence of ground-plane width on the ohmic losses of coplanar waveguides with finite lateral ground planes

G. Ghione and M. Goano. "The influence of ground-plane width on the ohmic losses of coplanar waveguides with finite lateral ground planes." 1997 Transactions on Microwave Theory and Techniques 45.9 (Sep. 1997 [T-MTT]): 1640-1642.

In this paper, analytical computer-aided design (CAD)-oriented conformal-mapping approximations are presented for the high-frequency attenuation of symmetric and asymmetric coplanar waveguides (ACPWs) with finite-extent lateral ground planes. A discussion is presented on the effect of ground-plane width on the losses, and design criteria are derived.



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Do covariant projection elements really satisfy the inclusion condition?

S. Caorsi, P. Fernandes and M. Raffetto. "Do covariant projection elements really satisfy the inclusion condition?." 1997 Transactions on Microwave Theory and Techniques 45.9 (Sep. 1997 [T-MTT]): 1643-1644.

Spurious modes which often are found among finite-element solutions of electromagnetic eigenvalue problems do not occur when covariant projection elements are used. It has been claimed that this happens because covariant projection elements satisfy the inclusion condition, but they do not satisfy it-as is proven in this paper.



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FDTD analysis of dielectric resonators with curved surfaces

N. Kaneda, B. Houshmand and T. Itoh. "FDTD analysis of dielectric resonators with curved surfaces." 1997 Transactions on Microwave Theory and Techniques 45.9 (Sep. 1997 [T-MTT]): 1645-1649.

In this paper, the finite-difference time-domain (FDTD) method is applied to calculate the resonant frequency of dielectric resonators (DRs) with curved surface. The contour-path integral FDTD (CFDTD) is modified to deal with the curved surface of the dielectric body while the traditional rectangular cells are maintained. Results are compared with theoretical values and staircase approximation, and show that the present method is more accurate than the staircase approximation.

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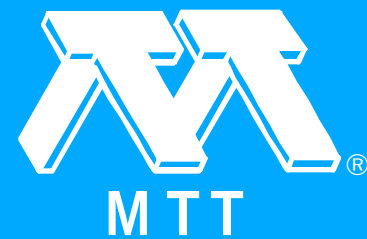


Abstracts

A pole-free modal field-matching technique for eigenvalue problems in electromagnetics

S. Amari and J. Bornemann. "A pole-free modal field-matching technique for eigenvalue problems in electromagnetics." 1997 Transactions on Microwave Theory and Techniques 45.9 (Sep. 1997 [T-MTT]): 1649-1653.

A pole-free formulation of the modal field-matching technique (MFMT) as applied to eigenvalue problems in electromagnetics is presented in this paper. The poles in the determinantal equation are systematically eliminated, without requiring previous knowledge of their locations or nature, resulting in well-behaved determinants. The minimum singular value in a singular-value decomposition of the pole-free matrix exhibits much wider dips than that obtained from the standard MFMT. The pole-free formulation is applied to determine the cutoff wavenumbers of a ridged waveguide to demonstrate its validity and efficiency.



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An application of FDTD in studying the end effects of slotline and coplanar waveguide with anisotropic substrates

J.C. Goswami and R. Mittra. "An application of FDTD in studying the end effects of slotline and coplanar waveguide with anisotropic substrates." 1997 Transactions on Microwave Theory and Techniques 45.9 (Sep. 1997 [T-MTT]): 1653-1657.

In this paper, the finite-difference time-domain (FDTD) method is applied in conjunction with the generalized pencil of function (GPOF) technique to evaluate the reflection coefficient from shorted slotlines and coplanar waveguides (CPW) on anisotropic substrates, and to extract the propagation constant along the line from these data. For each frequency, the field solutions at different locations are processed by using the GPOF technique to extract two complex exponents that correspond to the forward and backward traveling waves, which provide all the information about the reflection coefficient and the dispersion characteristic of the transmission line. The advantage of combining the GPOF technique with the FDTD method is that the reflection coefficients can be obtained with a single run. Recognizing that there is a dearth of results for the reflection coefficients of slotline and CPW-line discontinuities with anisotropic substrates, the present problem is also solved by using the spectral-domain method for the purpose of validation, and the two results are found to compare quite well with each other. For further validation, the FDTD and GPOF solutions are derived for isotropic substrates, and are compared with the published theoretical and experimental results.



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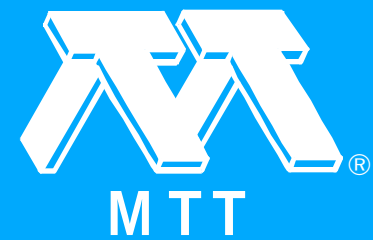
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Editorial: New Editor (Oct. 1997, Part I [T-MTT])

R.J. Trew. "Editorial: New Editor (Oct. 1997, Part I [T-MTT])." 1997 Transactions on Microwave Theory and Techniques 45.10 (Oct. 1997, Part I [T-MTT]): 1661-1661.

My term as Editor of this TRANSACTIONS is expiring and the time has come to pass the journal on to a new editor. The past three years have been very rewarding and I have gained an appreciation for the amount of work required from a large number of people to publish a quality technical journal. The process is only possible due to the dedicated and selfless efforts of a large number of highly skilled and devoted people. In particular, I want to thank the large number of reviewers who spend a significant amount of their time to ensure the high technical quality of our TRANSACTIONS.



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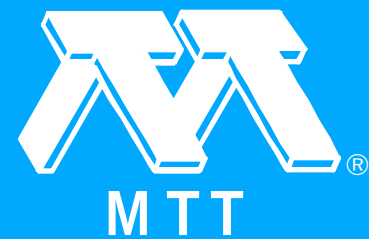


Abstracts

Systematic elaboration of trial function bases for the study of planar structures

I. Proust, B. Sauviac, J.-L. Amalric and H. Baudrand. "Systematic elaboration of trial function bases for the study of planar structures." 1997 Transactions on Microwave Theory and Techniques 45.10 (Oct. 1997, Part I [T-MTT]): 1662-1671.

This paper presents an integral method in combination with Green's functions and the boundary-element method to characterize a rectangular waveguide with electric or magnetic walls, loaded with a conductor of arbitrary cross section. The results provided by this method are in good agreement with available data in the literature. The modes of this type of waveguide are determined in the case of an arbitrarily shaped inner conductor with no consideration of size. The existence of the TEM mode has been verified. The modes calculated by this method are used as numerical basis functions in other applications. It is shown that they can be used to determine the resonant frequencies of a metallic patch or the input impedance of a planar antenna fed by a coaxial line. In this last case, the theoretical results are confronted with the experimental results.



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Mode distinction and radiation-efficiency analysis of planar leaky-wave line source

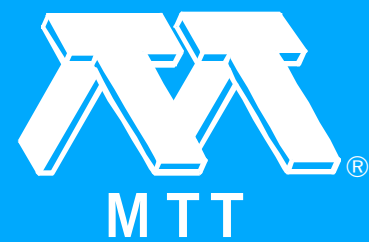
Yu-De Lin and Jyh-Wen Sheen. "Mode distinction and radiation-efficiency analysis of planar leaky-wave line source." 1997 Transactions on Microwave Theory and Techniques 45.10 (Oct. 1997, Part I [T-MTT]): 1672-1680.

Using the first microstrip-line higher order mode as an example, mode distinction and radiation efficiency of leaky-wave line sources in the radiation region are presented in this paper. The spectral-domain approach is used to calculate complex power flows, leaving the line source in the transverse directions and those guided down the line source. By observing the behavior of these complex power flows in different frequency regions, the leaky-wave line source can be distinguished into the antenna mode and the reactive mode in the radiation region.

Experimental results are shown to confirm this mode distinction. Moreover, by comparing the power carried away by the surface and the space waves, radiation efficiency of the first microstrip-line higher order mode of various structural parameters is analyzed. The microstrip line is more efficient as a leaky-wave line source when its substrate is thin, the dielectric constant of the substrate is low, and the antenna main beam is away from the end-fire direction.

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LIGA micromachined planar transmission lines and filters

T.L. Willke and S.S. Gearhart. "LIGA micromachined planar transmission lines and filters." 1997 Transactions on Microwave Theory and Techniques 45.10 (Oct. 1997, Part I [T-MTT]): 1681-1688.

This paper introduces a new class of three-dimensional (3-D) micromachined microwave and millimeter-wave planar transmission lines and filters. The LIGA process allows tall (10 /spl mu/m-1 mm), high-aspect ratio metal structures to be very accurately patterned and is compatible with integrated circuit-fabrication processes. The tall metal transmission lines will enable the development of high-power monolithic circuits as well as couplers and filters that require very high coupling. Using conductor thickness as a new variable in filter design permits the fabrication of elements requiring a wider than usual range of even- and odd-mode characteristic impedances by lowering the attainable odd-mode impedance without greatly influencing even-mode impedance. Bandpass and low-pass filters fabricated using 200-/spl mu/m tall nickel microstrip lines are demonstrated at X-band. Insertion losses of the network testing setup and waveguides were calibrated out using the thru-reflection-line (TRL) calibration method via LIGA-fabricated calibration standards. The high aspect ratio and slope that the LIGA process offers will enable the design of end-coupled narrow-band bandpass filters and planar side-coupled 3-dB couplers. Filter structures were fabricated possessing coupling gaps with aspect ratios of better than 6.75 and conductor sidewall slope >89.9/spl deg/, figures that are easily obtainable with the LIGA process. Additionally, W-band 3-dB coplanar waveguide-coupler LIGA geometries suitable for implementation on gallium arsenide or membrane (i.e., air dielectric) substrates are presented. A thin film-to-LIGA tapered waveguide transition is presented which will allow integration of conventional planar transmission lines with these LIGA devices.

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Study of the ridge-loaded helical-groove slow-wave structure

Wenxiang Wang, Guofen Yu and Yanyu Wei. "Study of the ridge-loaded helical-groove slow-wave structure." 1997 Transactions on Microwave Theory and Techniques 45.10 (Oct. 1997, Part I [T-MTT]): 1689-1695.

The proposition to name the helical waveguide with the inner wall removed helical groove is presented in this paper. As an all-metal slow-wave circuit, the ridge-loaded helical-groove structure is especially suited for use in millimeter TWT's due to its advantages of large size, high manufacturing precision, and good heat dissipation. However, the analysis of this slow-wave circuit was never before done. For analyzing this structure, the cylindrical coordinates are employed in the center space and the helical ones are used in the gap and groove regions. Making use of the matching conditions of the RF fields and the continuity of the voltage and current at the boundaries, the expressions for the dispersion and the coupling impedance of the ridge-loaded helical groove are obtained. The relationship of the dispersion and impedance to the ridge dimensions are also given. It is indicated from the calculation results that approximately 30% bandwidth for this structure can be achieved.

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Abstracts

Device and circuit-level modeling using neural networks with faster training based on network sparsity

A.H. Zaabab, Qi-Jun Zhang and M.S. Nakhla. "Device and circuit-level modeling using neural networks with faster training based on network sparsity." 1997 Transactions on Microwave Theory and Techniques 45.10 (Oct. 1997, Part I [T-MTT]): 1696-1704.

Recently, circuit analysis and optimization featuring neural-network models have been proposed, reducing the computational time during optimization while keeping the accuracy of physics-based models. We present a novel approach for fast training of such neural-network models based on the sparse matrix concept. The new training technique does not require any structure change in neural networks, but makes use of the inherent nature of neural networks that for each pattern some neuron activations are close to zero, and hence, have no effect on network outputs and weights update. Much of the computation effort is saved over standard training techniques, while achieving the same accuracy. FET device and VLSI interconnect modeling examples verified the proposed technique.



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A 1.4-2.7-GHz analog MMIC vector modulator for a crossbar beamforming network

J. Grajal, J. Gismero, M. Mahfoudi and F.A. Petz. "A 1.4-2.7-GHz analog MMIC vector modulator for a crossbar beamforming network." 1997 Transactions on Microwave Theory and Techniques 45.10 (Oct. 1997, Part I [T-MTT]): 1705-1714.

The design and performance of a monolithic 1.4-2.7-GHz vector modulator with analog amplitude and phase control are presented in this paper. A full 360/spl deg/ coverage range and a dynamic range greater than 13 dB is achieved by combining two out of three vectors 120/spl deg/ apart with variable amplitude. Amplitude control is performed by three sets of quasi-dual-gate MESFETs (two single-gate MESFETs in cascade) while the 120/spl deg/ shift among the vectors is achieved through LC filters covering the 1.4-2.7-GHz band. Since the active devices throughout the circuit are not working in saturation, large-signal models must be used in the simulations. The circuit is used as the matrix node element in an analog crossbar beamforming network (CBFN) and as the general-purpose wide-band vector modulator device.

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Efficient hybrid TLM/mode-matching analysis of packaged components

M. Righi, J.L. Herring and W.J.R. Hoefer. "Efficient hybrid TLM/mode-matching analysis of packaged components." 1997 Transactions on Microwave Theory and Techniques 45.10 (Oct. 1997, Part I [T-MTT]): 1715-1724.

A combination of the transmission-line matrix (TLM) method and time-domain mode-matching method is proposed. The resulting hybrid algorithm takes full advantage of time-domain methods for regions with highly complex geometries while exploiting the efficiency of analytical formulations for the more regular regions. The computational aspects and the errors involved in the procedure are investigated. The approach is demonstrated with the analysis of a packaged microstrip line containing a via-hole, and results are compared with independent measurements. While the planar circuit is discretized by a TLM mesh, the field in the package is decomposed into modal fields. The two sub-domains are joined by modal diakoptics. Thus, we obtain not only a significant reduction in computer time and memory, but also gain new physical insight into the physics of package resonance.

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Coplanar stripline components for high-frequency applications

K. Goverdhanam, R.N. Simons and L.P.B. Katehi. "Coplanar stripline components for high-frequency applications." 1997 Transactions on Microwave Theory and Techniques 45.10 (Oct. 1997, Part I [T-MTT]): 1725-1729.

In this paper, coplanar stripline (CPS) discontinuities such as a narrow transverse slit, a symmetric step, a right-angle bend, and a T-junction are characterized and their performance is parameterized with respect to frequency and geometry. In addition, filter design using coplanar stripline discontinuities has been investigated. Lumped equivalent circuits are presented for some of the discontinuities. The element values are obtained from the measured discontinuity scattering parameters. The experimental results are compared with theoretical data obtained using the finite-difference time-domain (FDTD) technique for validation and show very good agreement.

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Complex dielectric measurements and analysis of brain tissues in the radio and microwave frequencies

Jian-Zhong Bao, Shin-Tsu Lu and W.D. Hurt. "Complex dielectric measurements and analysis of brain tissues in the radio and microwave frequencies." 1997 Transactions on Microwave Theory and Techniques 45.10 (Oct. 1997, Part I [T-MTT]): 1730-1741.

We present in-vitro complex dielectric measurements of gray and white matter of rat brains in the frequency range between 45 MHz and 26.5 GHz at body and room temperatures using the open-ended coaxial probe technique with an HP8510B network analyzer. The measurement data exhibited two separated dispersions, and were analyzed by means of a complex nonlinear least-squares technique. We suggest two empirical models to describe the experimental data: one containing two Cole-Cole functions was applied to the data from this paper, and another including one Havriliak-Negami and one Cole-Cole function was utilized to a combination of past and present literature data in a wider frequency range from 100 kHz to 26.5 GHz. The adoption of previously published data at the frequencies below 45 MHz increases the valid frequency range of the model.

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Integrated active antenna with full duplex operation

M.J. Cryan, P.S. Hall, S.H. Tsang and Jizhang Sha. "Integrated active antenna with full duplex operation." 1997 Transactions on Microwave Theory and Techniques 45.10 (Oct. 1997, Part I [T-MTT]): 1742-1748.

This paper discusses the design and implementation of a novel two-element active transmit-receive array using dual linear polarization and sequential rotation. Each element includes an integrated oscillator and amplifier mounted on orthogonal edges of a square patch, such that the transmit and receive paths are isolated and polarization duplexed. The array gives in excess of 45-dB transmit-receive isolation with an output power of 5.4 dBm and a receive gain of 8.2 dB at 4.05 GHz. Link budget calculations are used to show expected system performances. These active antennas have potential uses in both short-range communication and radar systems.

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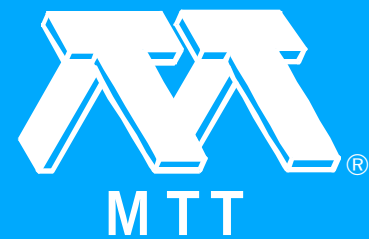
Absorbing-boundary conditions using perfectly matched-layer (PML) technique for three-dimensional TLM simulations

N. Pena and M.M. Ney. "Absorbing-boundary conditions using perfectly matched-layer (PML) technique for three-dimensional TLM simulations." 1997 Transactions on Microwave Theory and Techniques 45.10 (Oct. 1997, Part I [T-MTT]): 1749-1755.

This paper describes the algorithm that interfaces the three-dimensional (3-D) transmission-line matrix (TLM) with an absorbing-boundary condition (ABC) based on the perfectly matched-layer (PML) approach. The algorithm uses a coupling between the TLM symmetrical condensed node (SCN) network and a finite-difference approximation of the PML equations. Examples are presented in scattering problems and S-parameter characterization of discontinuities. Excellent results are found even with absorbing walls located in the region of evanescent waves. Absorption performances obtained are significantly superior to ABC's based on the one-way equation approach and currently used for TLM simulations. Finally, it is found that for all tested situations, the algorithm is numerically stable.

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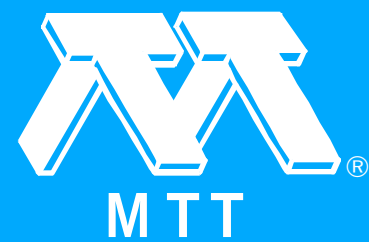
A method-of-moments study of strip dipole antennas in rectangular waveguide

A.R. Adams, R.D. Pollard and C.M. Snowden. "A method-of-moments study of strip dipole antennas in rectangular waveguide." 1997 Transactions on Microwave Theory and Techniques 45.10 (Oct. 1997, Part I [T-MTT]): 1756-1766.

A theoretical and experimental study of strip dipole antennas located on a supporting dielectric slab mounted transversely in rectangular waveguide is presented. Galerkin's method is used in the full-wave solution of an integral equation for each antenna's surface-current density using the Green's function for the slab-loaded waveguide. The paper is motivated by the need for multiport-network models to aid the development of multiple-device power-combining circuits in rectangular waveguide. The design data presented here for single antennas should prove useful for planar-mixer and oscillator circuits. The presence of slab modes is noted and the slab-mode resonant frequencies are predicted. Validation of the numerical models is provided by scattering experiments on shorted antennas, and excellent agreement is obtained in the range of 8.0-12.5 GHz.

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Resonant frequencies and field distributions for the shielded uniaxially anisotropic dielectric resonator by the FD-SIC method

Jenn-Ming Guan and Ching-Chuan Su. "Resonant frequencies and field distributions for the shielded uniaxially anisotropic dielectric resonator by the FD-SIC method." 1997 Transactions on Microwave Theory and Techniques 45.10 (Oct. 1997, Part I [T-MTT]): 1767-1777.

New formulations for resonant modes of a shielded uniaxially anisotropic dielectric resonator (DR), such as sapphire, are proposed. They are solved by the finite-difference and simultaneous iteration with the Chebyshev (FD-SIC) acceleration method. Like an isotropic DR cavity, one azimuthal field is used for azimuthally invariant TM or TE modes and two TM fields are used for azimuthally variant hybrid modes. It is shown that the governing equation for TE modes is the same as that for the isotropic DR case. For TM and hybrid modes, more general $\psi(r, \phi, z)$ and $H(r, \phi, z)$ formulations than those for the isotropic DR are derived, respectively. Cylindrical cavities loaded with a rod or ring DR can be easily modeled and analyzed by the present method. Resonant frequencies and field distributions can be accurately and efficiently obtained. Numerical results of resonant frequencies of rod sapphire DR cavities are compared to those by the mode-matching method in the literature to verify the present approach. The electric- and magnetic-field distributions are also presented for hybrid modes of the uniaxially anisotropic DR cavity.

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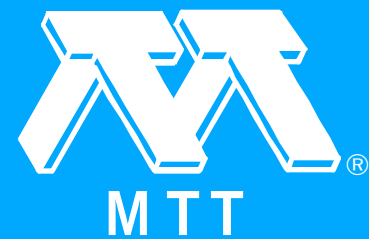
Analysis of the suspended strip in elliptical cross section by separation of variables

T. Rozzi, L. Pierantoni and M. Ronzitti. "Analysis of the suspended strip in elliptical cross section by separation of variables." 1997 Transactions on Microwave Theory and Techniques 45.10 (Oct. 1997, Part I [T-MTT]): 1778-1784.

The coaxial suspended strip configuration in elliptical cross section is often found in transitions from ordinary coax to planar circuits and other geometries. Using elliptical coordinates makes the problem separable, leading to closed-form solutions for the fundamental TEM mode and the TE/TM higher modes. It is emphasized that the presence of the thin strip is dealt with analytically by this approach. Mode patterns and TEM characteristic impedance are reported. The cutoff frequencies versus eccentricity are computed for the first eight modes.

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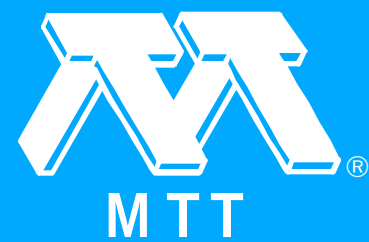
Optimum termination networks for tightly coupled microstrip lines under random and deterministic excitations

S. Amari and J. Bornemann. "Optimum termination networks for tightly coupled microstrip lines under random and deterministic excitations." 1997 Transactions on Microwave Theory and Techniques 45.10 (Oct. 1997, Part I [T-MTT]): 1785-1789.

A general method to determine the termination network of multiple coupled lines for lowest input return loss is presented. Each line is connected to the ground and its nearest neighbors by resistors whose values are determined by minimizing the reflected power. It is demonstrated that under these conditions the optimum termination network depends on the excitation. The inequality of the modal propagation constants requires that the length of the lines be properly taken into account when designing a termination network which ensures maximum power delivery to the loads. Matching networks for five and seven coupled transmission lines under different excitations are presented. For the more practical case of unknown excitations, a design procedure based on minimizing the reflected power for independent random-incident voltage variables is presented.

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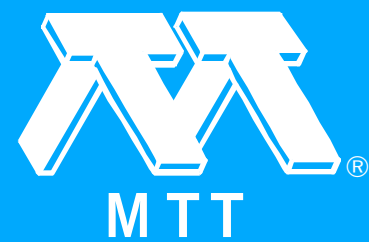
An FD-FD formulation for the analysis of the optical axis misalignment effect on propagation characteristics of anisotropic dielectric waveguides

C.L. da S.S. Sobrinho and A.J. Giarola. "An FD-FD formulation for the analysis of the optical axis misalignment effect on propagation characteristics of anisotropic dielectric waveguides." 1997 Transactions on Microwave Theory and Techniques 45.10 (Oct. 1997, Part I [T-MTT]): 1789-1792.

A finite-difference frequency-domain (FD-FD) formulation is developed to study the dispersion characteristics of anisotropic dielectric waveguides with their optical axes not aligned with the coordinate-system axes. In this analysis, the optical axes are initially assumed to be aligned with the coordinate-system axes such that the electric-permittivity and magnetic-permeability tensors are diagonal. The optical axes of the anisotropic dielectric are then rotated an angle θ (or ϕ) with respect to the coordinate-system axes. While the FD-FD formulation developed is general, it is applied here only to waveguides containing uniaxial anisotropic dielectrics. The results show that accurate optical-axis orientation is important in the design of dielectric waveguides.

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Scattering by an infinite elliptic dielectric cylinder coating eccentrically a circular metallic or dielectric cylinder

S.P. Savaidis and J.A. Roumeliotis. "Scattering by an infinite elliptic dielectric cylinder coating eccentrically a circular metallic or dielectric cylinder." 1997 Transactions on Microwave Theory and Techniques 45.10 (Oct. 1997, Part I [T-MTT]): 1792-1800.

In this paper, the scattering of a plane electromagnetic wave by an infinite elliptic dielectric cylinder, coating eccentrically a circular metallic or dielectric inner cylinder, is treated. The electromagnetic field is expressed in terms of both circular and elliptical-cylindrical wave functions, which are connected with one another by well-known expansion formulas.

Translational addition theorems for circular cylindrical wave functions are also used. If the solution is specialized to small values of $h=k_{\text{sub } 2}/c/2$, where $k_{\text{sub } 2}$ is the wavenumber of the elliptic dielectric cylinder and c its interfocal distance, semianalytical expressions of the form $S(h)=S(0)[1+gh/\text{sup } 2/+O(h/\text{sup } 4/)]$ are obtained for the scattered field and the various scattering cross sections of this configuration. The coefficients g are independent of h . Both polarizations are considered for normal incidence. Graphical results for the scattering cross sections are given for various values of the parameters.



Enhancements of the spectral-domain approach for analysis of microstrip Y-junction

B.L. Ooi, M.S. Leong, P.S. Kooi and T.S. Yeo. "Enhancements of the spectral-domain approach for analysis of microstrip Y-junction." 1997 Transactions on Microwave Theory and Techniques 45.10 (Oct. 1997, Part I [T-MTT]): 1800-1805.

Some enhancements of the spectral-domain approach in the polar coordinate are described. A simple and efficient algorithm is devised to numerically evaluate the contribution of the oscillatory tail of the two-dimensional (2-D) Sommerfeld integral. For the first time, four new vectorized basis functions are proposed. Good agreement is obtained between the simulated results and the measured data for a microstrip Y-junction in the 4-12 GHz range.



Abstracts

Analyticity of electromagnetic fields in regions characterized by analytic dielectric parameters and analytic sources

S. Caorsi and M. Raffetto. "Analyticity of electromagnetic fields in regions characterized by analytic dielectric parameters and analytic sources." 1997 Transactions on Microwave Theory and Techniques 45.10 (Oct. 1997, Part I [T-MTT]): 1805-1807.

In this paper, the analyticity of time-harmonic electromagnetic fields in regions characterized by analytic dielectric parameters and analytic sources is proven.



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Effect of finite metallization and inhomogeneous dopings on slow-wave-mode propagation

J.J. Kucera and R.J. Gutmann. "Effect of finite metallization and inhomogeneous dopings on slow-wave-mode propagation." 1997 Transactions on Microwave Theory and Techniques 45.10 (Oct. 1997, Part I [T-MTT]): 1807-1810.

A finite-element simulation has been implemented to evaluate the slow-wave-mode propagation characteristics in metal-insulator-semiconductor (MIS) waveguiding structures. Particular emphasis has been placed on coplanar waveguides compatible with silicon integrated circuits (ICs), with an objective of evaluating the effect of inhomogeneous doping on propagation characteristics. The simulator has been successfully benchmarked against a number of cases presented in the literature, including MIS coplanar waveguides. The effect of inhomogeneous doping and finite metallization in maintaining a large slowing factor while reducing the attenuation constant and increasing transmission-line Q is presented, and constraints on slow-wave-mode passive components are discussed.

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Abstracts

Optical Generation of a Megahertz-Linewidth Microwave Signal Using Semiconductor Lasers and a Discriminator-Aided Phase-Locked Loop (Corrections)

Z.F. Fan and M. Dagenais. "Optical Generation of a Megahertz-Linewidth Microwave Signal Using Semiconductor Lasers and a Discriminator-Aided Phase-Locked Loop (Corrections)." 1997 Transactions on Microwave Theory and Techniques 45.10 (Oct. 1997, Part I [T-MTT]): 1811-1811.

In the above paper, the title was published incorrectly. The correct title should read: "Optical Generation of a mHz-Linewidth Microwave Signal Using Semiconductor Lasers and a Discriminator-Aided Phase-Locked Loop".



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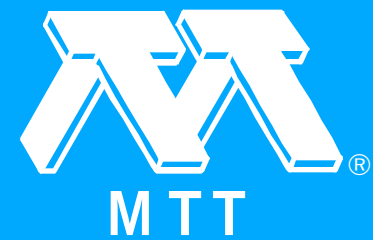
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"Inside Cover (Oct. 1997, Part II [T-MTT])." 1997 Transactions on Microwave Theory and Techniques 45.10 (Oct. 1997, Part II [T-MTT] (Special Issue on Interconnects and Packaging)): 0_3-0_4.



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Guest Editorial (Oct. 1997, Part I [T-MTT])

V.K. Tripathi and R. Sturdivant. "Guest Editorial (Oct. 1997, Part I [T-MTT])." 1997 Transactions on Microwave Theory and Techniques 45.10 (Oct. 1997, Part II [T-MTT] (Special Issue on Interconnects and Packaging)): 1817-1818.

With the advancements in RFIC, MMIC, and VLSI technologies, packaging of the resultant high-speed digital, RF and microwave, and millimeter-wave integrated circuits and systems in a cost-effective and high-performance manner has become a major challenge. The convergence of modern communication and computer technologies and the startling growth of corresponding high-frequency commercial electronics has brought new demands for increased performance with simultaneous decreases in cost and size on both integrated circuits and packaging and interconnect technologies.



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Abstracts

MCM packaging for present- and next-generation high clock-rate digital- and mixed-signal electronic systems: areas for development

B.K. Gilbert and Guang-Wen Pan. "MCM packaging for present- and next-generation high clock-rate digital- and mixed-signal electronic systems: areas for development." 1997 Transactions on Microwave Theory and Techniques 45.10 (Oct. 1997, Part II [T-MTT] (Special Issue on Interconnects and Packaging)): 1819-1835.

This paper will review the manner in which electronic packaging will be driven by the high-level performance requirements of next-generation mixed-signal systems, and by the evolving characteristics of next-generation integrated circuits. Present performance and fabrication limitations of the multichip module (MCM) technology will be discussed, as well as possible approaches to remove or minimize these constraints. Areas fruitful for research by the simulation community will be noted. This review is intended to provide a broad applications-oriented framework for the theoretical and simulation-directed papers in this special issue on interconnect and packaging.



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When are transmission-line effects important for on-chip interconnections?

A. Deutsch, G.V. Kopcsay, P.J. Restle, H.H. Smith, G. Katopis, W.D. Becker, P.W. Coteus, C.W. Surovic, B.J. Rubin, R.P. Dunne, T. Gallo, K.A. Jenkins, L.M. Terman, R.H. Dennard, G.A. Sai-Halasz, B.L. Krauter and D.R. Knebel. "When are transmission-line effects important for on-chip interconnections?." 1997 Transactions on Microwave Theory and Techniques 45.10 (Oct. 1997, Part II [T-MTT] (Special Issue on Interconnects and Packaging)): 1836-1846.

Short, medium, and long on-chip interconnections having linewidths of 0.45-52 μm are analyzed in a five-metal-layer structure. We study capacitive coupling for short lines, inductive coupling for medium-length lines, inductance and resistance of the current return path in the power buses, and line resistive losses for the global wiring. Design guidelines and technology changes are proposed to achieve minimum delay and contain crosstalk for local and global wiring. Conditional expressions are given to determine when transmission-line effects are important for accurate delay and crosstalk prediction.

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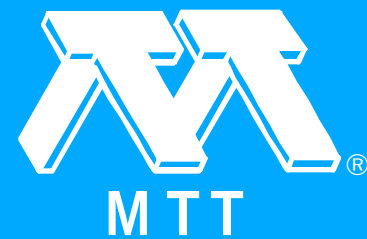


Abstracts

Application of system-level EM modeling to high-speed digital IC packages and PCBs

Jong-Gwan Yook, L.P.B. Katehi, K.A. Sakallah, R.S. Martin, L. Huang and T.A. Schreyer.
"Application of system-level EM modeling to high-speed digital IC packages and PCBs." 1997
Transactions on Microwave Theory and Techniques 45.10 (Oct. 1997, Part II [T-MTT] (Special Issue on Interconnects and Packaging)): 1847-1856.

A system-level electromagnetic (EM) modeling tool combining a three-dimensional (3-D) full-wave finite-element EM-field analysis tool and a time-domain electric-circuit simulator is developed and applied to various geometries such as multilayer printed circuit boards (PCBs), signal lines embedded in a PCB or package, and split power-distribution network. Since the signal integrity is a primary concern of high-speed digital circuits, the noise distributions on various circuit planes are evaluated from the analysis. These noise distributions, often called voice maps, are utilized to identify the location of the major source of simultaneous switching noise (SSN). This information can eventually be adapted for optimum placement of decoupling capacitors to minimize the noise fluctuations on the various circuit planes on an entire PCB.



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An all-purpose transmission-line model for interconnect simulation in SPICE

M. Celik, A.C. Cangellaris and A. Yaghmour. "An all-purpose transmission-line model for interconnect simulation in SPICE." 1997 Transactions on Microwave Theory and Techniques 45.10 (Oct. 1997, Part II [T-MTT] (Special Issue on Interconnects and Packaging)): 1857-1867.

A new all-purpose multiconductor transmission-line model is described for efficient and robust interconnect simulation using nonlinear circuit simulators such as SPICE. All types of interconnects, i.e., uniform, nonuniform, lossless, lossy/dispersive, can be handled by the proposed model. Furthermore, coupling of electromagnetic radiation to interconnects can be directly modeled without the need for developing a new subcircuit. Another advantage of the proposed model is that it enables sensitivity analysis with respect to both circuit and interconnect parameters, thus facilitating interconnect circuit optimization. Chebyshev expansions for the spatial variations of the interconnect voltages and currents are used to effect highly accurate numerical approximations of the Telegrapher's equations using as small a number of degrees of freedom as possible. A simple rule of thumb is provided for the selection of the order of the approximation given the frequency bandwidth of interest. Numerical examples are presented to demonstrate the validity of the proposed model and illustrate its application to a variety of interconnect-induced noise interactions in high-speed electronic systems.

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The finite-element method for modeling circuits and interconnects for electronic packaging

A.C. Polycarpou, P.A. Tirkas and C.A. Balanis. "The finite-element method for modeling circuits and interconnects for electronic packaging." 1997 Transactions on Microwave Theory and Techniques 45.10 (Oct. 1997, Part II [T-MTT] (Special Issue on Interconnects and Packaging)): 1868-1874.

A full-wave finite-element method (FEM) is formulated and applied in the analysis of practical electronic packaging circuits and interconnects. The method is used to calculate S-parameters of unshielded microwave components such as patch antennas, filters, spiral inductors, bridges, bond wires, and microstrip transitions through a via. Although only representative microwave passive circuits and interconnects are analyzed in this paper, the underlined formulation is applicable to structures of arbitrary geometrical complexities including microstrip and coplanar-waveguide transitions, multiple conducting vias and solder bumps, multiple striplines, and multilayer substrates. The accuracy of the finite-element formulation is extensively verified by calculating the respective S-parameters and comparing them with results obtained using the finite-difference time-domain (FDTD) method. Computational statistics for both methods are also discussed.

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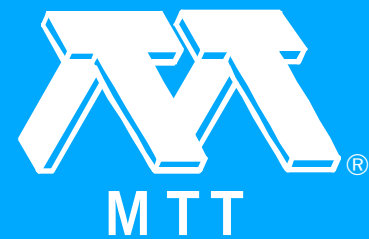


Abstracts

Rigorous and simplified models for the capacitance of a circularly symmetric via

A.W. Mathis, A.F. Peterson and C.M. Butler. "Rigorous and simplified models for the capacitance of a circularly symmetric via." 1997 Transactions on Microwave Theory and Techniques 45.10 (Oct. 1997, Part II [T-MTT] (Special Issue on Interconnects and Packaging)): 1875-1878.

An integral-equation method is presented for analyzing the capacitance of circularly symmetric vias with thick conductors and conical posts. From the numerical data, simple expressions are derived which account for the effect of conductor thickness and cone angle. Use of the approximate expressions allows one to accurately determine via capacitance while using a simpler thin-conductor straight-post via model.



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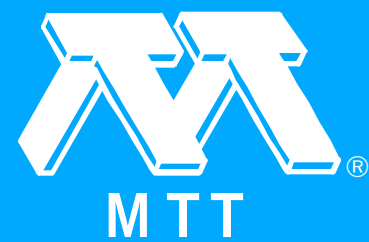
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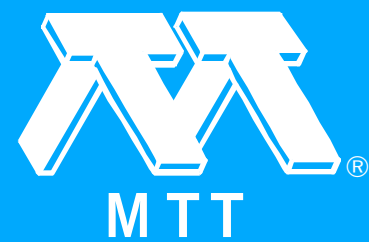
Low-profile enhanced-bandwidth PIFA antennas for wireless communications packaging

K.L. Virga and Y. Rahmat-Samii. "Low-profile enhanced-bandwidth PIFA antennas for wireless communications packaging." 1997 Transactions on Microwave Theory and Techniques 45.10 (Oct. 1997, Part II [T-MTT] (Special Issue on Interconnects and Packaging)): 1879-1888.

The development of small integrated antennas plays a significant role in the progress of the rapidly expanding military and commercial communications applications. The recent advances in RF and microwave high-density circuit packaging technologies in multifunction wireless communications systems have called for the parallel development of compact and efficient antennas that can be used over a wide frequency range. This paper addresses the development and characterization of several low-profile and integrated antennas with enhanced bandwidth for wireless communications systems. The new radiators are developed by adding parasitic elements or tuning devices to a familiar integrated antenna-the planar inverted F antenna (PIFA). Simulations based upon the finite-difference time-domain (FDTD) method and method of moments (MoM) are used to model the performance of the antennas. Comparisons with measured results on fabricated antenna structures are provided for simulations validation.

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Hybrid electromagnetic modeling of noise interactions in packaged electronics based on the partial-element equivalent-circuit formulation

W. Pinello, A.C. Cangellaris and A. Ruehli. "Hybrid electromagnetic modeling of noise interactions in packaged electronics based on the partial-element equivalent-circuit formulation." 1997 Transactions on Microwave Theory and Techniques 45.10 (Oct. 1997, Part II [T-MTT] (Special Issue on Interconnects and Packaging)): 1889-1896.

The partial-element equivalent-circuit (PEEC) method is used to develop a flexible, hierarchical electromagnetic modeling and simulation environment for the analysis of noise generation and signal degradation mechanisms in packaged electronic components and systems. The circuit-oriented approach used by the method for the development of the numerical approximation of the electric-field integral equation leads to SPICE-compatible, yet fully dynamic, discrete approximation of the electromagnetic problem. Contrary to other full-wave formulations, the proposed method has the important attribute of lending itself to a very systematic and physical model complexity reduction on the basis of the electrical size of the various portions of the system. Thus, a hybrid electromagnetic modeling and simulation environment is established for the analysis of complex structures which exhibit large variation in electrical size over their volume, using a combination of lumped-circuit elements, transmission lines, as well as three-dimensional (3-D) distributed electromagnetic models. These models may or may not account for retardation, depending on the electrical size of the part of the structure that is being modeled. These special attributes of the proposed electromagnetic-simulation environment are demonstrated through several examples from its application to the modeling of noise interactions in generic interconnect and package geometries.

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High-frequency circuit modeling of large pin count packages

S. Sercu and L. Martens. "High-frequency circuit modeling of large pin count packages." 1997 Transactions on Microwave Theory and Techniques 45.10 (Oct. 1997, Part II [T-MTT] (Special Issue on Interconnects and Packaging)): 1897-1904.

In this paper, a technique is presented for the high-frequency circuit modeling of coupled conductor structures. The method is, in particular, very useful for the modeling of structures with a varying signal/ground configuration. Structures with a large number of conductors ($N+1$, $N>100$) are also easy to model, as the method reduces the modeling of the $2N$ -port to the modeling of two- and four-port structures. Two- and four-port structures are much easier to model since their equivalent circuit model has fewer parameter values. Examples of multiconductor structures are high-density connectors and large pin count electronic packages. The model accurately simulates the electrical properties, such as reflection and transmission of all conductors, and the backward and forward crosstalk to all other conductors.

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Abstracts

Time-domain characterization of packaging effects via segmentation technique

M. Righi, G. Tardioli, L. Cascio and W.J.R. Hoefer. "Time-domain characterization of packaging effects via segmentation technique." 1997 Transactions on Microwave Theory and Techniques 45.10 (Oct. 1997, Part II [T-MTT] (Special Issue on Interconnects and Packaging)): 1905-1910.

The analysis of a monolithic microwave integrated circuit (MMIC) placed in a surface-mount plastic package is presented. Critical issues such as poor grounding conditions and crosstalk are addressed and discussed. The significance of a full-wave characterization of the component is shown. Results are validated with data available in the literature showing good agreement. A segmentation approach is also proposed to efficiently analyze the problem. The package effects are extracted and can be combined with MMIC parameters at the design stage to predict the performance of the packaged circuit.



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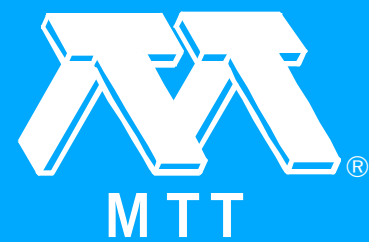
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An FDTD-Touchstone hybrid technique for equivalent circuit modeling of SOP electronic packages

Yinchao Chen, P. Harms, R. Mittra and W.T. Beyene. "An FDTD-Touchstone hybrid technique for equivalent circuit modeling of SOP electronic packages." 1997 Transactions on Microwave Theory and Techniques 45.10 (Oct. 1997, Part II [T-MTT] (Special Issue on Interconnects and Packaging)): 1911-1918.

The electromagnetic-field behavior within electronic packages used for high-speed digital-circuit or high-frequency analog-circuit applications often cannot be accurately modeled by using a quasi-static approximation, and a frequency-dependent analysis is sometimes needed for accurate modeling. In this paper, we employ the finite-difference time-domain (FDTD) approach, in conjunction with the commercially available software called Touchstone, to model the generic 24-pin silicon on plastic (SOP) package. The model for the package includes many details, such as the plastic encasement, bonding pads, and wires. The frequency responses of the package are tested against the results obtained with only the FDTD algorithm. It is shown that by extracting the equivalent-circuit elements from the field data, the hybrid FDTD-Touchstone technique allows greater flexibility in deriving a circuit configuration at the expense of fine tuning the circuit to reproduce the response of the package. It is hoped that the technique presented in this paper will lead to more accurate circuit simulations of complex packaging configurations than has been possible up to this point, by using quasi-static analyses.

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Abstracts

Modeling millimeter-wave IC behavior for flipped-chip mounting schemes

R.W. Jackson and R. Ito. "Modeling millimeter-wave IC behavior for flipped-chip mounting schemes." 1997 Transactions on Microwave Theory and Techniques 45.10 (Oct. 1997, Part II [T-MTT] (Special Issue on Interconnects and Packaging)): 1919-1925.

A circuit topology is presented for modeling flipped-chip-mounted monolithic microwave integrated circuits (MMIC's) at microwave frequencies. The proposed topology especially models the loss of isolation due to the flipped-chip structure. Both coplanar and microstrip flipped chips are circuit modeled and their results compared to full numerical simulations and to scale-model measurements. Both measurements and numerical modeling show resonances in the millimeter-wave range.



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Abstracts

Microwave-circuit modeling of high lead-count plastic packages

R.W. Jackson and S. Rakshit. "Microwave-circuit modeling of high lead-count plastic packages." 1997 Transactions on Microwave Theory and Techniques 45.10 (Oct. 1997, Part II [T-MTT] (Special Issue on Interconnects and Packaging)): 1926-1933.

A microwave-circuit model topology for elevated-paddle surface-mount packages is extended to packages with high-lead counts. Features such as irregular lead structures, long wirebonds, smaller pitches, and finite-lead thickness are all examined. The modeling technique is applied to a shrink small-outline package (SSOP-24) with the results compared to measurements of a 25 times size scale model. The circuit model is used to investigate the performance of a matched transition.



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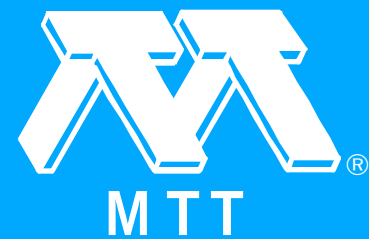
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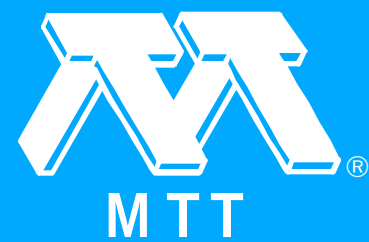
Automatic netlist extraction for measurement-based characterization of off-chip interconnect

S.D. Corey and A.T. Yang. "Automatic netlist extraction for measurement-based characterization of off-chip interconnect." 1997 Transactions on Microwave Theory and Techniques 45.10 (Oct. 1997, Part II [T-MTT] (Special Issue on Interconnects and Packaging)): 1934-1940.

An approach is presented for modeling board-level, package-level, and multichip module (MCM) substrate-level interconnect circuitry based on measured time-domain reflectometry (TDR) data. The time-domain scattering parameters of a multiport system are used to extract a SPICE netlist from standard elements to match the behavior of the device up to a user-specified cutoff frequency. Linear or nonlinear circuits may be connected to the model ports, and the entire circuit simulated in a standard circuit simulator. Two- and four-port microstrip-circuit examples are characterized, and the simulation results are compared with measured data. Delay, reflection, transmission, and crosstalk are accurately modeled in each case.

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Accurate frequency-domain modeling and efficient circuit simulation of high-speed packaging interconnects

W.T. Beyene and J.E. Schutt-Aine. "Accurate frequency-domain modeling and efficient circuit simulation of high-speed packaging interconnects." 1997 Transactions on Microwave Theory and Techniques 45.10 (Oct. 1997, Part II [T-MTT] (Special Issue on Interconnects and Packaging)): 1941-1947.

The paper describes an efficient frequency-domain modeling and simulation method of a coupled interconnect system using scattering parameters. First, low-order rational approximations of the multiport scattering parameters are derived over a wide frequency range using a robust interpolation technique. The method applies frequency normalization, shift, and Householder QR orthogonalization to improve the stability and the accuracy when solving the resulting systems of equations. For interconnects characterized with frequency-dependent parasitic parameters, the order of the rational of approximation is reduced by using appropriate reference system. Then, the generated multiport pole-residue models are incorporated into a circuit simulator using recursive convolution. Thus, the method avoids explicit convolution, numerical transform, and artificial filtering of a large number of points that are often necessary in conventional approaches. Examples with experimental and simulated results are given to illustrate the method.

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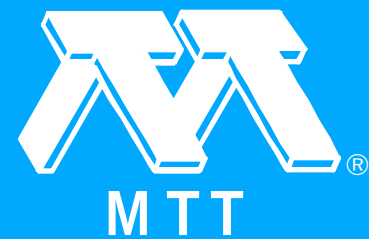


Abstracts

Development of microwave package models utilizing on-wafer characterization techniques

C. Chun, A.-V. Pham, J. Laskar and B. Hutchison. "Development of microwave package models utilizing on-wafer characterization techniques." 1997 Transactions on Microwave Theory and Techniques 45.10 (Oct. 1997, Part II [T-MTT] (Special Issue on Interconnects and Packaging)): 1948-1954.

A package characterization technique using coplanar waveguide (CPW) probes and line-reflect-match (LRM) calibrations for surface-mountable packages is presented. CPW-to-package adapters (CPA) are fabricated on alumina substrates to mount and measure the high-frequency response of plastic packages. Offset CPA standards in conjunction with an LRM calibration are used to de-embed the response of the adapters from the measured S-parameters. Application of this method is demonstrated by characterizing and modeling surface-mount microwave plastic packages.



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Determination of complex permittivity of low-loss dielectrics

R.H. Voelker, Guang-Tsai Lei, Guang-Wen Pan and B.K. Gilbert. "Determination of complex permittivity of low-loss dielectrics." 1997 Transactions on Microwave Theory and Techniques 45.10 (Oct. 1997, Part II [T-MTT] (Special Issue on Interconnects and Packaging)): 1955-1960.

A new high-order-mode analytical method is described for calculating the frequency-dependent complex permittivity of a low-loss dielectric in a parallel-plate structure using a planar microwave circuit model. An analytical expression for the complex permittivity is derived in terms of the terminal impedance at a modal resonant frequency of the structure. The derivation provides physical and mathematical insight into the relation between complex permittivity and port impedance. The technique is validated by good agreement between manufacturer's specifications and complex permittivity calculated from measurements near resonant frequencies for a printed circuit board (PCB).

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Spiral inductors and transmission lines in silicon technology using copper-damascene interconnects and low-loss substrates

J.N. Burghartz, D.C. Edelstein, K.A. Jenkins and Y.H. Kwark. "Spiral inductors and transmission lines in silicon technology using copper-damascene interconnects and low-loss substrates." 1997 Transactions on Microwave Theory and Techniques 45.10 (Oct. 1997, Part II [T-MTT] (Special Issue on Interconnects and Packaging)): 1961-1968.

Spiral inductors and different types of transmission lines are fabricated by using copper (Cu)-damascene interconnects and high-resistivity silicon (HRS) or sapphire substrates. The fabrication process is compatible with the concepts of silicon device fabrication. Spiral inductors with 1.4-nH inductance have quality factors (Q) of 30 at 5.2 GHz and 40 at 5.8 GHz for the HRS and the sapphire substrates, respectively. 80-nH inductors have Q's as high as 13. The transmission-line losses are near 4 dB/cm at 10 GHz for microstrips, inverted microstrips, and coplanar lines, which are sufficiently small for maximum line lengths within typical silicon-chip areas. This paper shows that inductors with high Q's for lumped-element designs in the 1-10-GHz range and transmission lines with low losses for distributed-element designs beyond 10 GHz can be made available with the proposed adjustments to commercial silicon technology.





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An integrated CMOS distributed amplifier utilizing packaging inductance

P.J. Sullivan, B.A. Xavier and W.H. Ku. "An integrated CMOS distributed amplifier utilizing packaging inductance." 1997 Transactions on Microwave Theory and Techniques 45.10 (Oct. 1997, Part II [T-MTT] (Special Issue on Interconnects and Packaging)): 1969-1976.

An integrated CMOS distributed amplifier is presented. The required inductance needed for the distributed waveguide structure is realized by the parasitic packaging inductance of a plastic surface-mount package. A fully packaged three-stage distributed amplifier fabricated in a 0.8- μm CMOS process is presented. The distributed amplifier has a unity gain cutoff frequency of 4.7 GHz, a gain of 5 dB, with a gain flatness of ± 1.2 dB over the 300-kHz to 3-GHz band. At a frequency of 2 GHz the amplifier has an input referred third-order intercept point of +15 dBm and an input referred 1-dB compression point of +7 dBm. The amplifier consumes 18 mA from a 3.0-V supply. The distributed amplifier is matched to 50 Ω at the input and output and has a maximum input voltage standing-wave ratio (VSWR) of 1.7:1, and a maximum output VSWR of 1.3:1 over the 300 kHz to 3 GHz band. The amplifier has a noise figure of 5.1 dB at 2 GHz.

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Abstracts

A new approach for the experimental circuit modeling of coupled interconnection structures based on causality

S. Sercu and L. Martens. "A new approach for the experimental circuit modeling of coupled interconnection structures based on causality." 1997 Transactions on Microwave Theory and Techniques 45.10 (Oct. 1997, Part II [T-MTT] (Special Issue on Interconnects and Packaging)): 1977-1981.

In this paper, a time-frequency-domain technique for the experimental circuit modeling of coupled interconnection structures and discontinuities is presented. The technique models and de-embeds all discontinuities and coupled substructures of the device under test (DUT) one by one, and is based on the principle of causality. Validation of each part of the model is done in the time domain, while all calculations are performed in the frequency domain. To validate the accuracy of the circuit models, measured reflection, transmission, and near- and far-end crosstalk are compared with simulated results.



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Coax via-A technique to reduce crosstalk and enhance impedance match at vias in high-frequency multilayer packages verified by FDTD and MoM modeling

E.R. Pillai. "Coax via-A technique to reduce crosstalk and enhance impedance match at vias in high-frequency multilayer packages verified by FDTD and MoM modeling." 1997 Transactions on Microwave Theory and Techniques 45.10 (Oct. 1997, Part II [T-MTT] (Special Issue on Interconnects and Packaging)): 1981-1985.

Large-scale crosstalk at vias and poor via electrical performance are major drawbacks in state-of-the-art high-frequency multilayer first- or second-level integrated-circuit/monolithic-microwave integrated-circuit (IC/MMIC) packages. The coax via design modeled in this paper breaks new ground in achieving more than 30-dB ultrawide-band crosstalk reduction and providing an enhanced impedance match.



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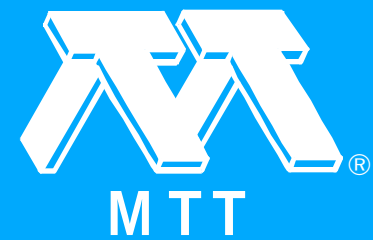
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Evaluation of MESFET nonlinear intermodulation distortion reduction by channel-doping control

J.C. Pedro. "Evaluation of MESFET nonlinear intermodulation distortion reduction by channel-doping control." 1997 Transactions on Microwave Theory and Techniques 45.11 (Nov. 1997 [T-MTT]): 1989-1997.

This paper is intended to evaluate the linearity that can be provided by general-purpose MESFETs. By a simple physics-based analysis and a practical amplifier design, it will be shown how educated device and bias-point selection can approximate intermodulation distortion (IMD) performance of some normal channel-doping profiles, for which previous theories would not be able to predict good IMD performance, to the one expected from MESFET devices with specially tailored doping profiles.



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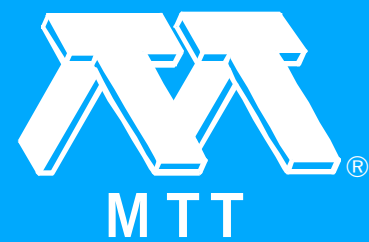
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A fast spatial-domain method for the suppression of excitation-induced spurious modes in SCN TLM

S. Lindenmeier, B. Isele, R. Weigel and P. Russer. "A fast spatial-domain method for the suppression of excitation-induced spurious modes in SCN TLM." 1997 Transactions on Microwave Theory and Techniques 45.11 (Nov. 1997 [T-MTT]): 1998-2006.

An efficient method for the suppression of excitation-induced spurious modes in the symmetrical condensed node (SCN) transmission-line matrix (TLM) method is presented for the general case of dielectric, anisotropic, or lossy media in planar structures. A special mapping of the field-excitation onto the wave amplitudes of the TLM algorithm completely prevents the emanation of the spurious modes. The application of the mapping in the k - ω space can be done for waveguides with low computational effort. The method is generalized for planar structures with high spatial frequencies of the field at the discontinuities. We use precomputed field templates at the entrance of the three-dimensional (3-D) structures. The mapping is mainly done in the space domain based on the quasi-TEM propagation of the guided waves to keep the computational effort low. Instead of the four-dimensional (4-D) k - ω transformation, only independent one-dimensional (1-D) transformations to the wave coefficient of the conductors direction and ω are necessary. In the case of propagation with low dispersion, the expenditure can be further reduced to 1-D transformations with respect to ω . The efficiency of the present method is demonstrated by investigation of a coplanar waveguide and a triplate waveguide.

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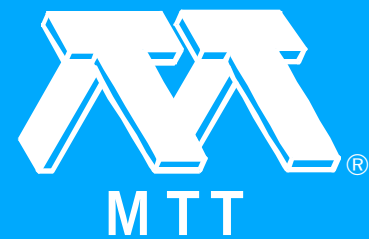
Class-F power amplifiers with maximally flat waveforms

F.H. Raab. "Class-F power amplifiers with maximally flat waveforms." 1997 Transactions on Microwave Theory and Techniques 45.11 (Nov. 1997 [T-MTT]): 2007-2012.

Class-F power amplifiers (PA's) employ harmonic-frequency resonators to shape their drain or collector waveforms to improve efficiency. Generally, the output network must present the drain with either an open or short circuit at the harmonic frequencies. At VHF and higher frequencies, the drain capacitance, lead inductance, lead length, and dispersion make implementation of reasonably ideal tuned circuits difficult. However it is possible to control the impedances at a finite number of harmonics. This note first derives the basic relationships among the Fourier coefficients of the waveforms and the performance of the amplifier. Fourier coefficients for maximally flat waveforms are then derived for inclusion of up to the fifth harmonic. Amplifier performance is then tabulated as a function of which harmonics are included in the voltage and current waveforms. Efficiency increases from 50% of class A toward 100% as harmonics are added. Power-output capability increases by up to 27%.

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Superconducting microstrip resonator with yttrium iron garnet single crystals

T. Fukusako and M. Tsutsumi. "Superconducting microstrip resonator with yttrium iron garnet single crystals." 1997 Transactions on Microwave Theory and Techniques 45.11 (Nov. 1997 [T-MTT]): 2013-2017.

A magnetically tunable microstrip superconducting resonator using an yttrium-iron-garnet (YIG) single crystal was demonstrated experimentally. Tunability of 200 MHz at a center frequency of 5.3 GHz was observed, and a quality factor of 965 with minimum insertion loss of 19.5 dB was measured for a half-wavelength microstrip line consisting of a YIG-YBCO-MgO composite structure. The dispersion relation of the resonator was analyzed using the spectral-domain method and discussed with experimental results on the mixed states of TEM and magnetostatic-wave modes. Power dependence of the characteristics is also discussed.

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Transmission-line analysis of a capacitively coupled microstrip-ring resonator

Cheng-Cheh Yu and Kai Chang. "Transmission-line analysis of a capacitively coupled microstrip-ring resonator." 1997 Transactions on Microwave Theory and Techniques 45.11 (Nov. 1997 [T-MTT]): 2018-2024.

The resonant frequencies of a microstrip-ring resonator capacitively coupled to a feed line are accurately analyzed using a transmission-line model. By making use of ABCD- and Y-admittance matrices, a compact closed-form expression for the input impedance of the ring alone is analytically derived and shows that the ring can be equivalently viewed as a frequency-dependent capacitor. The coupling gap is then modeled by an equivalent L-network comprising a parallel and a series gap capacitance obtained by modifying Garg and Bahl's closed-form expressions for an end-to-end microstrip gap. By simplifying the parallel and series combinations of the overall equivalent circuit, the total input impedance looking from the feed line to the gap is analytically derived to predict the resonant frequencies. To verify the analysis, the resonant frequencies of the capacitively coupled ring resonator have been accurately measured, with the experimental results showing very good agreement with the theoretical predictions.

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Whispering gallery modes in a dielectric resonator: characterization at millimeter wavelength

G. Annino, M. Cassettari, I. Longo and M. Martinelli. "Whispering gallery modes in a dielectric resonator: characterization at millimeter wavelength." 1997 Transactions on Microwave Theory and Techniques 45.11 (Nov. 1997 [T-MTT]): 2025-2034.

Applications of whispering-gallery-mode (WGM) dielectric resonators in the millimeter and submillimeter frequency range are discussed. A summary of the main peculiarities of these resonators is given, and a method to obtain approximate analytical expressions of electromagnetic field components is developed. Problems connected with the excitation by far infrared (FIR) laser radiation are examined. The analysis of electromagnetic propagation in different structures drives the best choice for the transmission line (metallic and dielectric waveguides), and the same theoretical analysis allows to face the basic problem of optimizing the matching between transmission-line and WG resonators; the role in this application of dielectric waveguides with variable diameter is discussed. All of the predictions are obtained in a unified theoretical picture. The experimental characterization of a WG resonator at 240 GHz involved the measurement of the effectiveness of the coupling between the transmission line and the resonator, the determination of the merit factor and free spectral range for the different resonance families in different resonators. Accurate measurements were carried out to acquire knowledge of the field distribution in both axial and radial directions; to this purpose, dielectric antennas with high directivity were used to sense the field intensities for different resonance modes. The good agreement between the experimental results and the theoretical predictions is carefully discussed.



Phase noise in externally injection-locked oscillator arrays

Heng-Chia Chang, Xudong Cao, M.J. Vaughan, U.K. Mishra and R.A. York. "Phase noise in externally injection-locked oscillator arrays." 1997 Transactions on Microwave Theory and Techniques 45.11 (Nov. 1997 [T-MTT]): 2035-2042.

Previous investigations of noise in mutually synchronized coupled-oscillator systems are extended to include the effects of phase noise introduced by externally injected signals. The analysis is developed for arbitrarily coupled arrays and an arbitrary collection of coherent injected signals, and is illustrated with the specific case of linear chains of nearest neighbor coupled oscillators either globally locked (locking signal applied to each array element) or with the locking signal applied to a single-array element. It is shown that the general behavior is qualitatively similar to a single injection-locked oscillator, with the output noise tracking the injected noise near the carrier, and returning to the free-running array noise far from the carrier, with intermediate behavior significantly influenced by the number of array elements and injection strength. The theory is validated using a five-element GaAs MESFET oscillator array operating at S-band.





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Design of waveguide-to-orotron-resonator transition with modified Bethe theory

G. Faby and K. Schunemann. "Design of waveguide-to-orotron-resonator transition with modified Bethe theory." 1997 Transactions on Microwave Theory and Techniques 45.11 (Nov. 1997 [T-MTT]): 2043-2048.

The modified Bethe theory is applied to the waveguide-to-resonator transition, which is used for output coupling in an orotron oscillator designed for operation at 94 GHz. The finite thickness of the coupling hole between output waveguide and resonator is taken into account. The approach results in an equivalent circuit, which describes the reflection-type resonator, with respect to the output waveguide. Its equivalent circuit parameters are given in closed-form expressions. The calculated reflection coefficients are compared to experimental results. The assumed single-mode operation in the resonator is demonstrated by field-profile measurements.

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Modeling of surface hairline-crack detection in metals under coatings using an open-ended rectangular waveguide

C. Huber, H. Abiri, S.I. Ganchev and R. Zoughi. "Modeling of surface hairline-crack detection in metals under coatings using an open-ended rectangular waveguide." 1997 Transactions on Microwave Theory and Techniques 45.11 (Nov. 1997 [T-MTT]): 2049-2057.

A surface-breaking hairline crack or a narrow slot in a metallic specimen when scanned by an open-ended rectangular waveguide probe influences the reflection-coefficient properties of the incident dominant mode. Subsequent recording of a change in the standing-wave pattern while scanning such a surface results in what is known as the crack characteristic signal. Since microwave signals penetrate inside dielectric materials, this methodology is capable of detecting cracks under dielectric coatings of various electrical thicknesses as well. To electromagnetically model the interaction of an open-ended rectangular waveguide with a surface-breaking hairline crack under a dielectric coating, the dielectric-coating layer is modeled as a waveguide with a large cross section. Thus, the problem is reduced to a system of three waveguides interacting with each other while the location of the crack is continuously changing relative to the probing waveguide aperture (a dynamic scanning problem). An analysis of modeling the dielectric-coating layer as a dielectric-filled waveguide with a large cross section is given, and its comparison with radiation into an unbounded medium is presented. For obtaining the reflection coefficients of the dominant and higher order modes, the electromagnetic properties of the probing waveguide-dielectric-coating layer junction and the dielectric-coating layer-crack junction are separately analyzed. For each junction, a magnetic-current density M is introduced over the common aperture. Subsequently, the junction formed by the two respective waveguide sections is separated into two systems. A numerical solution employing the method of moments is obtained, and the properties of the junctions are expressed by their respective generalized scattering matrices. Consequently, the generalized scattering matrix for the total system can be evaluated. The convergence behavior of the system is studied to determine an optimal set of basis functions and the optimal number of higher order modes for a fast and accurate solution. Finally, the theoretical and measured crack characteristic signals are compared.



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The dependence of electromagnetic energy absorption upon human-head modeling at 1800 MHz

K. Meier, V. Hombach, R. Kastle, Roger Yew-Siow Tay and N. Kuster. "The dependence of electromagnetic energy absorption upon human-head modeling at 1800 MHz." 1997 *Transactions on Microwave Theory and Techniques* 45.11 (Nov. 1997 [T-MTT]): 2058-2062.

The authors of a previously published paper on the dependence of electromagnetic (EM) energy absorption concluded that homogeneous modeling of the human head is suited for assessing the spatial-peak absorption for transmitters operating at 900 MHz or below. Additional studies became necessary for the frequency bands utilized by new mobile communications systems (i.e., 1.5 and 2.5 GHz) since some peripheral tissue layers have a thickness of the range of $\lambda/4$ to $\lambda/2$. The results of the simulations combined with worst-case considerations confirmed the anticipated and more complex relationship between absorption and anatomical details at these higher frequencies. Nevertheless, a homogeneous representation of the head is suited for assessing the maximum specific absorption rate (SAR) in the head of the user of mobile telecommunication equipment (MTE) if the appropriate dielectric parameters are chosen.

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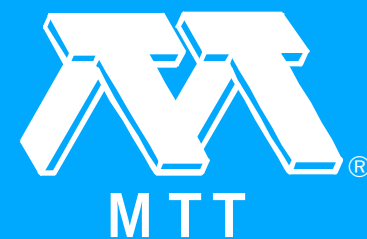


Abstracts

Resonant Disk Turnstile (Corrections)

R.K. Zimmerman. "Resonant Disk Turnstile (Corrections)." 1997 Transactions on Microwave Theory and Techniques 45.11 (Nov. 1997 [T-MTT]): 2063-2063.

The original paper can be found in IEEE Trans. Microwave Theory Tech., vol. 45, pp. 1600-1610, Sept. 1997.



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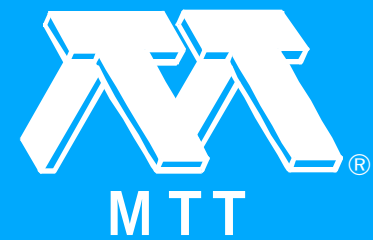
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Inside Cover (Dec. 1997, Part I [T-MTT])

"Inside Cover (Dec. 1997, Part I [T-MTT])." 1997 Transactions on Microwave Theory and Techniques 45.12 (Dec. 1997, Part I [T-MTT]): 0_2-0_3.



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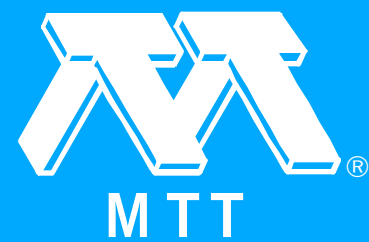
Intermodulation mechanism and linearization of AlGaAs/GaAs HBTs

Joonwoo Lee, Woonyun Kim, Youngsik Kim, Taemoon Rho and Bumman Kim.

"Intermodulation mechanism and linearization of AlGaAs/GaAs HBTs." 1997 Transactions on Microwave Theory and Techniques 45.12 (Dec. 1997, Part I [T-MTT]): 2065-2072.

The intermodulation (IM) mechanism of heterojunction bipolar transistors (HBTs) has been studied by using an analytical nonlinear equivalent circuit model and Volterra-series analysis of the model. Although the third-order IM intercept point (IP3) does not depend on the emitter parameter, it is appreciably affected by base and collector parameters and has been substantially improved by utilizing punchthrough collector structure. The measured IP3 of punchthrough collector HBTs is 31 dBm with 150-mW dc power, which is higher than that of normal collector HBTs by 3 dB. The investigation of the cancellation effects of nonlinear elements reveals that the output nonlinear current components generated by emitter-base current source and base-collector current source cancel each other almost exactly, resulting in high linear characteristics of HBTs.





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Thin-sample measurements and error analysis of high-temperature coaxial dielectric probes

S. Bringham, M.F. Iskander and M.J. White. "Thin-sample measurements and error analysis of high-temperature coaxial dielectric probes." 1997 Transactions on Microwave Theory and Techniques 45.12 (Dec. 1997, Part I [T-MTT]): 2073-2083.

A metallized-ceramic probe has been designed for high-temperature broad-band dielectric properties measurements. The probe has been used to make complex dielectric properties measurements over the complete frequency band from 500 MHz to 3 GHz, and up to temperatures as high as 1000/spl deg/C. In this paper, we investigate new aspects of the development and utilization of this high-temperature dielectric probe. The first aspect is related to the results of an uncertainty analysis which was performed to quantify the errors due to the differential thermal expansion between the inner and outer conductors of metal coaxial probes. In this case, a two-dimensional (2-D) cylindrical finite-difference time-domain (FDTD) code was developed and used for this analysis. The obtained results were compared and shown to be in good agreement with error-analysis data based on analytical solutions for the special case when an air gap exists between the probe and the material under test. Additional new error-analysis results show that differential thermal expansions and rough surfaces cause considerable errors in these measurements, and the use of probes of small differential thermal expansions, such as the developed metallized-ceramic probe, is essential for obtaining accurate results. We also used FDTD numerical simulations to help investigate the use of this probe for the nondestructive complex-permittivity measurements of electrically "thin" samples. It is shown that by backing the material under test with a standard material of known dielectric constant, such as air or metal, the complex permittivity of thin samples can be accurately measured. The other new development is related to the use of the developed metallized-ceramic probe to measure the dielectric properties of thin samples at high temperature and over a broad frequency band. With the developed knowledge from the error analysis, and the new FDTD code for thin-sample measurements, the metallized-ceramic probe was used to measure dielectric properties of thin Al/sub 2/O/sub 3/ and sapphire samples for temperatures up to 1000/spl deg/C. This measurement method has important applications in the on-line characterization of semiconductor wafers. Results from the high-temperature thin-sample measurements and the uncertainty analysis are presented.

Click on title for a complete paper.



Abstracts

A novel approach for determining the GaAs MESFET small-signal equivalent-circuit elements

Ban-Leong Ooi, Mook-Seng Leong and Pang-Shyan Kooi. "A novel approach for determining the GaAs MESFET small-signal equivalent-circuit elements." 1997 Transactions on Microwave Theory and Techniques 45.12 (Dec. 1997, Part I [T-MTT]): 2084-2088.

A simple way of extracting the small-signal equivalent circuit of a MESFET is proposed. The intrinsic elements and one of the extrinsic parameters are described as functions of the remaining extrinsic parameters. This drastically reduces the search space and the number of unknowns for optimization. It provides an important new insight into the correlation between the various extrinsic and intrinsic parameters. The method also reveals that there are two sets of solution for the parameters $R_{\text{sub } s/}$ and $L_{\text{sub } s/}$ which can fully satisfy the global solution. A numerical comparison in terms of both accuracy and speed between the proposed method and some conventional methods on a 400-/spl mu/m gatewidth GaAs MESFET is presented.



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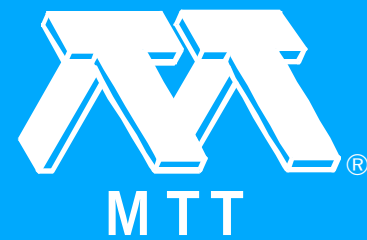


Abstracts

Study of the influence of grounding for microstrip resonators

T. Ishizaki, T. Kitamura, M. Geshiro and S. Sawa. "Study of the influence of grounding for microstrip resonators." 1997 Transactions on Microwave Theory and Techniques 45.12 (Dec. 1997, Part I [T-MTT]): 2089-2093.

The influence of ground terminal shape on the resonant frequency of a microstrip resonator is investigated through numerical simulations and experiments. Resonators are one of the basic components of very small high-dielectric stripline filters, named the laminated-planar filter. The resonant frequencies are calculated by means of the finite-difference time-domain (FDTD) method and compared with experimental results. It is also shown that the resonant frequency is directly related to the square root of its line inductance when the resonator is regarded equivalently as a series LC circuit.



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Transitional combine/evanescent-mode microwave filters

R. Levy, Hui-Wen Yao and K.A. Zaki. "Transitional combine/evanescent-mode microwave filters." 1997 Transactions on Microwave Theory and Techniques 45.12 (Dec. 1997, Part I [T-MTT]): 2094-2099.

Traditional combine-filter theory based on TEM-mode coupling results in bandwidths which are too large-the increase being a function of the ground-plane spacing to wavelength ratio $b/\text{spl } \lambda$. As the $b/\text{spl } \lambda$ ratio increases from 0.05 to 0.35, the bandwidth ratio (BWR), defined as actual bandwidth/TEM bandwidth, increases from unity to over 2:1. This bandwidth increase has now been confirmed by calculation of the coupling coefficient between combine resonators using mode matching. Accompanying the increased bandwidth is a considerable increase in the unloaded Q in accordance with the higher Q of the evanescent waveguide modes. A similar study carried out in the case of interdigital filters shows that these effects are much less significant.

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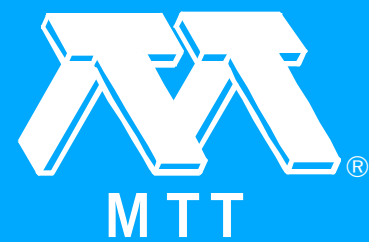
Maximally flat quarter-wavelength-coupled transmission-line filters using Q distribution

J.M. Drozd and W.T. Joines. "Maximally flat quarter-wavelength-coupled transmission-line filters using Q distribution." 1997 Transactions on Microwave Theory and Techniques 45.12 (Dec. 1997, Part I [T-MTT]): 2100-2113.

This paper presents a technique for accurately designing maximally flat quarter-wavelength-coupled transmission-line filters using arbitrary resonant elements. The design procedure currently used, which is based on the lumped-element low-pass prototype, yields a response that is only approximately maximally flat. In addition, the current procedure results in an inaccurate prediction of the total Q for the filter. The technique presented in this paper, herein called the Q-distribution (QD) method, corrects these problems. With the QD method, the designer chooses the number and type of resonant elements and the total Q desired. In turn, the designer is provided with the individual resonator QD, which gives the designer flexibility in selecting the resonator that is most appropriate.

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Characterization of unbounded multiport microstrip passive circuits using an explicit network-based method of moments

L. Zhu and K. Wu. "Characterization of unbounded multiport microstrip passive circuits using an explicit network-based method of moments." 1997 Transactions on Microwave Theory and Techniques 45.12 (Dec. 1997, Part I [T-MTT]): 2114-2124.

This paper is concerned with a field-theoretical characterization of unbounded multiport microstrip passive circuits using an explicit network technique. The cornerstone of this efficient modeling framework is based on a method of moments (MoM) that makes use of the explicit representation of a generalized matrix of network parameters. To physically formulate the equivalent multiport network for a multiport circuit, a delta-gap voltage source backed by a vertical electric wall is conceptually introduced to terminate each port. In this way, the multiport microstrip circuit to be modeled is externally connected at an adequate location. The image principle is applied at the port to remove the electric wall and the open environment can effectively be simulated. With the unified impressed delta-gap source model and appropriate partition of the entire multiport circuit topology, a MoM procedure is developed and applied to extract the network parameters directly from the field-theoretical formulations. All possible physical phenomena such as radiation and leakage losses are incorporated in the algorithm. Two distinctive examples presented in this paper demonstrate the effectiveness of the proposed algorithm for handling multilayered multiport passive and antenna circuits. Convergence analysis is made for the filter example compared with experimental results, showing that the proposed algorithm is very stable and accurate. Theoretical and experimental results indicate that the implicit unbounded effects may be influential on electrical performance and should be considered in such a field-theoretical modeling and design tool as proposed in this paper.

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Abstracts

A new edge element for the modeling of field singularities in transmission lines and waveguides

J.M. Gil and J.P. Webb. "A new edge element for the modeling of field singularities in transmission lines and waveguides." 1997 Transactions on Microwave Theory and Techniques 45.12 (Dec. 1997, Part I [T-MTT]): 2125-2130.

Edge finite elements are widely used in the analysis of waveguides and transmission lines. They have tangential continuity and they do not produce spurious modes. However, they cannot model the singular behavior of the transverse fields in the neighborhood of sharp edges. This fact limits the accuracy of the representation of the fields and the order of convergence of the method. In this paper, we present a new edge element in which the singular approximation of the three fields components and the correct modeling of the curl is incorporated. The development of the basis functions is described. Some numerical results for waveguides with sharp metal edges are shown in order to validate this theory.



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Analysis of coplanar-waveguide discontinuities with finite-metallization thickness and nonrectangular edge profile

Fang-Lih Lin and Ruey-Beei Wu. "Analysis of coplanar-waveguide discontinuities with finite-metallization thickness and nonrectangular edge profile." 1997 Transactions on Microwave Theory and Techniques 45.12 (Dec. 1997, Part I [T-MTT]): 2131-2138.

In this paper, the hybrid finite-element method (FEM) is proposed to analyze the coplanar-waveguide (CPW) discontinuities with finite-metallization thickness. A variational formula for the electric field in the slot region between upper and lower half-space is derived by applying the variational-reaction theory and solved by the FEM. In the limiting case of zero metallization thickness, this finite-element analysis is reduced to a moment-method analysis using Galerkin's approach with rooftop basis functions. The edge profile effects of a trapezoidal slot cross resulting from the etching or sputtering process can also be easily considered by this approach. Some numerical results are presented for short- and open-ended CPW discontinuities for different conductor thicknesses. It has been shown that not only the metallization thickness, but also the conductor-edge profile, can produce noticeable effects on circuit performance and should be taken into account for accurately modeling the CPW discontinuities.

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Abstracts

A modified Lanczos algorithm for the computation of transient electromagnetic wavefields

R.F. Remis and P.M. van den Berg. "A modified Lanczos algorithm for the computation of transient electromagnetic wavefields." 1997 Transactions on Microwave Theory and Techniques 45.12 (Dec. 1997, Part I [T-MTT]): 2139-2149.

A new method for computing transient electromagnetic wavefields in inhomogeneous and lossy media is presented. The method utilizes a modified Lanczos scheme, where a so-called reduced model is constructed. A discretization of the time variable is then superfluous. This reduced model represents the transient electromagnetic wavefield on a certain bounded interval in time. Some theoretical aspects of the method are highlighted and numerical results showing the performance of the method for two-dimensional (2-D) configurations are given. Also, comparisons between this Lanczos method and the finite-difference time-domain (FDTD) method are made.



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Uniplanar broad-band push-pull FET amplifiers

P.-C. Hsu, C. Nguyen and M. Kintis. "Uniplanar broad-band push-pull FET amplifiers." 1997 Transactions on Microwave Theory and Techniques 45.12 (Dec. 1997, Part I [T-MTT]): 2150-2152.

We report the development of completely uniplanar broadband balanced push-pull FET amplifiers using slot line and coplanar waveguide. The amplifiers employ broad-band uniplanar baluns to achieve the push-pull function over a wide bandwidth. One amplifier, designed in the unconditionally stable region, exhibits a gain of 3.5-5 dB over the frequency range of 5.4-10 GHz and an output 1-dB compression point of 19 dBm at 10 GHz. The other amplifier was designed in the potentially unstable range and achieves a high gain between 10-11 dB from 2 to 4 GHz and an output 1-dB compression point of 17 dBm at 4 GHz. These results show the feasibility of the push-pull FET amplifier configuration using uniplanar technology for microwave and millimeter-wave integrated circuits and systems.





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The method of lines for the hybrid analysis of multilayered cylindrical resonator structures

D. Kremer and R. Pregla. "The method of lines for the hybrid analysis of multilayered cylindrical resonator structures." 1997 Transactions on Microwave Theory and Techniques 45.12 (Dec. 1997, Part I [T-MTT]): 2152-2155.

A very powerful numerical model based on the method of lines (MoL) is developed for the hybrid analysis of composite multilayered cylindrical dielectric resonator structures. These structures are composed of a number of coaxial rings which are arbitrarily layered in the axial direction, the resonant frequencies, as well as quality factors caused by radiation or dielectric loss and the corresponding field distributions of all resonant modes can be determined with the described algorithm. The theory is verified in case of the conical dielectric resonator and a comparison of our numerical results with those of other authors shows excellent consistency.

[Click on title for a complete paper.](#)



Nonradiating sources in time-domain transmission-line theory

A. Sihvola, G. Kristensson and I.V. Lindell. "Nonradiating sources in time-domain transmission-line theory." 1997 Transactions on Microwave Theory and Techniques 45.12 (Dec. 1997, Part I [T-MTT]): 2155-2159.

The concept of nonradiating (NR) sources is introduced to transmission lines in the time-domain analysis. A method is presented to construct localized voltage and current sources which do not produce any fields outside the source domain. These sources cannot, therefore, be detected by measurements made outside the source region. The importance of such sources for the uniqueness of the inverse-source problem is pointed out, and energy conditions for the uniqueness are discussed. The analysis can be advantageously used in the design and optimization of the electromagnetic compatibility (EMC) properties of transmission lines.



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"Front Cover (Dec. 1997, Part II [T-MTT])." 1997 Transactions on Microwave Theory and Techniques 45.12 (Dec. 1997, Part II [T-MTT] (1997 Symposium Issue)): 0_1-0_1.



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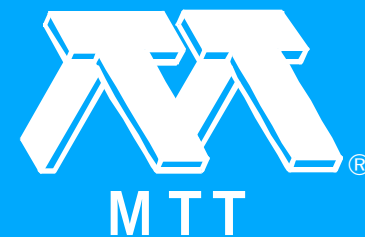
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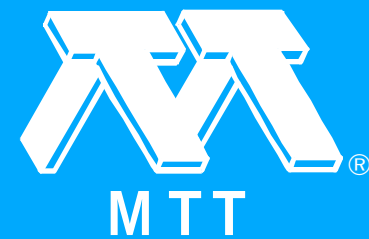
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"Inside Cover (Dec. 1997, Part II [T-MTT])." 1997 Transactions on Microwave Theory and Techniques 45.12 (Dec. 1997, Part II [T-MTT] (1997 Symposium Issue)): 0_5-0_6.



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Abstracts

Guest Editors' Overview (Dec. 1997, Part II [T-MTT])

F. Ali, R.B. Marks and R.C. Booton. "Guest Editors' Overview (Dec. 1997, Part II [T-MTT])." 1997 Transactions on Microwave Theory and Techniques 45.12 (Dec. 1997, Part II [T-MTT] (1997 Symposium Issue)): 2164-2166.

The excellent technical program of 413 papers presented at the 1997 International Microwave Symposium (IMS), as described in this issue by K. C. Gupta, resulted in a record number of 147 papers being submitted for the Special Symposium Issue of the IEEE TRANSACTIONS ON MICROWAVE THEORY AND TECHNIQUES. In addition to the papers from IMS, seven RFIC papers, and five ARFTG papers (an innovation this year) were submitted. Instructions from the Transactions Editor were to select a total of 45-50 papers. The excellent quality of most of the submitted papers has made selection of the papers to be published in this Special Issue very difficult. The final selection was a total of 49 papers, consisting of 44 IMS papers, four RFIC papers, and one ARFTG paper, for an overall acceptance rate of 32%.



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The 1997 IEEE MTT-S International Microwave Symposium/Microwave Week: "High Frequencies in High Places"

C.M. Weil, R.B. Marks and M. Kanda. "The 1997 IEEE MTT-S International Microwave Symposium/Microwave Week: "High Frequencies in High Places"." 1997 Transactions on Microwave Theory and Techniques 45.12 (Dec. 1997, Part II [T-MTT] (1997 Symposium Issue)): 2167-2171.

The 41st annual IEEE MTT-Society International Microwave Symposium (IMS), the primary event of the 1997 "Microwave Week", took place in Denver, Colorado, on June 8-13, 1997.



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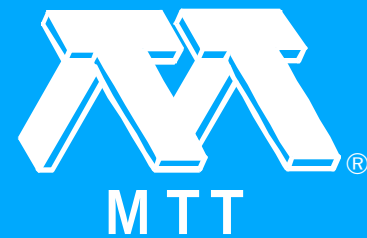


Abstracts

1997 IMS Technical Program (Overview)

K.C. Gupta and Z.B. Popovic. "1997 IMS Technical Program (Overview)." 1997 Transactions on Microwave Theory and Techniques 45.12 (Dec. 1997, Part II [T-MTT] (1997 Symposium Issue)): 2172-2174.

The technical program of the 1997 IEEE MTT-S International Microwave Symposium was a great success. The technical program consisted of 55 technical sessions, six panel sessions, one rump session, three student-paper sessions, and 24 workshops spread over the week of June 8-13, 1997.



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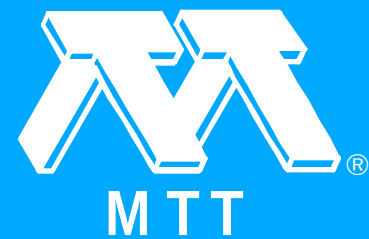
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1997 MTT-S Awards (Overview)

D.N. McQuiddy. "1997 MTT-S Awards (Overview)." 1997 Transactions on Microwave Theory and Techniques 45.12 (Dec. 1997, Part II [T-MTT] (1997 Symposium Issue)): 2175-2182.

Our President R. E. "Skip" Bryan presented the annual IEEE MTT-S Awards in the Plenary Session and at the Awards Banquet during the 1997 International Microwave Symposium in the mile-high city of Denver, Colorado. The Awards Committee, the Fellows Evaluation Sub-Committee, and the Microwave Prize Sub-Committee have carefully evaluated an extensive list of outstanding candidates from the nominations solicited from our members over the last year. The Awards Committee, which works anonymously, is to be commended for their objective selection of this year's awardees.

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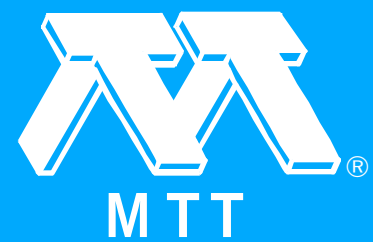
Optimal control of intermodulation distortion in hybrid fiber-coaxial CATV systems

G.D. Alley and Yen Long Kuo. "Optimal control of intermodulation distortion in hybrid fiber-coaxial CATV systems." 1997 Transactions on Microwave Theory and Techniques 45.12 (Dec. 1997, Part II [T-MTT] (1997 Symposium Issue)): 2183-2196.

The distortion optimization in a phase-controlled hybrid fiber coaxial (HFC) CATV system is presented both in the frequency domain and in the time domain. A general quadratic-phase relationship of the National Television System Community (NTSC) video carriers has been used as the basis for minimizing the peak/rms ratio of the broad-band signal as well as the second- and third-order intermodulation distortion products. Emphasis is placed on distortion products which fall outside the band occupied by the NTSC signals and thus degrade digital performance. An experimental phase-controlled coherent HFC CATV system consisting of 81 live video channels and four 64 quadrature amplitude modulation (QAM) digital channels has been used to demonstrate the advantages of an optimal phase-controlled headend over traditional systems.

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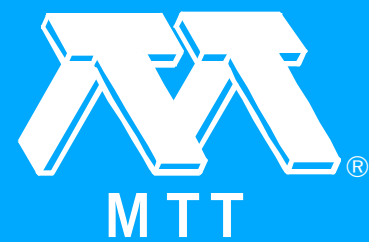
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Wide-band millimeter-wave/optical-network applications in Japan

N. Imai, H. Kawamura, K. Inagaki and Y. Karasawa. "Wide-band millimeter-wave/optical-network applications in Japan." 1997 Transactions on Microwave Theory and Techniques 45.12 (Dec. 1997, Part II [T-MTT] (1997 Symposium Issue)): 2197-2207.

This paper describes work on wide-band millimeter-wave (MMW)/optical-network applications in Japan-in particular, projects being pursued at the Advanced Telecommunications Research Institute (ATR). Digital-signal transmission at 118 Mb/s was tested. Results of the experiments demonstrate that highspeed digital-signal transmission, with a total carrier-to-noise ratio (C/N) degradation of less than 1.2 dB from a modem at a BER of 10^{-6} , is feasible. Similarly, analog FM-signal transmission with a weighted S/N of more than 45 dB is also feasible at a signal bandwidth of 18 MHz and FM carrier frequency of 43.75 GHz. Based on these results, a demonstration system was constructed, and the feasibility of the system was confirmed. Several key technologies for system construction such as an MMW optical modulator and an MMW high-speed p-i-n detector and some related technologies are also described. In addition, an advanced system considered suitable for future high-speed mobile communications is proposed. This system employs an optical signal-processing multibeam antenna, where the direction of each sharp beam can be adaptively controlled.





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Global modeling of millimeter-wave circuits: electromagnetic simulation of amplifiers

S.M.S. Imtiaz and S.M. El-Ghazaly. "Global modeling of millimeter-wave circuits: electromagnetic simulation of amplifiers." 1997 Transactions on Microwave Theory and Techniques 45.12 (Dec. 1997, Part II [T-MTT] (1997 Symposium Issue)): 2208-2216.

Global modeling of microwave and millimeter-wave circuits is important to simulate the electromagnetic (EM) coupling, device-EM wave interaction, and the EM radiation effects of the closely spaced active and passive components of monolithic microwave integrated circuits (MMIC's). In this paper, a global-modeling technique is presented to characterize the millimeter-wave integrated-circuit amplifiers. The characterization of amplifier circuits, including the input and output matching networks, are performed using a full-wave analysis coupled with physical modeling of the semiconductor devices. The entire amplifier is simulated with the finite-difference time-domain (FDTD) algorithm, which also solves for the EM fields inside the transistor. The intensive computer-memory requirement and the large simulation time are reduced by applying a hybridization approach. The small signal as well as the large signal propagation through the amplifier circuit are demonstrated. The scattering parameters are extracted for the amplifier circuit at small and large signals for different frequencies. The global technique is able to model the nonlinearity and the harmonic distortion of the amplifier circuit. The third and fifth harmonic components in the output spectrum at large signal are predicted for different frequencies.





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A hybrid full-wave analysis of via-hole grounds using finite-difference and finite-element time-domain methods

Dongsoo Koh, Hong-bae Lee and T. Itoh. "A hybrid full-wave analysis of via-hole grounds using finite-difference and finite-element time-domain methods." 1997 Transactions on Microwave Theory and Techniques 45.12 (Dec. 1997, Part II [T-MTT] (1997 Symposium Issue)): 2217-2223.

A hybrid full-wave analysis using finite-difference time-domain (FDTD) and finite-element time-domain (FETD) methods is developed to analyze locally arbitrarily shaped microwave structures. This hybrid method employs the standard FDTD method with super-absorbing Mur's first-order absorbing-boundary condition (ABC) and the FETD method using the second-order vector prism elements. An interpolation scheme is proposed for communicating between the FDTD and FETD fields, which will not require the effort of fitting the FETD mesh to the FDTD cells in the interface region. This method is applied to calculate the scattering parameters of single and multiple cylindrical via holes in a microstrip structure. Applying FETD to the via-hole grounds and FDTD to the remaining region preserves the advantages of both FETD flexibility and FDTD efficiency. A comparison of the results with the mode-matching data and the FDTD staircasing data verifies the accuracy of the proposed method.

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28-V low thermal-impedance HBT with 20-W CW output power

D. Hill and T.S. Kim. "28-V low thermal-impedance HBT with 20-W CW output power." 1997 Transactions on Microwave Theory and Techniques 45.12 (Dec. 1997, Part II [T-MTT] (1997 Symposium Issue)): 2224-2228.

AlGaAs/GaAs heterojunction bipolar transistors (HBT's) have been fabricated which exhibit record output power for GaAs flip-chip technology, and record operating voltage for GaAs microwave power devices. Transistors with 2-mm emitter length readily achieved 20-W continuous wave (CW) output power at 2 GHz when biased at 28 V, with typical power-added efficiencies of 62% (typical collector efficiencies of 70%). Maximum CW output power of 25 W was obtained, corresponding to a power density of 12.5 W/mm. All results reported were obtained with devices requiring less than 1-mm²/die area. High efficiency, high power, and high power density are enabled by the low device temperatures afforded by the thermally efficient low thermal impedance (LTI) technology.





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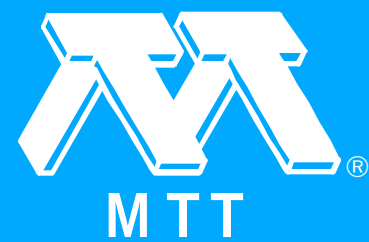
A double lightly doped drain (D-LDD) structure H-MESFET for MMIC applications

Y. Yamane, K. Onodera, T. Nittono, K. Nishimura, K. Yamasaki and A. Kanda. "A double lightly doped drain (D-LDD) structure H-MESFET for MMIC applications." 1997 Transactions on Microwave Theory and Techniques 45.12 (Dec. 1997, Part II [T-MTT] (1997 Symposium Issue)): 2229-2233.

This paper proposes a new double lightly doped drain (D-LDD) structure for InGaP/InGaAs heterostructure MESFETs (H-MESFETs). A D-LDD H-MESFET has three kinds of low-resistant layers in the drain region, while a conventional LDD H-MESFET has two layers. This structure improves maximum stable gain (MSG) accompanied by R_{ds}/d reduction with minimized gate-breakdown-voltage degradation and C_{gs}/gd increase. A heuristic model is proposed to predict V_{bgs} from sheet resistance of implanted layers, and its validity is confirmed with experimental data. This model successfully predicted the tradeoff relation between V_{bgs} and parasitic resistance, and it has enough generality so that it can be applied to usual ion-implanted GaAs MESFETs. Consequently, a typical MSG at 50 GHz exhibits 8.9 dB in a MESFET and 7.7 dB S21 in an one-stage amplifier. The high-frequency circuit operation proves that this technology is one of the most promising for monolithic-microwave integrated-circuit (MMIC) applications.

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Uniplanar hybrid couplers using asymmetrical coplanar striplines

B.R. Heimer, Lu Fan and Kai Chang. "Uniplanar hybrid couplers using asymmetrical coplanar striplines." 1997 Transactions on Microwave Theory and Techniques 45.12 (Dec. 1997, Part II [T-MTT] (1997 Symposium Issue)): 2234-2240.

This paper presents four new uniplanar 3-dB hybrid couplers using asymmetrical coplanar strips (ACPSs) for microwave integrated circuit (MIC) and monolithic MIC (MMIC) applications. Experimental results show that the standard ($1.5 \lambda_g$ circumference) uniplanar 180° hybrid-ring coupler has ± 0.4 dB coupling, greater than 21-dB isolation, and greater than 23.4-dB return loss over a 25% bandwidth centered at 3 GHz. The 180° reverse-phase hybrid-ring coupler ($1.0 \lambda_g$ circumference) provides better performance as compared to conventional microstrip hybrid couplers. This circuit has a bandwidth of more than one octave from 2 to 4 GHz with ± 0.4 -dB power dividing imbalance and $\pm 4^\circ$ phase imbalance. The 180° reduced-size reverse-phase hybrid-ring coupler ($0.8 \lambda_g$ circumference) maintains the performance of the 180° reverse-phase hybrid coupler with the advantage of smaller size. This circuit also has a bandwidth of more than one octave from 2 to 4 GHz with ± 0.3 -dB power dividing imbalance and $\pm 3.1^\circ$ phase imbalance. A new 90° branch-line hybrid coupler is also introduced. Experimental results show the insertion loss of this component to be 0.5 dB at 3 GHz, and also greater than 15.3-dB isolation and 17.1-dB return loss over a 10% bandwidth centered at 3 GHz. The circuits were designed and simulated with Sonnet electromagnetic-circuit solver software. The measured results agree well with the simulations.

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Abstracts

Arbitrary termination impedances, arbitrary power division, and small-sized ring hybrids (Dec. 1997, Part II [T-MTT])

Hee-Ran Ahn, I. Wolff and Ik-soo Chang. "Arbitrary termination impedances, arbitrary power division, and small-sized ring hybrids (Dec. 1997, Part II [T-MTT])." 1997 Transactions on Microwave Theory and Techniques 45.12 (Dec. 1997, Part II [T-MTT] (1997 Symposium Issue)): 2241-2247.

If a ring hybrid is terminated by arbitrary impedances, design equations cannot be derived with conventional methods because symmetry planes for even- and/or odd-mode excitation are not available. Therefore, under these conditions, new design equations for ring hybrids were derived. They can be applied to ring hybrids with both arbitrary termination impedances and arbitrary power-division ratios. Also, new design equations for small-sized ring hybrids have been developed. They allow the design of arbitrary power division, arbitrary termination impedances, and especially small-sized ring hybrids. On the basis of these derived equations, a theoretical evaluation was made using microstrip ring hybrids, and experiments are demonstrated using a coplanar ring hybrid.



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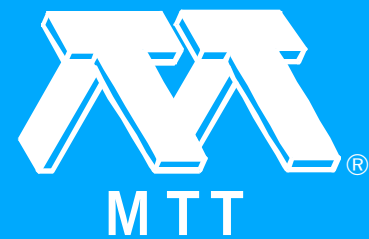


A scalable general-purpose model for microwave FETs including DC/AC dispersion effects

V.I. Cojocaru and T.J. Brazil. "A scalable general-purpose model for microwave FETs including DC/AC dispersion effects." 1997 Transactions on Microwave Theory and Techniques 45.12 (Dec. 1997, Part II [T-MTT] (1997 Symposium Issue)): 2248-2255.

This paper addresses the issue of scalability in equivalent circuit-based models for FETs, emphasizing for the first time the particularly difficult problems associated with the scalability of dc/ac dispersion phenomena. A study has been carried out on devices from both MESFET ($L/\text{sub } G=0.5 \text{ /spl mu/m}$) and pseudomorphic high electron-mobility transistor (PHEMT) ($L/\text{sub } G=0.2 \text{ /spl mu/m}$) foundry processes, with total gatewidths between 60-1200 /spl mu/m. Results are presented, showing that at least up to medium-size devices, dc characteristics, and most of the bias-dependent small-signal circuit elements scale in general, very well provided a reliable parameter extraction methodology is implemented. However, in the case of dispersion phenomena, while the differential dc/ac transconductance obeys straightforward scaling rules, the output conductance does not. The main features of a general-purpose scaleable microwave FET model-COBRA-are described. This includes an equivalent circuit-based solution to account for dispersion effects. The solution is compact, obeys the required conservation constraints, and can "absorb" the scaling inconsistencies observed in the output conductance. The corresponding modeling methodology is also described. Finally, a comprehensive set of measurement versus simulation scalability test results are presented, including dc, small-signal, and large-signal tests.





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A 60-GHz-band monolithic HJFET LNA incorporating a diode-regulated self-bias circuit

K. Maruhashi, K. Ohata and M. Madihian. "A 60-GHz-band monolithic HJFET LNA incorporating a diode-regulated self-bias circuit." 1997 Transactions on Microwave Theory and Techniques 45.12 (Dec. 1997, Part II [T-MTT] (1997 Symposium Issue)): 2256-2260.

This paper presents a 60-GHz-band GaAs heterojunction FET (HJFET) low-noise amplifier (LNA) operating with a single bias supply. A diode-regulated self-bias circuit was incorporated for suppressing the FET drain-current variations due to threshold voltage nonuniformities. The effect of the bias circuit on the drain-current distribution is carefully discussed based on the FET dc characteristics. A developed three-stage monolithic microwave integrated circuit (MMIC) LNA exhibited an average noise figure of 3.3 dB with 18-dB gain from 58 to 62 GHz. The LNA could operate over 2-5 V with a constant noise figure. The LNA chip size is 1.85 mm/spl times/1.07 mm.

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60-GHz flip-chip assembled MIC design considering chip-substrate effect

Y. Arai, M. Sato, H.T. Yamada, T. Hamada, K. Nagai and H.I. Fujishiro. "60-GHz flip-chip assembled MIC design considering chip-substrate effect." 1997 Transactions on Microwave Theory and Techniques 45.12 (Dec. 1997, Part II [T-MTT] (1997 Symposium Issue)): 2261-2266.

In this paper, 60-GHz microwave integrated circuits (MIC's) with flip chip assembled 0.1- μm /m-gate GaAs pseudomorphic high electron-mobility transistors (p-HEMT's) are demonstrated. To clarify the millimeter-wave characteristics of the flip-chip assembled structure, the parameters for the assembly equivalent circuit are examined using three-dimensional (3-D) electromagnetic-field analysis. The analytical results indicate that the optimum height of the bump is 30 μm to minimize degradation of the millimeter-wave characteristics. A 60-GHz-band MIC two-stage amplifier and 30/60-GHz frequency doubler designed using the results of the field analysis have been fabricated. The amplifier has maximum gain of 12.8 dB at 58.6 GHz, P/sub 1dB/ of 12.9 dBm has been obtained at 60 GHz. A 30/60-GHz frequency doubler has maximum conversion gain of 0.4 dB and fundamental frequency suppression of -23.0 dB at the input frequency of 30.4 GHz. Good agreement between the measured and the simulated results demonstrates the potential of the structure and design method.



Abstracts

The work of Jagadis Chandra Bose: 100 years of millimeter-wave research

D.T. Emerson. "The work of Jagadis Chandra Bose: 100 years of millimeter-wave research." 1997 Transactions on Microwave Theory and Techniques 45.12 (Dec. 1997, Part II [T-MTT] (1997 Symposium Issue)): 2267-2273.

Just 100 years ago, J.C. Bose described to the Royal Institution, London, U.K., his research carried out in Calcutta, India, of millimeter wavelengths. He used waveguides, horn antennas, dielectric lenses, various polarizers, and even semiconductors at frequencies as high as 60 GHz. Much of his original equipment is still in existence, currently at the Bose Institute, Calcutta, India. Some concepts from his original 1897 papers have been incorporated into a new 1.3-mm multibeam receiver now in use on the National Radio Astronomy Observatory (NRAO) 12-m telescope.



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Optical repeater circuit design based on InAlAs/InGaAs HEMT digital IC technology

M. Yoneyama, A. Sano, K. Hagimoto, T. Otsuji, K. Murata, Y. Imai, S. Yamaguchi, T. Enoki and E. Sano. "Optical repeater circuit design based on InAlAs/InGaAs HEMT digital IC technology." 1997 Transactions on Microwave Theory and Techniques 45.12 (Dec. 1997, Part II [T-MTT] (1997 Symposium Issue)): 2274-2282.

This paper describes an optical repeater circuit that uses an InAlAs/InGaAs HEMT digital integrated circuit (IC) chip set. The chip set includes a 64-Gb/s 2:1 multiplexer (MUX), a 40-Gb/s demultiplexer (DEMUX), a 46-Gb/s decision circuit (DEC), and a 48-GHz frequency divider (DIV). Electrically multiplexed and demultiplexed 40-Gb/s 300-km transmission is successfully demonstrated.

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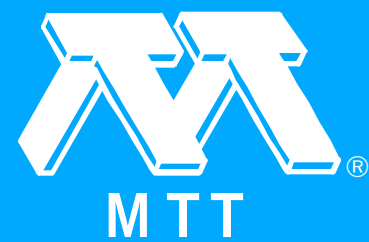
Chip design for monobit receiver

D.S.K. Pok, C.-I.H. Chen, J.J. Schamus, C.T. Montgomery and J.B.Y. Tsui. "Chip design for monobit receiver." 1997 Transactions on Microwave Theory and Techniques 45.12 (Dec. 1997, Part II [T-MTT] (1997 Symposium Issue)): 2283-2295.

A design for the monobit-receiver application-specific integrated circuit (ASIC) will be described. The monobit receiver is a wide-band (1-GHz) digital receiver designed for electronic-warfare applications. The receiver can process two simultaneous signals and has the potential for fabrication on a single multichip module (MCM). The receiver consists of three major elements: a nonlinear RF front end, a signal sampler and formatting system (analog-to-digital converter (ADC) and demultiplexers), and a patented "monobit" algorithm implemented as an ASIC for signal detection and frequency measurement. The receiver's front end, ADC, and algorithm experimental performance results were previously presented. The receiver uses a 2-b ADC operating at 2.5 GHz whose outputs are collected and formatted by demultiplexers for presentation to the ASIC. The ASIC has two basic functions: to perform a fast Fourier transform (FFT) and to determine the number of signals and report their frequencies. The ASIC design contains five stages: the input, the FFT, the initial sort, the squaring and addition, and the final sort. The chip will process the ADC outputs in real time, reporting detected signal frequencies every 102.4 ns.

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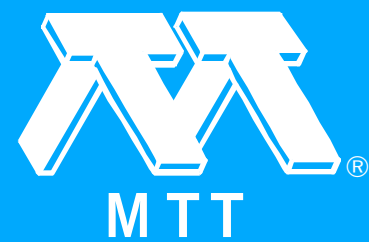
The nature of the spectral gap for leaky waves on a periodic strip-grating structure

S. Majumder, D.R. Jackson, A.A. Oliner and M. Guglielmi. "The nature of the spectral gap for leaky waves on a periodic strip-grating structure." 1997 Transactions on Microwave Theory and Techniques 45.12 (Dec. 1997, Part II [T-MTT] (1997 Symposium Issue)): 2296-2307.

The nature of the spectral gap at forward endfire for a periodic leaky-wave structure consisting of an infinite array of metallic strips on a lossless grounded dielectric layer is studied and compared with that for a simple grounded dielectric layer. The conclusions reached are expected to be valid for a general class of open periodic structures. One of the interesting features of the periodic structure is that a different branch choice is possible for each of the infinite number of space harmonics (although most of these will be nonphysical). This leads to an infinite number of steepest descent planes (SDP's) for the modal solutions, instead of only one as for the dielectric layer. As a result, one finds some interesting differences in the spectral-gap behavior, compared with that for the dielectric layer. One basic difference is that the nature of the spectral gap depends on whether or not a second space harmonic begins radiating before the main radiating harmonic is scanned to forward endfire. The spectral gap resembles that for a lossy dielectric layer when a second space harmonic is also radiating, and resembles that for a lossless dielectric layer otherwise. In addition, for the latter of these cases, the purely bound solution (which has a real propagation wavenumber and which occurs at the high-frequency end of the spectral gap) is physical only over a small frequency range, in contrast to the dielectric layer case, where that solution is present and physical at all higher frequencies. These behavioral differences are explained in detail in this paper.

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Line-loss and size reduction techniques for millimeter-wave RF front-end boards by using a polyimide/alumina-ceramic multilayer configuration

M. Nakatsugawa, A. Kanda, H. Okazaki, K. Nishikawa and M. Muraguchi. "Line-loss and size reduction techniques for millimeter-wave RF front-end boards by using a polyimide/alumina-ceramic multilayer configuration." 1997 Transactions on Microwave Theory and Techniques 45.12 (Dec. 1997, Part II [T-MTT] (1997 Symposium Issue)): 2308-2315.

This paper proposes a concept for constructing low-loss and small-size millimeter-wave RF front-end boards by using a polyimide/alumina-ceramic multilayer configuration. The thick polyimide layer enables us to design low-loss wide microstrip lines (MS's). Moreover, the board size can be reduced by compactly arranging all RF and dc lines in the intermediate layers of the polyimide/alumina-ceramic substrate. The size of a prototype board designed for the quasi-millimeter-wave region is 30 mm/spl times/30 mm. In experiments, it showed 23.2-dB linear gain and 7.4-dBm P/sub -1/ RF output power in transmitter (TX) mode, and 3.1-dB linear gain and -20.1-dBm P/sub -1/ IF output power in receiver (RX) mode. These performance levels agree well with predicted values. This paper further discusses applications to the integration of passive circuits fabricated in the substrate. The proposed configuration has enough potential to integrate all monolithic microwave integrated circuit (MMIC) chips, dc-bias integrated circuits (IC's), and passive circuits, and can improve the total performance in terms of the RF characteristics, board size, and fabrication cost.





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Millimeter-wave holographic power splitting/combining

M. Shahabadi and K. Schunemann. "Millimeter-wave holographic power splitting/combining." 1997 Transactions on Microwave Theory and Techniques 45.12 (Dec. 1997, Part II [T-MTT] (1997 Symposium Issue)): 2316-2323.

It is shown that holography offers a novel solution to the problem of millimeter-wave power splitting and combining. With the help of an approximate model, we demonstrate that a hologram will work as a beam-splitting element, provided that it records the holographic image of the beams to be generated. To verify this observation, a beam splitter consisting of a hologram and an antenna array is analyzed by means of a rigorous network model. This analysis serves to find the optimum structure of the beam splitter. Measurements on a realized prototype of the beam splitter prove the possibility of achieving a high splitting efficiency, a high inter-element isolation, and a relatively large bandwidth. Flexibility in the orientation and the number of outputs is another outstanding feature of this holographic approach.

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Megalithic microwave signal processing for phased-array beamforming and steering

T. Ohira, Y. Suzuki, H. Ogawa and H. Kamitsuna. "Megalithic microwave signal processing for phased-array beamforming and steering." 1997 Transactions on Microwave Theory and Techniques 45.12 (Dec. 1997, Part II [T-MTT] (1997 Symposium Issue)): 2324-2332.

A microwave signal processing (MSP) architecture is presented for active phased array beam forming and steering. A large scale network, comprising 63 power dividers and 32 pairs of vector-synthetic phase/amplitude controllers, has been successfully developed in an 11 mm/spl times/13 mm GaAs monolithic microwave integrated circuit (MMIC). It has a huge integration level of 128 metal-semiconductor field effect transmitters (MESFETs), 448 spiral inductors, 527 metal-insulator-metal (MIM) capacitors, and 357 ion-implanted resistors. The expected 360/spl deg/ phase is successfully obtained at all the output ports. Vector error standard deviations exhibited are within 0.38-dB root-mean square (rms) and 2.8/spl deg/ r.m.s. over the bandwidth of 20 MHz at 2.5 GHz. This megalithic chip could mark an epoch in phased array systems.



Knowledge-based neural models for microwave design

Fang Wang and Qi-Jun Zhang. "Knowledge-based neural models for microwave design." 1997 Transactions on Microwave Theory and Techniques 45.12 (Dec. 1997, Part II [T-MTT] (1997 Symposium Issue)): 2333-2343.

Neural networks have recently been introduced to the microwave area as a fast and flexible vehicle to microwave modeling, simulation and optimization. In this paper, a novel neural network structure, namely, knowledge-based neural network (KBNN), is proposed where microwave empirical or semi-analytical information is incorporated into the internal structure of neural networks. The microwave knowledge complements the capability of learning and generalization of neural networks by providing additional information which may not be adequately represented in a limited set of training data. Such knowledge becomes even more valuable when the neural model is used to extrapolate beyond training data region. A new training scheme employing gradient based $1/\text{sub } 2/$ optimization technique is developed to train the KBNN model. The proposed technique can be used to model passive and active microwave components with improved accuracy, reduced cost of model development and less need of training data over conventional neural models for microwave design.





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A 2-GHz subharmonic sampler for signal downconversion

A. Parssinen, R. Magoon, S.I. Long and V. Porra. "A 2-GHz subharmonic sampler for signal downconversion." 1997 Transactions on Microwave Theory and Techniques 45.12 (Dec. 1997, Part II [T-MTT] (1997 Symposium Issue)): 2344-2351.

Subharmonic sampling is a discrete-time solution to the signal downconversion problem. It can be used either to replace a traditional continuous-time mixer in a superheterodyne receiver or can be combined with other discrete-time analog signal processing blocks in novel receiver architectures. We present a 2-GHz bandwidth integrated mixer based on subharmonic sampling operating at sampling frequencies from 40 MHz to 1.5 GHz. The conversion efficiency is optimized by appropriate choice of the clock duty cycle. The sampler uses a two-diode topology with a 3-V supply. The downconversion loss for the passive sampler is 1 dB and the total system gain 3 dB. The mixer achieves IIP3 of +16-dBm and -1-dB compression +7 dBm for a single-tone input. The circuit was implemented with a 0.6- μm GaAs metal-semiconductor field effect transistor (MESFET) process.

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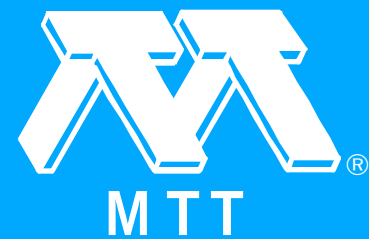


A bi-directional quasi-optical lens amplifier (Dec. 1997, Part II [T-MTT])

S. Hollung, A.E. Cox and Z.B. Popovic. "A bi-directional quasi-optical lens amplifier (Dec. 1997, Part II [T-MTT])." 1997 Transactions on Microwave Theory and Techniques 45.12 (Dec. 1997, Part II [T-MTT] (1997 Symposium Issue)): 2352-2357.

A 24-element bi-directional quasi-optical lens amplifier array is presented. The lens amplifier array is designed for X-band, and operates in transmission mode. Single-pole double-throw (SPDT) switches are used to switch between transmit and receive amplifiers. The lens amplifier array demonstrates gains of 5.5 dB at 10.1 GHz in receive mode, and 2 dB at 10.2 GHz in transmit mode, with more than 15-dB ON/OFF isolation. Several applications for the lens amplifier array are demonstrated: a quasi-optical transceiver front-end, reduction of multipath fading, and a multiuser frequency reuse application.





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Theory and experiment of novel microstrip slow-wave open-loop resonator filters

Jia-Sheng Hong and M.J. Lancaster. "Theory and experiment of novel microstrip slow-wave open-loop resonator filters." 1997 Transactions on Microwave Theory and Techniques 45.12 (Dec. 1997, Part II [T-MTT] (1997 Symposium Issue)): 2358-2365.

This paper presents the theory and experiment of a new class of microstrip slow-wave open-loop resonator filters. A comprehensive treatment of capacitively loaded transmission line resonator is described, which leads to the invention of microstrip slow-wave open-loop resonator. The utilization of microstrip slow-wave open-loop resonators allows various filter configurations including those of elliptic or quasi-elliptic function response to be realized. The filters are not only compact size due to the slow-wave effect, but also have a wider upper stopband resulting from the dispersion effect. These attractive features make the microstrip slow-wave open-loop resonator filters promising for mobile communications, superconducting and other applications. Two filter designs of this type are described in detail. The experimental results are demonstrated and discussed.

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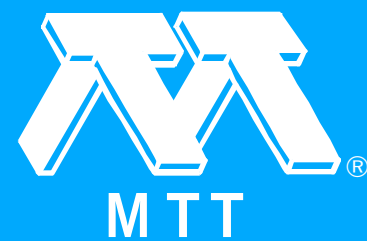


Abstracts

Rigorous and efficient fabrication-oriented CAD and optimization of complex waveguide networks (Dec. 1997, Part II [T-MTT])

F. Alessandri, M. Dionigi, R. Sorrentino and L. Tarricone. "Rigorous and efficient fabrication-oriented CAD and optimization of complex waveguide networks (Dec. 1997, Part II [T-MTT])." 1997 Transactions on Microwave Theory and Techniques 45.12 (Dec. 1997, Part II [T-MTT] (1997 Symposium Issue)): 2366-2374.

A sophisticated computer-aided design (CAD) and optimization tool of complex microwave networks, incorporating fabrication and realizability constraints has been developed. Rigorous full-wave models based on the mode matching technique are adopted along with specific algorithms to speed up both the analysis and optimization of the entire microwave structure. A number of beamforming Butler matrices in waveguide technology characterized by about 240 geometrical parameters have been designed and globally optimized. A full-wave analysis requires less than 1 s per frequency point, while the entire optimization can be performed in less than 1 h, using a PC Pentium 133 MHz.



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Wide-band SSB subharmonically pumped mixer MMIC (Dec. 1997, Part II [T-MTT])

H. Okazaki and Y. Yamaguchi. "Wide-band SSB subharmonically pumped mixer MMIC (Dec. 1997, Part II [T-MTT])." 1997 Transactions on Microwave Theory and Techniques 45.12 (Dec. 1997, Part II [T-MTT] (1997 Symposium Issue)): 2375-2379.

To achieve low conversion-loss and high image-rejection performance in the wide band for up and down conversion, an SSB subharmonically pumped mixer using an inphase RF divider/combiner is proposed. The SSB mixer monolithic microwave integrated circuit (MMIC) is integrated in a small area of 1.8/spl times/1.3 mm/sup 2/ and shows good performance at 21.6 to 30.8 GHz.

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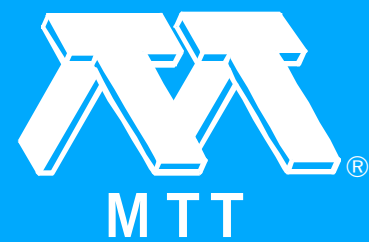


Analysis and optimization of grid oscillators

W.A. Shiroma and Z.B. Popovic. "Analysis and optimization of grid oscillators." 1997 Transactions on Microwave Theory and Techniques 45.12 (Dec. 1997, Part II [T-MTT] (1997 Symposium Issue)): 2380-2386.

A method for assessing and optimizing the feed-back level in a transistor-grid oscillator is presented. Based on the approximate large-signal S-parameters of the transistor, an equivalent circuit model for the grid is synthesized for maximum oscillator power. The resulting circuit serves as a convenient benchmark for determining the level of feedback for a given grid. Experimental results are presented for five different grid oscillators covering S through Ka bands. By varying the substrate thickness and metallization pattern of the grid, the feedback can be optimized in accordance with the theory. A grid with an asymmetric unit cell is shown to deliver almost 60% more effective radiated power (ERP) than a grid with a symmetric unit cell.





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Conductor loaded resonator filters with wide spurious-free stopbands

Chi Wang, K.A. Zaki, A.E. Atia and T.G. Dolan. "Conductor loaded resonator filters with wide spurious-free stopbands." 1997 Transactions on Microwave Theory and Techniques 45.12 (Dec. 1997, Part II [T-MTT] (1997 Symposium Issue)): 2387-2392.

A new configuration of conductor loaded resonator filters using two different size conductor loaded resonators and enclosures with significantly improved spurious performance is presented. A rigorous mode-matching method is used to compute the resonant frequencies, unloaded Q, and the fields of the resonant modes of the conductor (solid or ring) loaded resonators. The coupling coefficients between two resonators are computed using small aperture coupling theory. The stopband characteristics of the filter are investigated. An eight-pole elliptic-function filter was designed, constructed, and tested. Extremely wide spurious-free stopband filter response was obtained which verified the theory.

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Elliptical cavity resonators for dual-mode narrow-band filters

L. Accatino, G. Bertin and M. Mongiardo. "Elliptical cavity resonators for dual-mode narrow-band filters." 1997 Transactions on Microwave Theory and Techniques 45.12 (Dec. 1997, Part II [T-MTT] (1997 Symposium Issue)): 2393-2401.

A novel cavity resonator with elliptical cross section is proposed in order to realize dual-mode narrow-band filters without tuning and coupling elements. The absence of any discontinuity inside the cavities significantly enhances the unloaded Q , the ability to operate with higher power levels, and the ease of manufacturing. Proper choice of the ellipticity and of the inclination angle controls the desired coupling and tuning actions. Dual-mode coupling is generated by the step discontinuity between the input rectangular waveguide and an inclined elliptical waveguide. A rigorous full-wave electromagnetic model for this discontinuity has been developed and validated using a specialized hardware configuration. Experimental data compare very favorably with theoretical results. Representative prototypes of elliptical cavities exhibiting various degrees of coupling have been carefully measured proving the accuracy of the model and its applicability for narrow-band X- and Ku-band filter design. The full-wave analysis of a complete four-pole narrow-band elliptic filter at 12 GHz and the measured response of a corresponding prototype demonstrate the capability of achieving reliable results using the proposed approach.

Click on title for a complete paper.



Abstracts

Microwave phase shift using ferrite-filled waveguide below cutoff (Dec. 1997, Part II [T-MTT])

C.R. Boyd. "Microwave phase shift using ferrite-filled waveguide below cutoff (Dec. 1997, Part II [T-MTT])." 1997 Transactions on Microwave Theory and Techniques 45.12 (Dec. 1997, Part II [T-MTT] (1997 Symposium Issue)): 2402-2407.

Unlike conventional waveguides, lossless ferrite-filled guides may exhibit a complex propagation factor below cutoff of the dominant TE mode when a transverse magnetic bias field is applied. In that case, the field in a very long waveguide has the character of a traveling wave whose amplitude decays exponentially with distance from the driven end. The wavelength and the magnitude of the applied bias field are inversely related, and at zero field as the gyromagnetic effects vanish in the ferrite the wavelength becomes infinite. For a bias field of one polarity, the traveling wave will be a forward wave, and for the opposite polarity it will be a backward wave. This peculiar behavior allows phase shift to be produced in a bandpass filter-like structure in which small cross-section below-cutoff ferrite waveguide sections alternate with sections of high dielectric constant material.



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Abstracts

The waveguide below-cutoff attenuation standard (Dec. 1997, Part II [T-MTT])

D.H. Russell. "The waveguide below-cutoff attenuation standard (Dec. 1997, Part II [T-MTT])." 1997 Transactions on Microwave Theory and Techniques 45.12 (Dec. 1997, Part II [T-MTT] (1997 Symposium Issue)): 2408-2413.

A semitutorial review of the history, development, and application of waveguide below-cutoff (WBCO) attenuation standards is presented. A brief summary of the electromagnetic (EM) theory is followed by descriptions of the various designs implemented over a span of 60 years. Designs range from simplistic to elaborate electromechanical creations that stretch the toolmaker's art yet are ultimately dependent upon the primary standard of length.



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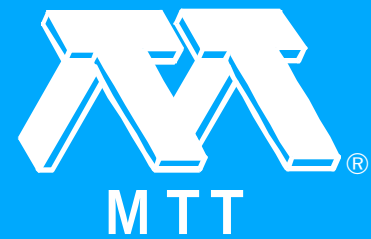


Abstracts

A (historical) review of the six-port measurement technique

G.F. Engen. "A (historical) review of the six-port measurement technique." 1997 Transactions on Microwave Theory and Techniques 45.12 (Dec. 1997, Part II [T-MTT] (1997 Symposium Issue)): 2414-2417.

The six-port measurement technique has found wide acceptance and has played a major role in microwave metrology, particularly in national standards laboratories. This paper reviews the development of this technology and includes some historical background.



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A 94-GHz 0.35-W power amplifier module

Pin-Pin Huang, Tian-Wei Huang, Huei Wang, E.W. Lin, Yonghui Shu, G.S. Dow, R. Lai, M. Biedenbender and J.H. Elliott. "A 94-GHz 0.35-W power amplifier module." 1997 Transactions on Microwave Theory and Techniques 45.12 (Dec. 1997, Part II [T-MTT] (1997 Symposium Issue)): 2418-2423.

This paper presents a 94-GHz power amplifier (PA) module. This module contains three identical monolithic microwave integrated circuit (MMIC) PA chips and demonstrates 0.35-W output power at the waveguide output port with a miniature size. The MMIC PA is a two-stage monolithic W-band PA using 0.1- μm pseudomorphic AlGaAs/InGaAs/GaAs T-gate power high electron mobility transistor (HEMT) process. This MMIC PA exhibits a measured linear gain of 8 dB and a maximum output power of 300 mW with 10.5% peak power-added efficiency (PAE) at 94 GHz. To our knowledge, both the 300-mW output power MMIC PA and the 0.35-W PA module represent the highest output power amplification component performance at this frequency.

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A 6-W Ka-band power module using MMIC power amplifiers

D.L. Ingram, D.I. Stones, J.H. Elliott, Huei Wang, R. Lai and M. Biedenbender. "A 6-W Ka-band power module using MMIC power amplifiers." 1997 Transactions on Microwave Theory and Techniques 45.12 (Dec. 1997, Part II [T-MTT] (1997 Symposium Issue)): 2424-2430.

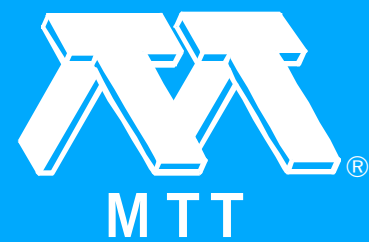
This paper presents the development of a 6-W 24% power-added efficiency (PAE) Ka-band power module with an associated power gain of 21.5 dB. The power module consists of a driver amplifier and two power amplifier chips. These monolithic millimeter-wave integrated (MMIC) amplifiers were fabricated with a 2-mil-thick substrate using 0.15- μm InGaAs/AlGaAs/GaAs high electron mobility transistor (HEMT) technology. The driver amplifier is a fully matched single-ended design with an output power of 27.5 dBm, a 10.7-dB power gain and 27% PAE. We use a hybrid approach for the output power amplifier, which consists of two partially matched MMIC chips and an eight-way Wilkinson combiner fabricated on alumina substrate. The MMIC power amplifiers delivered a record power of 35.4 dBm (3.5 W) with a PAE of 28% and an associated power gain of 11.5 dB. The eight-way combiner has an insertion loss of 0.6 dB.



A microwave miniaturized linearizer using a parallel diode with a bias feed resistance

K. Yamauchi, K. Mori, M. Nakayama, Y. Mitsui and T. Takagi. "A microwave miniaturized linearizer using a parallel diode with a bias feed resistance." 1997 Transactions on Microwave Theory and Techniques 45.12 (Dec. 1997, Part II [T-MTT] (1997 Symposium Issue)): 2431-2435.

A miniaturized linearizer using a parallel diode with a bias feed resistance has been proposed. The linearizer has positive gain and negative phase deviations and can be used as a linearizer for power amplifiers. These characteristics are provided by a nonlinearity of the diode and movement of bias point caused by a voltage drop at the bias feed resistance. By applying this linearizer to an S-band power amplifier, improvement of adjacent channel leakage power of 5 dB and improvement of power-added efficiency of 8.5% have been achieved for the $\pi/4$ -shift QPSK modulated signal.



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Wide-tuning range Si bipolar VCOs based on three-dimensional MMIC technology

K. Kamogawa, K. Nishikawa, C. Yamaguchi, M. Hirano, I. Toyoda and T. Tokumitsu. "Wide-tuning range Si bipolar VCOs based on three-dimensional MMIC technology." 1997 *Transactions on Microwave Theory and Techniques* 45.12 (Dec. 1997, Part II [T-MTT] (1997 Symposium Issue)): 2436-2443.

The first completely integrated silicon (Si) bipolar junction transistor (BJT) voltage-controlled oscillators (VCOs), based on three-dimensional (3-D) monolithic-microwave integrated-circuit (MMIC) technology are presented in this paper. The 3-D MMIC technology offers the use of reactive matching in circuit design as well as GaAs MMIC construction and expands the operation frequency of Si MMICs. Two types of VCO MMICs using 0.5- μm Si BJTs are presented and demonstrated. Both exhibit a very wide frequency tuning range in the 5- and 6-GHz bands. The former offers the frequency tuning range of 33% using the base-emitter conductance operation of the BJT, which works like a varistor with a large ratio. Furthermore, the oscillation frequency is remarkably linear against the controlled base bias. To confirm the wide-tuning ability of the proposed VCO at higher frequencies, a 7-GHz-band VCO is fabricated on the same Si masterslice array used for the 5-GHz-band VCO. It achieves a 28% tuning range from 5.53 to 7.09 GHz at the collector bias of 2 V. The latter, whose frequency is controlled by a varactor diode, also offers a wide tuning range from 5.15 to 6.75 GHz. The phase noise achieved ranges from -95 dBc/Hz to -117 dBc/Hz at 1-MHz offset frequency over the tuning range of 1.6 GHz (best phase noise performance is -90.5 dBc/Hz at 100 kHz). Measured results show that 3-D MMIC Si VCO's can be developed that yield frequencies above 7 GHz.

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Millimeter-wave radar sensor for automotive intelligent cruise control (ICC)

M.E. Russell, A. Crain, A. Curran, R.A. Campbell, C.A. Drubin and W.F. Miccioli. "Millimeter-wave radar sensor for automotive intelligent cruise control (ICC)." 1997 Transactions on Microwave Theory and Techniques 45.12 (Dec. 1997, Part II [T-MTT] (1997 Symposium Issue)): 2444-2453.

If automotive intelligent cruise-control (ICC) systems are to be successful in the marketplace, they must provide robust performance in a complex roadway environment. Inconveniences caused by reduced performance during inclement weather, interrupted performance due to dropped tracks, and annoying nuisance alarms will not be tolerated by the consumer, and would likely result in the rejection of this technology in the marketplace. An all-weather automotive millimeter-wave (MMW) radar sensor is described that uses a frequency-modulation coplanar-wave (FMCW) radar design capable of acquiring and tracking all obstacles in its field of view. Design tradeoffs are discussed and radar-sensor test results are presented along with the applicability of the radar to collision-warning systems.

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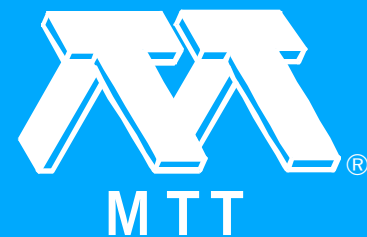


Abstracts

Measurement of transmittance and scattering of radome membranes from 30 to 1000 GHz (Dec. 1997, Part II [T-MTT])

M.N. Afsar, I.I. Tkachov and T.B. Wells. "Measurement of transmittance and scattering of radome membranes from 30 to 1000 GHz (Dec. 1997, Part II [T-MTT])." 1997 Transactions on Microwave Theory and Techniques 45.12 (Dec. 1997, Part II [T-MTT] (1997 Symposium Issue)): 2454-2460.

Transmittance of a number of woven and nonwoven radome membranes with various diameters of threads of the fabric and thickness of the laminate has been studied as a continuous function of frequency over the 30-1000-GHz range by utilizing Fourier transform spectroscopy (FTS). These woven and nonwoven radome membranes, now known as "Gore-Tex," were manufactured by W. L. Gore and Associates, Inc. In this paper and for the first time, the transmittance has been measured with various angles of incidence of the incident wave for both TE and TM modes. Strong diffractive scattering has been found above the frequency with wavelength comparable with the fabrics' period (240 GHz for the standard Gore-Tex product). Gore-Tex woven-membrane materials were found to be suitable for radome applications up to 1000 GHz.



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Determination of wave noise sources using spectral parametric modeling (Dec. 1997, Part II [T-MTT])

T. Werling, E. Bourdel, D. Pasquet and A. Boudiaf. "Determination of wave noise sources using spectral parametric modeling (Dec. 1997, Part II [T-MTT])." 1997 Transactions on Microwave Theory and Techniques 45.12 (Dec. 1997, Part II [T-MTT] (1997 Symposium Issue)): 2461-2467.

A new method for the extraction of a noise correlation matrix is presented in this paper. This method is based on a kind of reflectometric technique which needs two noise-power measurements corresponding to two different input coefficients for the extraction of the wave correlation matrix. Then, we measure those two noise-power densities emanating from the device under test (DUT) transistor and compute their inverse Fourier transform (FT) in order to find out noise-power behaviors in time domain. Thus, one may apply spectral parametric modeling to this power spectral density (PSD) for the estimation of noise sources that model the DUT noisy two-port. Finally, we calculate the standard noise parameters of the transistor, and the results obtained by this new method are experimentally compared with a conventional method.





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Design of planar circuit structures with an efficient magnetostatic-field solver

S. Lindenmeier and P. Russer. "Design of planar circuit structures with an efficient magnetostatic-field solver." 1997 Transactions on Microwave Theory and Techniques 45.12 (Dec. 1997, Part II [T-MTT] (1997 Symposium Issue)): 2468-2473.

We introduce a highly efficient field solver for the calculation of the quasi-static magnetic field in order to design lossless planar circuit elements with nearly arbitrary shape. The field solver is based on a finite-difference (FD) formulation of a scalar magnetic potential, using potential partitioning surfaces (PPS's). The modeling of the quasi-static fields in distributed circuit elements leads to the development of lumped element equivalent circuits in a very fast and efficient way. For structures with sizes far below the wavelength, the equivalent circuits can be derived in a direct way. For the field modeling of larger structures, the quasi-static field solver can be used in a hybrid full-wave analysis as well. Numerical examples are presented for different planar-circuit elements.

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Modeling of conductor loss in coplanar circuit elements by the method of lines

L. Vietzorreck and W. Pascher. "Modeling of conductor loss in coplanar circuit elements by the method of lines." 1997 Transactions on Microwave Theory and Techniques 45.12 (Dec. 1997, Part II [T-MTT] (1997 Symposium Issue)): 2474-2478.

The small dimensions of coplanar waveguides (CPW's) require due consideration of finite conductivity and metallization thickness. For this purpose, an efficient method of lines (MoL) approach for full-wave analysis of microstrip discontinuities is considerably extended. Two alternative models for the conductor loss are employed depending on the skin depth. Their respective region of validity is investigated and the current distribution in the center conductor of a CPW is given. Several cascaded discontinuities including a coplanar quarter-wave transformer and a short-end series stub in a microshield line are characterized.

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Modeling of conductor-loaded resonators and filters in rectangular enclosures

Chi Wang, Hui-Wen Yao and K.A. Zaki. "Modeling of conductor-loaded resonators and filters in rectangular enclosures." 1997 Transactions on Microwave Theory and Techniques 45.12 (Dec. 1997, Part II [T-MTT] (1997 Symposium Issue)): 2479-2485.

Full-wave modeling of conductor-loaded resonators in rectangular enclosures and the associated coupling structure is presented. The modeling yields generalized scattering matrices of the cylindrical conductor-loaded resonators in rectangular waveguides. By applying short and open conditions and cascading procedure, resonant frequencies, field distributions of the resonator, and coupling coefficients between two cavities through an iris are obtained. The computed results are compared with the measured data and both are in good agreement. A four-and an eight-pole dual-mode elliptic-function filter were designed, constructed, and tested. Measured frequency responses of the filters verify the theory.





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Design of SAW expander and compressor on LiTaO/sub 3/ for a TCDMA spread spectrum system

R. Weigel, F. Kalabic, G. Ostermayer, A. Pohl, F. Seifert and L. Reindl. "Design of SAW expander and compressor on LiTaO/sub 3/ for a TCDMA spread spectrum system." 1997 Transactions on Microwave Theory and Techniques 45.12 (Dec. 1997, Part II [T-MTT] (1997 Symposium Issue)): 2486-2492.

We report on the design and performance of surface-acoustic wave (SAW) minimum shift keying (MSK) tapped delay lines using pseudonoise code sequences with a length of 128 chips. As a substrate, X112/spl deg/rotY-LiTaO/sub 3/ has been used due to the system requirements of a given CDMA/TDMA (TCDMA) radio communication system. System IF frequency, bandwidth of the major lobe, and integration time of the SAW devices were, respectively, 360 MHz, 63.5 MHz, and 3 /spl mu/s. We used SAW tapped delay lines employing nonweighted as well as cosine-weighted input interdigital transducers incorporating split-fingers. We designed both expander as well as compressor filters attaining very similar experimental results. We found insertion loss values down to 16 dB and amplitude ripples of less than 2 dB. The close-in selectivity was 28 dB.

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HBT high-frequency modeling and integrated parameter extraction

Qian Cai, J. Gerber, U.L. Rohde and T. Daniel. "HBT high-frequency modeling and integrated parameter extraction." 1997 Transactions on Microwave Theory and Techniques 45.12 (Dec. 1997, Part II [T-MTT] (1997 Symposium Issue)): 2493-2502.

This paper presents, for the first time, a novel nonlinear model for accurate dc, small-signal, and noise characterization of AlGaAs-GaAs heterojunction bipolar transistors (HBTs). A new set of equations are introduced to take into account the bias, temperature, and frequency dependencies in noise calculations. This model provides significant improvement in predicting small-signal noise for HBT-based circuits. We also present an integrated method for accurate HBT model parameter extraction by fitting the dc, multibias S-parameter, and noise measurements simultaneously. The extracted model provides accurate small-signal, dc current, and noise characteristics. This technique is general and can be used for parameter extraction of other microwave devices such as MESFETs and high electron mobility transistors (HEMTs). Our new HBT model is validated using devices from different foundries. An integrated parameter extraction technique is demonstrated for a foundry HBT and excellent results are obtained.

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Abstracts

Nonlinear modeling of SiGe HBTs up to 50 GHz

C.N. Rheinfelder, F.J. Beißwanger and W. Heinrich. "Nonlinear modeling of SiGe HBTs up to 50 GHz." 1997 Transactions on Microwave Theory and Techniques 45.12 (Dec. 1997, Part II [T-MTT] (1997 Symposium Issue)): 2503-2508.

A new large-signal model for SiGe heterostructure bipolar transistors (HBTs) is presented that includes nonideal leakage currents, Kirk-effect, and thermal behavior. The parameters are extracted from S-parameter measurements using a special procedure which is insensitive to tolerances in measurement data. The model yields excellent accuracy for dc and S parameters up to 50 GHz. It proved its usefulness in MMIC oscillator design at 26 and 38 GHz.



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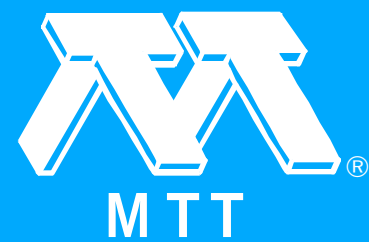
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Transfer characteristic of IM/sub 3/ relative phase for a GaAs FET amplifier (Dec. 1997, Part II [T-MTT])

N. Suematsu, Y. Iyama and O. Ishida. "Transfer characteristic of IM/sub 3/ relative phase for a GaAs FET amplifier (Dec. 1997, Part II [T-MTT])." 1997 Transactions on Microwave Theory and Techniques 45.12 (Dec. 1997, Part II [T-MTT] (1997 Symposium Issue)): 2509-2514.

The transfer characteristic of relative phase of the third-order intermodulation distortion (IM/sub 3/) of a GaAs FET amplifier is measured and analyzed. The measurement system and method are also described. For drives in the weakly nonlinear region, the measured relative phase of IM/sub 3/ is equal to that of the carrier and is in agreement with the analysis results using Volterra-series representation. For drives in the saturation region, the measured relative phase of IM/sub 3/ versus the input power moves drastically compared with that of the carrier and is in agreement with numerical analysis using discrete Fourier transform. Comparison between measured and analytical results shows the drastic move of IM/sub 3/ relative phase is caused by the generation of IM/sub 3/ due to AM-PM conversion. The measured results and the measurement method are useful for the design and adjustment of predistortion-type linearizers for GaAs FET high-power amplifiers.



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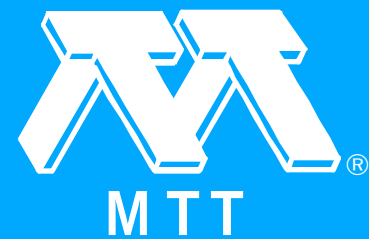
Design and optimization of CPW circuits using EM-ANN models for CPW components

P.M. Watson and K.C. Gupta. "Design and optimization of CPW circuits using EM-ANN models for CPW components." 1997 Transactions on Microwave Theory and Techniques 45.12 (Dec. 1997, Part II [T-MTT] (1997 Symposium Issue)): 2515-2523.

Accurate and efficient electromagnetically trained artificial neural-network (EM-ANN) models have been developed for coplanar waveguide (CPW) circuit components. Modeled components include: CPW transmission lines (frequency dependent Z_{0l} and $|S|_{\text{epsiv}/\text{re}}$), 90/spl deg/ bends, short-circuit stubs, open-circuit stubs, step-in-width discontinuities, and symmetric T-junctions. These models allow for circuit design, simulation, and optimization within a commercial microwave circuit simulator environment, while providing the accuracy of electromagnetic (EM) simulation. Design and optimization of a CPW folded double-stub filter and a 50-/spl Omega/ 3-dB power divider circuit using the developed CPW EM-ANN models are demonstrated.

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Three-dimensional masterslice MMIC on Si substrate (Dec. 1997, Part II [T-MTT])

I. Toyoda, K. Nishikawa, T. Tokumitsu, K. Kamogawa, C. Yamaguchi, M. Hirano and M. Aikawa. "Three-dimensional masterslice MMIC on Si substrate (Dec. 1997, Part II [T-MTT])." 1997 Transactions on Microwave Theory and Techniques 45.12 (Dec. 1997, Part II [T-MTT] (1997 Symposium Issue)): 2524-2530.

This paper describes Si-based three-dimensional (3-D) monolithic microwave integrated circuit (MMIC) technology. This technology greatly improves the operating frequency of Si MMIC's up to the Ku band and makes them competitive with GaAs MMIC's in the higher frequency band. The characteristics of the coplanar waveguide formed on a lossy Si substrate and the TFMS line which is a basic element of the 3-D MMIC are numerically compared and discussed. An X-band amplifier, mixer, and highly integrated single-chip receiver using Si bipolar transistors are demonstrated to highlight the advantages of the Si 3-D MMIC technology. The cost reduction effect of the technology is also discussed. In our estimation, cost reduction of about 95% from conventional GaAs 2-D MMIC's can be achieved.

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Abstracts

Highly integrated RF-IC's for GSM and DECT systems-A status review

J. Fenk. "Highly integrated RF-IC's for GSM and DECT systems-A status review." 1997 Transactions on Microwave Theory and Techniques 45.12 (Dec. 1997, Part II [T-MTT] (1997 Symposium Issue)): 2531-2539.

TDMA based digital systems like GSM for cellular and DECT for cordless application have created an increasing market within Europe and gained widespread acceptance also outside Europe. This paper gives an overview of both systems, The system requirements and their influences on highly integrated RF IC's for GSM and DECT are discussed in detail. The various trends of progresses in integration of both systems will be shown, with the different advantages and the disadvantages of the concepts in use. The challenges of increasing the level of integration and an outlook to future will be presented.



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Embedded transmission-Line (ETL) MMIC for low-cost high-density wireless communication applications

Hua-Quen Tserng, P. Saunier, A. Ketterson, L.C. Witkowski and T. Jones. "Embedded transmission-Line (ETL) MMIC for low-cost high-density wireless communication applications." 1997 Transactions on Microwave Theory and Techniques 45.12 (Dec. 1997, Part II [T-MTT] (1997 Symposium Issue)): 2540-2548.

A new embedded transmission-line (ETL) monolithic-microwave integrated-circuit (MMIC) approach which allows flexibility in mixing different transmission-line types (i.e., coplanar and striplines) for maximum MMIC design flexibility and permits the feasibility of eliminating backside processing for low production cost is described. This ETL MMIC approach is an enabling technology allowing for low-cost batch fabrication, and high-density integration of microwave and RF components (including silicon mixed-signal products) for emerging wireless communication applications. Designs and performance results of a number of ETL MMICs are described in this paper.



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High-frequency low-power ICs in a scaled submicrometer HBT technology

M. Hafizi. "High-frequency low-power ICs in a scaled submicrometer HBT technology." 1997 Transactions on Microwave Theory and Techniques 45.12 (Dec. 1997, Part II [T-MTT] (1997 Symposium Issue)): 2549-2554.

Fast, dense, and low-power integrated circuits (ICs) have been developed using a new scaled heterojunction bipolar transistor (HBT) IC process. HBTs have been fabricated with emitter dimensions of $0.3 \mu\text{m}/\text{m}^2$ and a circuit metallization pitch of $4 \mu\text{m}/\text{m}$ to reduce power and compact the chip size. Submicrometer HBTs exhibited f_T of over 160 GHz. A number of circuits using this new technology have been demonstrated, including a low-power comparator test chip clocked at 40 GHz and an ultra-low-power phase-locked-loop-based (PLL) clock and data-recovery circuit consuming 22-mW dc power at 4 GHz.

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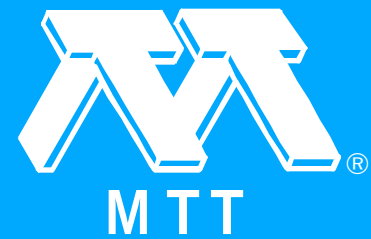


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Index, IEEE [T-MTT] 1997, Volume 45, and IEEE MTT-S Sponsored Conferences

"Index, IEEE [T-MTT] 1997, Volume 45, and IEEE MTT-S Sponsored Conferences." 1997 Transactions on Microwave Theory and Techniques 45.12 (Dec. 1997, Part II [T-MTT] (1997 Symposium Issue)): 2555-2664.

This index covers all technical items - papers, correspondence, reviews, etc. - that appeared in these periodicals during 1997, and items from previous years that were commented upon or corrected in 1997.



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"Table of Contents (Jan. 1997 [MGWL])." 1997 Microwave and Guided Wave Letters 7.1 (Jan. 1997 [MGWL]): 0_1-0_1.



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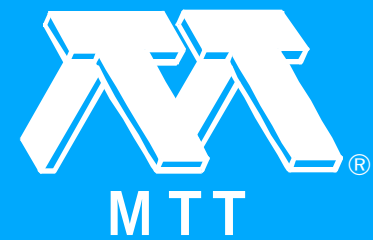
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"Inside Cover (Jan. 1997 [MGWL])." 1997 Microwave and Guided Wave Letters 7.1 (Jan. 1997 [MGWL]): 0_2-0_2.



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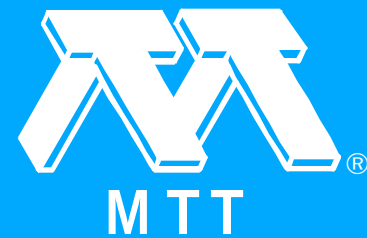


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Editorial (Jan. 1997 [MGWL])

R. Sorrentino. "Editorial (Jan. 1997 [MGWL])." 1997 Microwave and Guided Wave Letters 7.1 (Jan. 1997 [MGWL]): 1-1.

This is the seventh anniversary of the IEEE MICROWAVE AND GUIDED WAVE LETTERS (MGWL) and is also the last year of my term as the Editor-in-Chief. As is well known, MGWL is intended to provide a quick means of dissemination of significant new development of topical interest, written in a concise manner, relevant to microwave, millimeter-wave, and guided wave technologies. Key issues are: conciseness, novelty, high quality, and a quick evaluation process.



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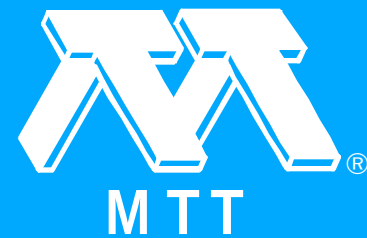


Abstracts

Asia-Pacific Abstracts Associate Editors (Jan. 1997 [MGWL])

R. Sorrentino. "Asia-Pacific Abstracts Associate Editors (Jan. 1997 [MGWL])." 1997 Microwave and Guided Wave Letters 7.1 (Jan. 1997 [MGWL]): 2-2.

The Asia-Pacific Abstracts, taken from journals published in Australia, India, China, Korea, and Japan, are an important source of information that is provided in each December issue to the readers of the IEEE MICROWAVE AND GUIDED WAVE LETTERS (MGWL).



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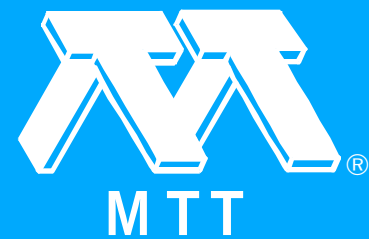


Abstracts

On the effects of hot electrons on the DC and RF characteristics of lattice-matched InAlAs/InGaAs/InP HEMTs

R. Menozzi, M. Borgarino, Y. Baeyens, M. Van Hove and F. Fantini. "On the effects of hot electrons on the DC and RF characteristics of lattice-matched InAlAs/InGaAs/InP HEMTs." 1997 Microwave and Guided Wave Letters 7.1 (Jan. 1997 [MGWL]): 3-5.

The authors for the first time present results of hot electron stressing of InAlAs/InGaAs/InP high electron mobility transistors (HEMTs). High drain bias, room temperature stress cycles have been applied to 0.3 μm , SiN-passivated, lattice-matched devices, and the changes of the DC and RF (up to 50 GHz) characteristics have been studied. Both the DC and RF device gain degrade after stressing; the effect of the stress on the unity current gain cutoff frequency $f_{\text{sub T}}$ is studied under different bias conditions. Results indicate that surface degradation may be responsible for the observed changes.



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InAlAs/InGaAs metamorphic low-noise HEMT

M. Kawano, T. Kuzuhara, H. Kawasaki, F. Sasaki and H. Tokuda. "InAlAs/InGaAs metamorphic low-noise HEMT." 1997 Microwave and Guided Wave Letters 7.1 (Jan. 1997 [MGWL]): 6-8.

An In/sub 0.52/Al/sub 0.48/As/In/sub 0.53/Ga/sub 0.47/As metamorphic low-noise high electron mobility transistor (HEMT) has been developed. A growth temperature by molecular beam epitaxy (MBE) and a thickness of a linearly graded InAlAs buffer layer have been optimized in order to reduce the density of lattice-misfit dislocation. Relatively high sheet electron density and mobility of $2.6 \times 10^{12} \text{ cm}^{-2}$ and $9500 \text{ cm}^2/\text{V sec}$ at room temperature, respectively, are obtained. A $0.1 \text{ m}\Omega/\text{m}$ -gate low-noise HEMT is fabricated using the developed epitaxial wafer. A minimum noise figure of 0.48 dB with an associated gain of 14.2 dB has been obtained at 18 GHz.



Time-domain model synthesis of microstrip

Qing-Xin Chu, Fung-Yuel Chang, Yuen-Pat Lau and Omar Wing. "Time-domain model synthesis of microstrip." 1997 Microwave and Guided Wave Letters 7.1 (Jan. 1997 [MGWL]): 9-11.

The time-domain model of a microstrip line is synthesized by means of deconvolution of response voltages and currents simulated by finite-difference time-domain (FDTD) method. With the model, the response voltages and currents of any excitation of the line with any loads can be easily and rapidly simulated, instead of using time-consuming FDTD again. This model has been applied to simulate the responses of several excitations and the voltage response of a diode terminating the microstrip line. The results show good agreement with the direct FDTD simulation.



Abstracts

The generalized TLM-based FDTD-summary of recent progress

Zhizhang Chen and Jian Xu. "The generalized TLM-based FDTD-summary of recent progress." 1997 Microwave and Guided Wave Letters 7.1 (Jan. 1997 [MGWL]): 12-14.

The transmission-line-matrix (TLM)-based finite-difference time-domain (FDTD) method has been generalized recently to incorporate graded mesh and anisotropic media. The method is equivalent to the three-dimensional TLM symmetrical condensed node, but is formulated and computed in a FDTD fashion. Therefore, it retains certain features of both the TLM and FDTD methods. The authors report recent progress in modeling with the TLM-based FDTD method, namely, successful implementation of the perfectly matched layer (PML) and simulation of nonlinear wave propagation.



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45-GHz MMIC power combining using a circuit-fed, spatially combined array

J.T. Delisle, M.A. Gouker and S.M. Duffy. "45-GHz MMIC power combining using a circuit-fed, spatially combined array." 1997 Microwave and Guided Wave Letters 7.1 (Jan. 1997 [MGWL]): 15-17.

We describe the design and measurement of a hybrid-circuit, tile-approach subarray for use in spatial power-combined transmitters. The subarray consists of 16 monolithic millimeter-wave integrated circuit (MMIC) amplifiers, each feeding a circularly polarized cavity-backed microstrip antenna. The average performance across the 43.5-45.5 GHz band is as follows: EIRP 18.3 dBW, DC-RF efficiency 10.3%, effective transmitter power 530 mW, system gain 13.2 dB, and combining efficiency of 46.2%. The minimum axial ratio is 1.2 dB at 43.9 GHz, and the array has a 3% 3-dB axial ratio bandwidth.

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Abstracts

Patent Abstracts (Jan. 1997 [MGWL])

"Patent Abstracts (Jan. 1997 [MGWL])." 1997 Microwave and Guided Wave Letters 7.1 (Jan. 1997 [MGWL]): 18-23.

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"IEEE Copyright Form (Jan. 1997 [MGWL])." 1997 Microwave and Guided Wave Letters 7.1 (Jan. 1997 [MGWL]): 0_3-0_4.



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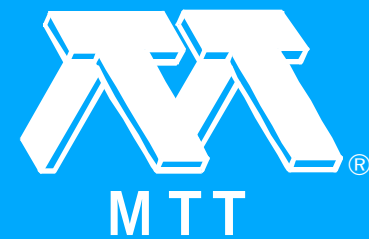
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Abstracts

27th European Microwave Conference and Exhibition (Announcement) (Jan. 1997 [MGWL])

*"27th European Microwave Conference and Exhibition (Announcement) (Jan. 1997 [MGWL])."
1997 Microwave and Guided Wave Letters 7.1 (Jan. 1997 [MGWL]): 0_5-0_5.*



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Finite Elements for Wave Electromagnetics - Methods and Techniques (Advertisement) (Jan. 1997 [MGWL])

"Finite Elements for Wave Electromagnetics - Methods and Techniques (Advertisement) (Jan. 1997 [MGWL])." 1997 Microwave and Guided Wave Letters 7.1 (Jan. 1997 [MGWL]): 0_6-0_6.



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Structural Engineering of Microwave Antennas for Mechanical Civil Engineers (Advertisement) (Jan. 1997 [MGWL])

*"Structural Engineering of Microwave Antennas for Mechanical Civil Engineers (Advertisement)
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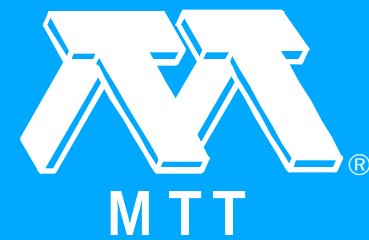
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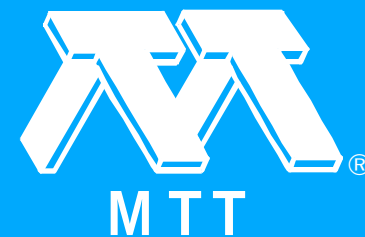
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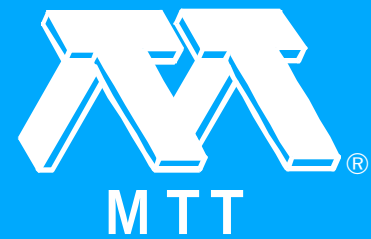
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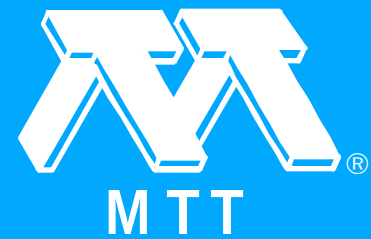
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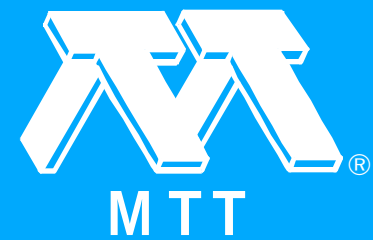
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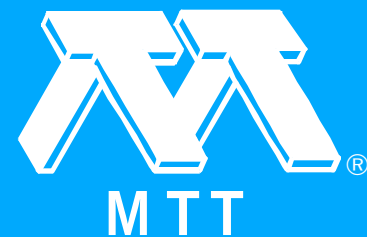


Abstracts

Modal PML

M. Okoniewski, M.A. Stuchly, M. Mrozowski and J. DeMoerloose. "Modal PML." 1997 Microwave and Guided Wave Letters 7.2 (Feb. 1997 [MGWL]): 33-35.

Hybrid numerical techniques in time domain offer computationally efficient means of analysis of certain classes of microwave structures. One of the recently proposed techniques combines the finite-difference time-domain (FDTD) method with the eigenfunction expansion. This method has proven to be very efficient in the analysis of properties of complex planar transmission lines and waveguide discontinuity problems. To achieve full functionality, in particular in the context of the discontinuity analysis, this method has to be complemented by a suitable high-performance absorbing boundary condition. In this letter, we examine a modified Berenger's perfectly matched layer (PML). Tests in a waveguide indicate that low reflections can be obtained in a wide frequency range with few layers of the absorbing medium with a properly selected conductivity profile.



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Low thermal impedance MMIC technology

D. Hill, R. Yarborough, Tae Kim and Hin-Fai Chau. "Low thermal impedance MMIC technology." 1997 Microwave and Guided Wave Letters 7.2 (Feb. 1997 [MGWL]): 36-38.

A technology has been developed that reduces the thermal resistance of monolithic microwave integrated circuits (MMICs). Novel processing techniques are used to fabricate thin-film capacitors and microstrip lines on the back side of the chip. The front side of the chip is metallized to serve as the ground-plane; the completed chip is assembled inverted so that the active devices are next to the heat sink, but the chip otherwise is a drop-in replacement for conventional MMICs. With very conservative deembedding of circuit losses, an AlGaAs/GaAs heterojunction bipolar transistor (HBT) fabricated in this technology achieved record performance at 20 GHz: over 1.2 W output power with 53% power-added efficiency while operating at 12.7 V.

Click on title for a complete paper.



High-efficiency power amplifier integrated with antenna

V. Radisic, Siou Teck Chew, Yongxi Qian and T. Itoh. "High-efficiency power amplifier integrated with antenna." 1997 Microwave and Guided Wave Letters 7.2 (Feb. 1997 [MGWL]): 39-41.

Two class B GaAs field-effect transistor (FET) power amplifiers integrated with patch antennas have been designed and fabricated at 2.48 GHz. Both amplifiers are integrated with patch antennas, which serve as load and radiator. In one case, a standard patch design was used with random harmonic termination. In another case, a modified patch design was used, which allows the tuning of the second harmonic. In this case the antenna has an additional function of a filter. An increase of 7% in the power-added efficiency (PAE) and 0.5 dB in the output power was achieved through the second harmonic tuning.





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Broadband spatially combined amplifier array using tapered slot transitions in waveguide

A. Alexanian and R.A. York. "Broadband spatially combined amplifier array using tapered slot transitions in waveguide." 1997 Microwave and Guided Wave Letters 7.2 (Feb. 1997 [MGWL]): 42-44.

Most reported spatially combined or quasioptical amplifier arrays exhibit resonant narrowband performance (<10%) and have not addressed thermal management issues. We report a waveguide-based spatial combining scheme using broadband tapered-slot transitions, capable of realizing full waveguide band coverage (40% fractional bandwidth) with good thermal properties. An X-band prototype using eight medium-power GaAs monolithic microwave integrated circuits (MMICs) produced an output power of 2.4 W and 9-dB power gain at 1-dB compression, with a combining efficiency of 68% and ± 1 -dB gain variation over the full waveguide band (8-12 GHz).

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High Q CMOS-compatible microwave inductors using double-metal interconnection silicon technology

Min Park, Seonghearn Lee, Hyun Kyu Yu, Jin Gun Koo and Kee Soo Nam. "High Q CMOS-compatible microwave inductors using double-metal interconnection silicon technology." 1997 Microwave and Guided Wave Letters 7.2 (Feb. 1997 [MGWL]): 45-47.

The authors' aim is to demonstrate the possibility of building high quality factor (Q) integrated inductors in the conventional complementary metal-oxide semiconductor (CMOS) process without any additional processes of previous papers, such as thick gold layer or multilayer interconnection. The comparative analysis is extensively carried out to investigate the detailed variation of Q performance according to inductor shape and substrate by varying the substrate resistivity with circular and rectangular shape. The high Q of nearly 12 is achieved from the fabricated inductors with 2 μm metal thickness on the 2 k Ω /cm silicon substrate using the CMOS process.



Numerical dispersion relation for FDTD method in general curvilinear coordinates

Fengchao Xiao and H. Yabe. "Numerical dispersion relation for FDTD method in general curvilinear coordinates." 1997 Microwave and Guided Wave Letters 7.2 (Feb. 1997 [MGWL]): 48-50.

The numerical dispersion relation (NDR) of the finite-difference time-domain method in general curvilinear coordinates (FDTD-GCC) is discussed for a two-dimensional (2-D) uniformly skewed mesh. The analysis shows that the average scheme, which is being used in the FDTD-GCC method, causes an additional numerical dispersion error. When this dispersion error is considered, the FDTD-GCC method holds the same NDR as that of the FDTD discrete surface integral (FDTD-DSI) method. It also indicates that the stable range of the FDTD-GCC method, with respect to the skewing angle in the 2-D case, is narrowed due to the average scheme.

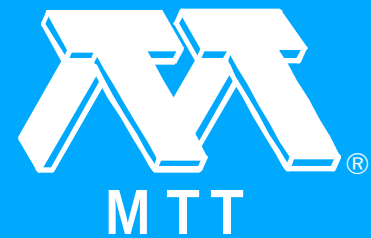


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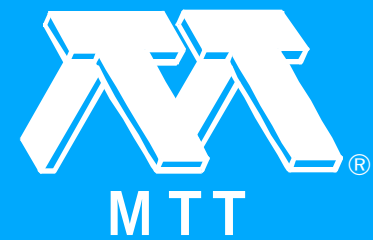
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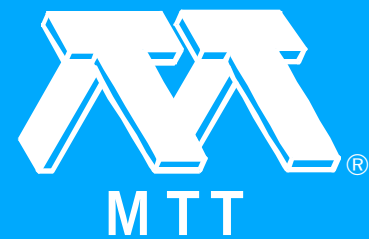
Reduced loss microwave fiber-optic links by intracavity modulation and carrier suppression

D.S. Glassner, M.Y. Frankel and R.D. Esman. "Reduced loss microwave fiber-optic links by intracavity modulation and carrier suppression." 1997 Microwave and Guided Wave Letters 7.3 (Mar. 1997 [MGWL]): 57-59.

Fiber-optic links are limited by the large V_{sub}/π of commercial modulators and by nonlinearities in the photodiodes used to demodulate the RF signals. Intracavity modulation and carrier suppression is shown to enhance the received microwave power in a fiber-optic link for a given optical power at a receiver. The carrier wavelength is automatically locked to the intracavity reflective notch filter that suppresses the carrier relative to the modulation sidebands. Link loss reductions exceeding 10 db were measured for frequencies from 1 to 25 GHz. Harmonic distortions can be decreased by combining this technique with above-quadrature biasing.

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A planar parabola-feed frequency multiplier

M. Kim, V.M. Lubecke, S.C. Martin, R.P. Smith and P.H. Siegel. "A planar parabola-feed frequency multiplier." 1997 Microwave and Guided Wave Letters 7.3 (Mar. 1997 [MGWL]): 60-62.

A novel quasi-optical all-planar frequency doubler that could provide an alternative approach to conventional waveguide circuits for millimeter- and submillimeter-wave signal generation is presented. The multiplier uses a quad-bridge diode configuration for inherent isolation between the input and output signals. Two pairs of double-slot antennas with orthogonal polarizations directly couple input and output signals to the diodes, without the need for hybrid couplers required in typical balanced circuits. The integrated quad-bridge-diode/slot-antenna circuit is mounted on a dielectric-filled parabola for coupling to quasi-optical propagation systems. Measurement results for an X to K-band doubler show frequency conversion loss of 6.8 dB at the output frequency of 20.3 GHz.

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A low-noise active receiving antenna using a SiGe HBT

W. Duerr, W. Menzel and H. Schumacher. "A low-noise active receiving antenna using a SiGe HBT." 1997 Microwave and Guided Wave Letters 7.3 (Mar. 1997 [MGWL]): 63-65.

A low-noise active receiving antenna based on a printed dipole and a Si-SiGe HBT in the 5.8 GHz band is presented. A power gain of 8.3 dB compared to the respective passive antenna and a noise figure of 1.4 dB at center frequency were achieved. To improve the antenna gain, two of these components were combined with a small array with reduced beamwidth and comparable noise figure.

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The voltage-dependent IP3 performance of a 35-GHz InAlAs/InGaAs-InP HBT amplifier

*K.W. Kobayashi, A.K. Oki, J. Cowles, L.T. Tran, P.C. Grossman, T.R. Block and D.C. Streit.
"The voltage-dependent IP3 performance of a 35-GHz InAlAs/InGaAs-InP HBT amplifier."
1997 Microwave and Guided Wave Letters 7.3 (Mar. 1997 [MGWL]): 66-68.*

Here we report on the first IP3 results of a 35-GHz Ka-band amplifier based on InAlAs/InGaAs-InP heterofunction bipolar transistors (HBT's). The amplifier combines four 1/spl times/10 /spl mu/m/sup 2/ quad-emitter HBT devices for a total emitter area of 160 /spl mu/m/sup 2/ to achieve a gain of 5 dB and an IP3 of 26.5 dBm at 35 GHz. IP3 was characterized over collector bias voltage and indicates that there is an optimum V_{ce} , corresponding to a maximum IP3 to DC power ratio, which is related to the HBT nonlinear voltage-dependent collector-base capacitance. A maximum IP3-to-DC power linearity figure of merit (LFOM) of 4.1 is achieved at a total collector current of 48 mA and a low V_{ce} of 2.25 V. This LFOM is comparable to HEMT's at these frequencies and is expected to improve with the maturity of InAlAs/InGaAs-InP HBT technology.

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Abstracts

Optically controlled serially fed phased-array transmitter

Y. Chang, B. Tsap, H.R. Fetterman, D.A. Cohen, A.F.J. Levi and I.L. Newberg. "Optically controlled serially fed phased-array transmitter." 1997 Microwave and Guided Wave Letters 7.3 (Mar. 1997 [MGWL]): 69-71.

A new optically controlled phased-array system has been developed that has all the advantages of true time delay (TTD), yet only requires one tunable laser, one optical modulator, and one fiber-optic grating unit. A two-element serial-feed transmitter has been assembled and tested to demonstrate the feasibility of this novel concept. Experimental results include TTD operation from 6-12 GHz using both 10 and 1 ns pulses transmitted to five different directions.



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Two-terminal edge-coupled InP/InGaAs heterojunction phototransistor optoelectronic mixer

C.P. Liu, A.J. Seeds and D. Wake. "Two-terminal edge-coupled InP/InGaAs heterojunction phototransistor optoelectronic mixer." 1997 Microwave and Guided Wave Letters 7.3 (Mar. 1997 [MGWL]): 72-74.

We report the first experimental results for optoelectronic mixing using a two-terminal edge-coupled InP/InGaAs heterojunction phototransistor (HPT). The HPT optoelectronic mixer (OEM) exhibits a maximum of 7-dB conversion gain relative to a 100% quantum efficient photodetector operated at the optical modulation frequency. We give a qualitative explanation for the observed conversion gain variation with the HPT bias voltage.

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A novel approach to extracting small-signal model parameters of silicon MOSFET's

S. Lee, H.K. Yu, C.S. Kim, J.G. Koo and K.S. Nam. "A novel approach to extracting small-signal model parameters of silicon MOSFET's." 1997 Microwave and Guided Wave Letters 7.3 (Mar. 1997 [MGWL]): 75-77.

We present a simple and accurate method to extract a small-signal equivalent circuit model of Si MOSFET's, based on the novel approach to determining parasitic inductances and resistances by fitting the frequency response of new analytic expressions with Z-parameters. This method is proposed to overcome the serious problem that conventional cold-FET methods cannot be applied for MOSFET's, and is also superior to the traditional optimization of the entire model parameters to fit the measured S-parameters. In particular, this technique is simple and reliable because no additional measurements are needed. The excellent correspondence is achieved between modeled and measured S-parameters from 0.5 to 39.5 GHz.

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A frequency dispersion model of GaAs MESFET for large-signal applications

Kye-ik Jeon, Young-se Kwon and Song-cheol Hong. "A frequency dispersion model of GaAs MESFET for large-signal applications." 1997 Microwave and Guided Wave Letters 7.3 (Mar. 1997 [MGWL]): 78-80.

Deficiencies in conventional frequency dispersion models of GaAs MESFET are addressed regarding their large-signal response. A new model which can accurately describes the large-signal dynamic properties is proposed. Only DC and scattering parameter data are required to extract the model parameters, which can be easily implemented into microwave circuit simulators in the macro circuit form. The validity of this model is demonstrated by comparing predicted pulsed I-V characteristics and power saturation characteristics with measured ones.

Click on title for a complete paper.



IF-based polarimetric receivers

N.S. Barker and G.M. Rebeiz. "IF-based polarimetric receivers." 1997 Microwave and Guided Wave Letters 7.3 (Mar. 1997 [MGWL]): 81-83.

A low-cost low-power polarimetric receiver has been developed based on the idea of IF processing. This architecture allows accurate measurement of the incident wave polarization and greatly reduces the cost and size of the receiver. An X-band polarimetric receiver with a dual-polarized microstrip antenna has been designed and tested. The results show a maximum $\pm 5^\circ$ polarization error using low-cost IF components and demonstrate the feasibility of performing inexpensive polarimetric processing at IF frequencies.

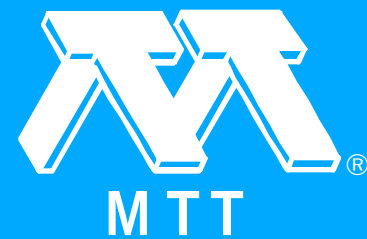


Abstracts

Closed-form asymptotic extraction method for coupled microstrip lines

Seong-Ook Park and C.A. Balanis. "Closed-form asymptotic extraction method for coupled microstrip lines." 1997 Microwave and Guided Wave Letters 7.3 (Mar. 1997 [MGWL]): 84-86.

The effective dielectric constants of a symmetric coupled microstrip line operating in the dominant mode are solved by using a closed-form formula of the asymptotic part of the impedance matrix elements. Using this asymptotic closed-form solution, the finite upper limit for numerical integration in the evaluation of the impedance matrix elements is significantly reduced. This results in improved computational efficiency for determining the ϵ_{eff} of a coupled microstrip line while retaining a good accuracy compared to the conventional spectral domain approach (SDA).



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Waveguide-to-coupled fin-line transition in a Ka band (Comments and Authors' Reply)

D.B. Sillars, J. de Mingo, A. Moliner and A. Comeron. "Waveguide-to-coupled fin-line transition in a Ka band (Comments and Authors' Reply)." 1997 Microwave and Guided Wave Letters 7.3 (Mar. 1997 [MGWL]): 87-87.

For original paper see D.B.Sillars, Proc. Inst. Elec. Eng., vol.134, pt.H, no.3, pp.229-33 (1987). The authors of the above letter may be interested in work that was previously carried out to excite both odd and even modes in coupled-slot fin-line circuits. A similar transition from microstrip into the even mode coupled-slot fin-line to that proposed in the above letter was developed for Ka band, particularly over 28 to 40 GHz, with levels of performance achieved similar to that reported in the above letter. This transition was primarily developed as part of an investigation into the nonreciprocal effects of loading coupled-slot fin-line circuits with longitudinally magnetized ferrite slabs.

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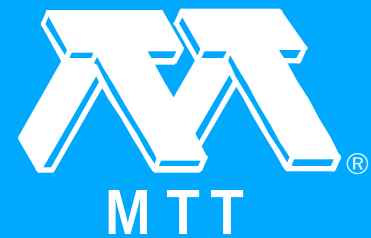


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"Patent Abstracts (Mar. 1997 [MGWL])." 1997 Microwave and Guided Wave Letters 7.3 (Mar. 1997 [MGWL]): 88-92.

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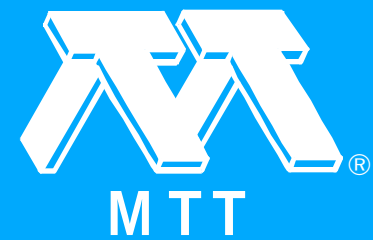
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Compensation for geometrical variations in coplanar waveguide probe-tip calibration

D.K. Walker and D.F. Williams. "Compensation for geometrical variations in coplanar waveguide probe-tip calibration." 1997 Microwave and Guided Wave Letters 7.4 (Apr. 1997 [MGWL]): 97-99.

We show how coplanar-waveguide probe-tip scattering parameter calibrations performed in one coplanar waveguide conductor geometry may be adjusted for measurement in another. The method models the difference between the two probe-tip-to-coplanar-waveguide transitions as a change in shunt capacitance and applies previously developed techniques for its determination and compensation. Comparison to accurate multiline Thru-Reflect-Line calibrations verifies the accuracy of the method. Differences in both conductor geometry and substrate permittivity are considered in the comparison. The method requires only a single, compact open stub or thru line fabricated on the measurement wafer.

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A 26-MESFET spatial power-combining oscillator

M. Rahman, T. Ivanov and A. Mortazawi. "A 26-MESFET spatial power-combining oscillator." 1997 Microwave and Guided Wave Letters 7.4 (Apr. 1997 [MGWL]): 100-102.

Several spatial power-combining oscillators based on an extended resonance technique was designed and fabricated. Experimental results for these combiners are provided and their performance is compared. An effective isotropic radiated power (EIRP) of 19.9 W at 9.923 GHz was obtained from a 26-MESFET spatial power combiner. The total radiated power for this combiner was 160 mW. The measured and predicted radiation patterns in E- and H-planes are also compared.

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Microwave band demonstration of a reflective geometry fiber and free-space binary photonic delay line

N.A. Riza and N. Madamopoulos. "Microwave band demonstration of a reflective geometry fiber and free-space binary photonic delay line." 1997 Microwave and Guided Wave Letters 7.4 (Apr. 1997 [MGWL]): 103-105.

For the first time, a modulated 2-b, one-channel binary switched, photonic time delay system (PTDS) is demonstrated that is based on a compact reflective optical delay path geometry that consists of one free-space delay line and one non-polarization-maintaining (PM) fiber delay line. Polarization switching using birefringent-mode nematic liquid crystals and a polarization noise-reduction technique are used to minimize the optical noise when using the cube polarization beamsplitters (PBSs) required in the reflective geometry delay. This gives the high electrical signal-to-noise ratios measured from 52 to 89 dB for the four settings of the delay line.

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An 18-22-GHz down-converter based on GaAs/AlGaAs HBT-Schottky diode integrated technology

K.W. Kobayashi, L.T. Tran, A.K. Oki, M. Lammert, T.R. Block and D.C. Streit. "An 18-22-GHz down-converter based on GaAs/AlGaAs HBT-Schottky diode integrated technology." 1997 Microwave and Guided Wave Letters 7.4 (Apr. 1997 [MGWL]): 106-108.

Here we report on a K-band AlGaAs/GaAs HBT-Schottky diode down-converter which represents the highest complexity monolithic integrated GaAs HBT-Schottky MMIC so far demonstrated at K-band frequencies. The MMIC integrates a double-balanced Schottky diode mixer with an 18-22 GHz two-stage K-band radio frequency (RF) amplifier, a 6-10 GHz two-stage X-band IF amplifier, and a 12-GHz local oscillator (LO) heterojunction bipolar transistor (HBT) buffer amplifier. The Schottky diodes are constructed from the existing GaAs HBT base and collector vertical epitaxy layers and can be easily fabricated with only one additional mask processing step. The double-balanced Schottky mixer provides high IP3 and high 2-2 spur suppression over a broad band while consuming little dc power. The HBT-Schottky integrated down-converter MMIC achieves >16-dB conversion gain over an RF input band from 18-22 GHz and a corresponding IP3>10 dBm with only +3 dBm of LO drive. The total chip is 3.85/spl times/3.75 mm/sup 2/ and can be self-biased through a single 5.5-V supply while consuming 545 mW of dc power. The use of GaAs HBT vertical-Schottky-diode technology has inherent performance advantages for frequency conversion MMIC's.





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Microwave circuit design for chirp or intensity fluctuation suppression in multielectrode DFB lasers

K.C. Sum and N.J. Gomes. "Microwave circuit design for chirp or intensity fluctuation suppression in multielectrode DFB lasers." 1997 Microwave and Guided Wave Letters 7.4 (Apr. 1997 [MGWL]): 109-111.

Realizable microstrip circuits have been designed to provide the required modulation current characteristics to suppress the chirp or intensity fluctuations occurring in a multielectrode distributed feedback laser structure under intensity or frequency modulation schemes, respectively. The designs have been performed using the combination of a commercial microwave circuit simulator and a time domain laser model. It is shown that good chirp or intensity fluctuation suppression can be achieved without significantly affecting the desired intensity or frequency modulation performance.

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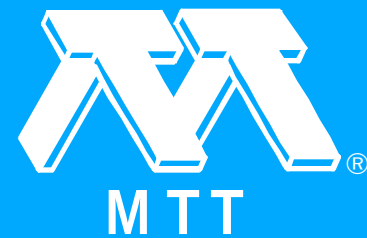


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Simple Treatment Of Multi-term Dispersion In FDTD

M. Okoniewski, M. Mrozowski and M.A. Stuchly. "Simple Treatment Of Multi-term Dispersion In FDTD." 1997 Microwave and Guided Wave Letters 7.5 (May 1997 [MGWL]): 121-123.

Three new simple and efficient algorithms are proposed for the numerical treatment of the multi-term Debye or Lorentz dispersion in the FDTD method. The formulation is based on the auxiliary differential equation, but requires much fewer operations than the published schemes. The approach is equivalent to the best higher order recursive schemes in terms of memory and computational expense, but without the linearity assumptions.

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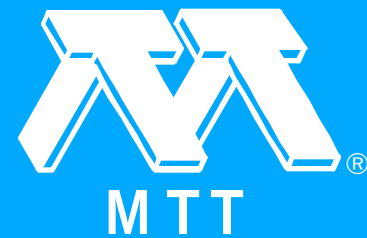


Abstracts

Time-domain Characteristics Of Slotted-waveguide Leaky-wave Antennas

D. Kralj and L. Carin. "Time-domain Characteristics Of Slotted-waveguide Leaky-wave Antennas." 1997 Microwave and Guided Wave Letters 7.5 (May 1997 [MGWL]): 124-126.

A general asymptotic theory is presented to describe the time-domain behavior of leaky transmission lines and antennas. The results are interpreted via a simple geometric construct and data are presented for the particular case of time-domain radiation from a slotted-waveguide antenna. The example data are obtained both experimentally and numerically, with the expected phenomenology demonstrated via time-frequency processing.



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Comparison Between Simulations And Measurements Of Large Signal And Nonlinear Noise Behaviors Of MMIC Analog Frequency Divider By Two

B. Branger, E. LaPorte, J.C. Nallatamby, M. Prigent and L. Lapierre. "Comparison Between Simulations And Measurements Of Large Signal And Nonlinear Noise Behaviors Of MMIC Analog Frequency Divider By Two." 1997 Microwave and Guided Wave Letters 7.5 (May 1997 [MGWL]): 127-129.

For the first time, the large signal and nonlinear noise behaviors of an analog frequency divider has been fully simulated and measured: comparisons between predicted and measured results of this circuit are given. The circuit designed is a monolithic microwave integrated circuit (MMIC) X -band 8.2-4.1-GHz analog frequency divider by two. The large signal analysis relies on the open-loop method extended to synchronous systems. The simulation of noise behavior of such a circuit has been performed by means of the nonlinearities conversion matrices and noise generators correlation matrices analysis.

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Abstracts

Scattering Analyses Of Asymmetric Conductor-backed CPW Open-end Discontinuity Problem

Shih-Ping Liu and C.-K.C. Tzuang. "Scattering Analyses Of Asymmetric Conductor-backed CPW Open-end Discontinuity Problem." 1997 Microwave and Guided Wave Letters 7.5 (May 1997 [MGWL]): 130-132.

The space-domain integral equation method using the generalized scattering matrix description of microwave passive circuits is employed to investigate the mode conversion of a CBCPW open-end discontinuity with unequal side plane widths. The conversion into two additional dominant modes, the c-mode-like mode and the pi-mode-like mode, and into the transmitted microstrip mode from an incident CPW mode is studied against side plane width, degree of asymmetry, substrate thickness, and frequency. Theoretical results are in excellent agreement with experimental ones.



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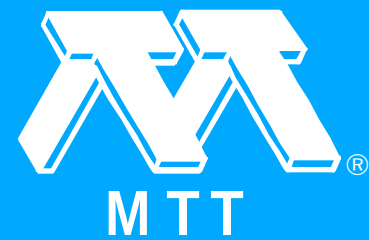


Abstracts

A 94-GHz 130-mW InGaAs/InAlAs/InP HEMT High-power MMIC Amplifier

Y.C. Chen, R. Lai, E. Lin, H. Wang, T. Block, H.C. Yen, D. Streit, W. Jones, P.H. Liu, R.M. Dia, T.-W. Huang, P.-P. Huang and K. Stamper. "A 94-GHz 130-mW InGaAs/InAlAs/InP HEMT High-power MMIC Amplifier." 1997 Microwave and Guided Wave Letters 7.5 (May 1997 [MGWL]): 133-135.

We have developed W-band high-power monolithic microwave integrated circuit (MMIC) amplifiers using passivated 0.15- μm gate length InGaAs/InAlAs/InP HEMT's. A 640- μm single-stage MMIC amplifier demonstrated an output power of 130 mW with 13% power-added efficiency and 4-dB associated gain at 94 GHz. This result represents the best output power to date measured from a single fixtured InP-based HEMT MMIC at this frequency.



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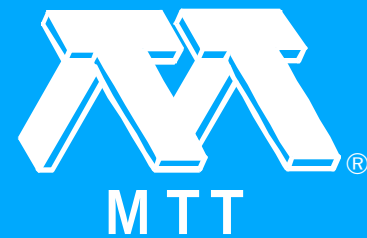


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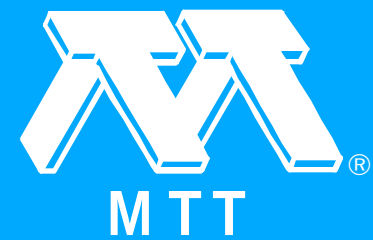
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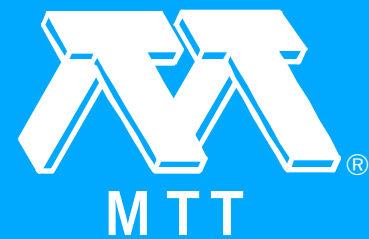
Multilayer MMIC broad-side coupler with a symmetric structure

H. Okazaki and T. Hirota. "Multilayer MMIC broad-side coupler with a symmetric structure." 1997 Microwave and Guided Wave Letters 7.6 (Jun. 1997 [MGWL]): 145-146.

A multilayer monolithic microwave integrated circuit (MMIC) broad-side coupler that has a symmetric structure has been fabricated and demonstrated. To enable the coupler area to be reduced, the width of the coupled lines in the fabricated coupler is made as narrow as 15 μm by using a meander-like configuration. The coupled lines are 2.28-mm long and effectively laid out in a small area of 0.9 mm/spl times/0.12 mm. The device works well and has good performance at frequencies between 10-17.5 GHz, with coupling loss of 4.2/spl plusmn/0.4 dB and return loss of better than 20 dB. This newly developed coupler offers advantages of simple symmetric design and small circuit area.

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A super absorbing boundary condition for the analysis of waveguide discontinuities with the finite-difference method

Jian Yi Zhou and Wei Hong. "A super absorbing boundary condition for the analysis of waveguide discontinuities with the finite-difference method." 1997 Microwave and Guided Wave Letters 7.6 (Jun. 1997 [MGWL]): 147-149.

A super absorbing boundary condition is presented for the analysis of waveguide discontinuities with the finite difference method (FDM). The discontinuity region is enclosed by the waveguide wall and two truncated planes at input and output waveguides, respectively. On the wall, homogeneous conditions are available. At mesh nodes in the region, finite-difference (FD) equations can be applied. When the truncated planes are far away from the discontinuity, the conventional dominant mode transmission condition can be used for deducing the FD-type local equation at the terminated mesh nodes. A super absorbing boundary condition presented in this letter can be used to terminate the meshes very close to the discontinuity. It results in dramatic savings in computing time and memory needs.

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A wide-band corrugated rectangular waveguide phase shifter for cryogenically cooled receivers

S. Srikanth. "A wide-band corrugated rectangular waveguide phase shifter for cryogenically cooled receivers." 1997 Microwave and Guided Wave Letters 7.6 (Jun. 1997 [MGWL]): 150-152.

A wide-band phase shifter rectangular in cross section with transverse corrugations on all four walls is presented. The loading for the two orthogonal modes is different and is achieved by choosing dissimilar corrugation parameters. This phase shifter measures a return loss of -25 dB or better and differential phase shift of $90^\circ/\text{spl deg}/\text{spl plusmn}/3.3^\circ/\text{spl deg/}$ between 18.9-26.5 GHz, This all-metal robust phase shifter is ideal for cryogenically cooled radioastronomy receivers.



Abstracts

Full implementation of an implicit nonlinear model with memory in an harmonic balance software

R. Sommet and E. Ngoya. "Full implementation of an implicit nonlinear model with memory in an harmonic balance software." 1997 Microwave and Guided Wave Letters 7.6 (Jun. 1997 [MGWL]): 153-155.

This letter describes the mathematical formalism for a full computation of the Jacobian matrix as part of the harmonic balance (HB) technique in the case of implicit nonlinear equations with memory. This new formalism, based on a double Fourier transform of the nonlinearity derivatives versus the time-domain commands, has been developed especially in order to permit the direct coupling of the semiconductor equations of a GaInP/GaAs heterostructure bipolar transistor in a circuit simulator based on the HB analysis technique.



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A new finite-element solution for parameter extraction of multilayer and multiconductor interconnects

Yang Zhao and Yun-Yi Wang. "A new finite-element solution for parameter extraction of multilayer and multiconductor interconnects." 1997 Microwave and Guided Wave Letters 7.6 (Jun. 1997 [MGWL]): 156-158.

In this letter, the geometry-independent measured equation of invariance is adopted with the finite-element method for mesh truncation and is successfully used in parameter extraction of interconnects. The major advantage is overcoming the tedious closed-form Green's function deduction and disagreeable Sommerfeld integral calculation for multilayer and multiconductor structures. Moreover, the high-order finite-element is employed to increase the accuracy and save computer resources. Furthermore, an optimizing numerical scheme, which is found to be very efficient, is developed to solve finite-element equations.



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Microwave propagation in p-i-n transmission lines

Z. Zhu and A.V. Vorst. "Microwave propagation in p-i-n transmission lines." 1997 Microwave and Guided Wave Letters 7.6 (Jun. 1997 [MGWL]): 159-161.

In this paper the layered structure of p-i-n photodetectors is modeled for the first time as a transmission line. The method of lines, as a two-dimensional (2-D) full-wave approach, is used to calculate the propagation constant. The numerical results agree well with measurements made on experimental devices over a frequency range of 1-30 GHz. An important new result is that the analysis of the current distribution in the bottom shielding layer shows that the finite conductivity of the high-doped semiconductor material in the layer results in a significant edge effect. This effect is properly taken into account in our 2-D model.



Abstracts

Waveform relaxation synthesis of time-domain characteristic model of loaded microstrip from FDTD simulation

Qing-Xin Chu and Fung-Yuel Chang. "Waveform relaxation synthesis of time-domain characteristic model of loaded microstrip from FDTD simulation." 1997 Microwave and Guided Wave Letters 7.6 (Jun. 1997 [MGWL]): 162-164.

From the finite-difference time-domain (FDTD) simulation of response voltages and currents of a microstrip terminated by a step-pulse excitation voltage source and a resistor load, the time-domain characteristic model (TDCM) of the microstrip is synthesized by use of the waveform relaxation method, which is based on the iteration and deconvolution techniques. As an example, the extracted model is applied to simulate the responses of the microstrip loaded by a capacitor and a resistor in parallel. The results are compared with the direct FDTD simulation to validate the accuracy of the model.



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Concurrent implementation of the complementary operators method in 2-D space

O.M. Ramahi. "Concurrent implementation of the complementary operators method in 2-D space." 1997 Microwave and Guided Wave Letters 7.6 (Jun. 1997 [MGWL]): 165-167.

The author presents a novel implementation of the complementary operators method (COM). In contrast to the original implementation of COM, in this approach, the complementary operators are applied concurrently on a set of fields in the boundary region. This not only allows the cancellation of first-order reflections, but the reduction of all subsequent reflections as well. A numerical example is given to validate this new scheme and to show that it results in unprecedented suppression of artificial reflections.

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A micromachined high-Q X-band resonator

J. Papapolymerou, Jui-Ching Cheng, J. East and L.P.B. Katehi. "A micromachined high-Q X-band resonator." 1997 Microwave and Guided Wave Letters 7.6 (Jun. 1997 [MGWL]): 168-170.

The authors present a new structure which can be used as a microwave high-Q resonator for the development of narrow-band low-loss filters in a planar environment. The resonator is made of a low-loss micromachined cavity which is easy to integrate with monolithic circuits. Compared to conventional metallic resonators, the performance of this resonator is similar, but the weight and size are significantly reduced.

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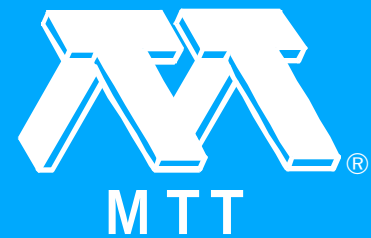


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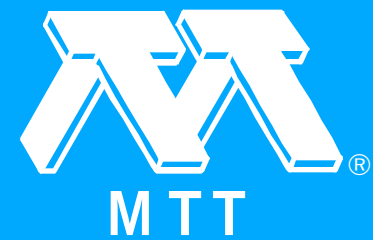
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An actively balanced GaAs HBT-Schottky mixer for 3-V wireless applications

K.W. Kobayashi, L.T. Tran, A.K. Okj, M. Lammert, T.R. Block and D.C. Streit. "An actively balanced GaAs HBT-Schottky mixer for 3-V wireless applications." 1997 Microwave and Guided Wave Letters 7.7 (Jul. 1997 [MGWL]): 181-183.

Here we present a novel low-voltage active mixer topology which enables 3-V double-balanced active mixer operation from wide-bandgap GaAs-based heterojunction bipolar transistors (HBTs). The compact mixer design integrates directly coupled active radio frequency (RF) and local oscillator (LO) transformer baluns with a Schottky-diode ring-quad to form a double-balanced mixer which operates from DC to 5 GHz. Biased with a low 3-V supply and operated as a down-converter with a fixed LO at 800 MHz and 0 dBm, the mixer achieves 9.4-dB conversion gain (CG) at 1 GHz with positive CG out to 4 GHz and an IP3 of -5 dBm. The LO-IF isolation is >20 dB while the 2-2 spur suppression is >20 dB over a broad 1-5 GHz RF input band. The novel 2.1/spl middot/V/sub BE/ supply design topology allows 3-V operation from the high turn-on voltage GaAs HBT's, making them suitable for portable wireless applications, and can enable 1.5-V operation for Si, Si-Ge, and InP BJT/HBT technologies.

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An unsplit step 3-D PML for use with the FDTD method

D.M. Sullivan. "An unsplit step 3-D PML for use with the FDTD method." 1997 Microwave and Guided Wave Letters 7.7 (Jul. 1997 [MGWL]): 184-186.

An important advance in the use of the finite-difference time-domain (FDTD) method has been the introduction of the perfectly matched layer (PML) to act as the absorbing boundary condition. The initial implementation required the E and H fields to be split. Recent advances have suggested a new unsplit step PML. This paper describes an FDTD implementation of this new unsplit PML in three dimensions, but implements them in the D and H fields. This has the advantage of isolating the PML from the rest of the FDTD computation, but, unlike the split step formulation, requires almost no additional computational resources.

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Unconditionally thermally stable cascode GaAs HBTs for microwave applications

B. Bayraktaroglu and M. Salib. "Unconditionally thermally stable cascode GaAs HBTs for microwave applications." 1997 Microwave and Guided Wave Letters 7.7 (Jul. 1997 [MGWL]): 187-189.

The authors describe the performance of a thermally stabilized cascode-heterojunction bipolar transistor (TSC-HBT) that exhibits unconditional thermal stability without the use of ballast resistors. A thermal isolation inserted between the current source (CE stage) and the power stage (CB stage) eliminates the positive electrothermal feedback that causes thermal runaway in bipolar transistors. The TSC-HBT cell designs with $f_{\text{sub max}}$ values in excess of 100 GHz demonstrated about 300% improvement in DC power dissipation capability compared to conventional cascode HBTs in a direct comparison.

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An integrated active circulator antenna

M.J. Cryan and P.S. Hall. "An integrated active circulator antenna." 1997 Microwave and Guided Wave Letters 7.7 (Jul. 1997 [MGWL]): 190-191.

An active circulator is integrated with a quarter-wave short-circuited microstrip patch antenna to produce a fully duplexed transceiver with transmit and receive operation at the same frequency and with the same polarization. The active circulator antenna is shown to have 14-dBi transmit gain and 7.4-dBi receive gain with a transmit-receive isolation of 26.9 dB at 3.745 GHz. This active antenna has potential uses in both short-range communication and radar systems.

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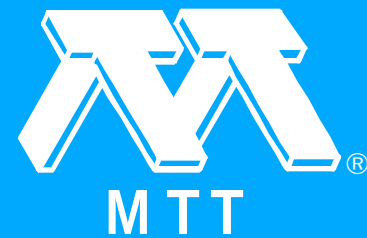


Abstracts

Volterra analysis of spectral regrowth

S.A. Maas. "Volterra analysis of spectral regrowth." 1997 Microwave and Guided Wave Letters 7.7 (Jul. 1997 [MGWL]): 192-193.

The author presents an analysis of the broadening of the bandwidth of narrowband modulated signals, commonly called spectral regrowth, caused by weak nonlinearities. The analysis uses Volterra methods and operates entirely in the frequency domain. It is applicable to signals having either discrete or continuous spectra.



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Electrically injection-locked intermodal oscillation in a long optical cavity laser diode

A.S. Daryoush, K. Sato, K. Horikawa and H. Ogawa. "Electrically injection-locked intermodal oscillation in a long optical cavity laser diode." 1997 Microwave and Guided Wave Letters 7.7 (Jul. 1997 [MGWL]): 194-196.

This paper presents frequency stabilization of intermodal oscillations observed in long optical cavity laser diodes. A 2170- μm -long optical cavity for a 1.5- μm laser experiences intermodal oscillation of ≈ 19.3 GHz. This optical oscillation is stabilized using electrical injection locking process by modulating the gain section. A significant improvement in frequency stability and phase-noise reduction is observed. Performance of the injection-locked intermodal oscillation is compared to the mode-locking experimental results in terms of modulation power and FM noise degradation level.





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A wideband variable waveguide coupler for millimeter applications

K.-F. Schuster, M. Carter, D. Charriere, J. Lamb and F. Mattiocco. "A wideband variable waveguide coupler for millimeter applications." 1997 Microwave and Guided Wave Letters 7.7 (Jul. 1997 [MGWL]): 197-199.

We present a variable waveguide coupler for the short millimeter-wavelength range. The coupler has low ohmic and insertion losses in all paths, flat coupling characteristic, and high directivity over a large bandwidth. The construction of the coupler allows a variable independent adjustment of power transferred into several paths when several couplers are used in series. The coupler is therefore useful for multichannel receivers and especially for superconductor-insulator-superconductor (SIS) mixer arrays where individual local oscillator (LO) power adjustment might be necessary. We present measurements for a coupler working at 230 GHz and compare them with a simple analytical model.

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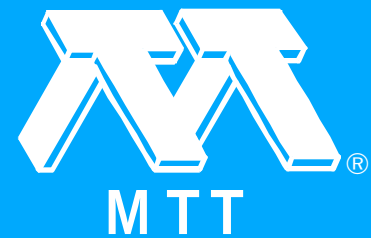


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"Patent Abstracts (Jul. 1997 [MGWL])." 1997 Microwave and Guided Wave Letters 7.7 (Jul. 1997 [MGWL]): 200-206.

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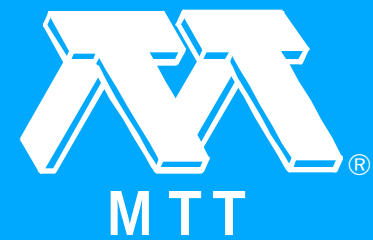
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A low-power HBT MMIC filter based on tunable active inductors

R. Kaunisto, P. Alinikula, K. Stadius and V. Porra. "A low-power HBT MMIC filter based on tunable active inductors." 1997 Microwave and Guided Wave Letters 7.8 (Aug. 1997 [MGWL]): 209-211.

An integrated active microwave filter employing high-Q active inductance simulating circuits is presented in this paper. Heterojunction bipolar transistor (HBT) technology is best-suited for this specific application facilitating the design and giving optimum performance with low power consumption. The prototype triple-resonator filter operates at 2.32 GHz with a 300 MHz -3-dB bandwidth. The power consumption is only 25 mW drawn from a 3-V supply.

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Two-stage bandpass filters based on rotated excitation of circular dual-mode resonators

I. Awai and T. Yamashita. "Two-stage bandpass filters based on rotated excitation of circular dual-mode resonators." 1997 Microwave and Guided Wave Letters 7.8 (Aug. 1997 [MGWL]): 212-213.

A new excitation method for dual-mode circular resonators is studied. The bandwidth and the frequency of attenuation poles of the resulting two stage bandpass filter (BPF) are determined by the angle between I/O ports. Addition of a shunt susceptance at the I/O ports gives an independent control of the bandwidth.

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Coplanar stripline propagation characteristics and bandpass filter

K. Goverdhanam, R.N. Simons and L.P.B. Katehi. "Coplanar stripline propagation characteristics and bandpass filter." 1997 Microwave and Guided Wave Letters 7.8 (Aug. 1997 [MGWL]): 214-216.

In this paper, a coplanar stripline bandpass filter is developed. The propagation characteristics of the coplanar stripline used for the construction of the filter are presented in the form of phase constant and attenuation constant. The filter is characterized experimentally as well as theoretically by use of the finite-difference time-domain (FDTD) technique. The agreement between the measured and modeled filter characteristics is very good.

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Abstracts

A compact planar magic-T junction with aperture-coupled difference port

M. Davidovitz. "A compact planar magic-T junction with aperture-coupled difference port." 1997 Microwave and Guided Wave Letters 7.8 (Aug. 1997 [MGWL]): 217-218.

The operating principles of a compact planar magic-T junction are described and experimentally validated. The distinguishing feature of this component is the placement of the difference port on a layer separated from the other three ports by a ground plane. Moreover, the two parts of the component are electromagnetically coupled through a slot-aperture in the ground plane. The component is inherently multilayer, i.e., the transition between the circuit layers is a functional part of the device. The tested microstrip prototype performs well over a frequency range of about 40%.



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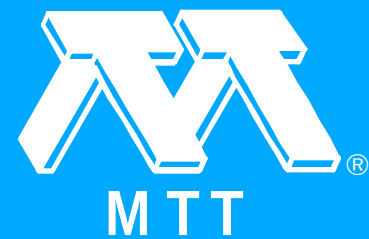
2-V-operation /spl delta/-doped power HEMT's for personal handy-phone systems

Yeong-Lin Lai, E.Y. Chang, Chun-Yen Chang, T.H. Liu, S.P. Wang and H.T. Hsu. "2-V-operation /spl delta/-doped power HEMT's for personal handy-phone systems." 1997 Microwave and Guided Wave Letters 7.8 (Aug. 1997 [MGWL]): 219-221.

A high-efficiency and high-power-density /spl delta/-doped AlGaAs/InGaAs HEMT with low adjacent channel leakage has been developed for the digital wireless personal handy-phone system (PHS). When qualified by 1.9-GHz /spl pi//4-shifted quadrature phase shift keying (QPSK) modulated PHS standard signals, the 2.0-V-operation HEMT with a 1-mm gate width demonstrated a power-added efficiency of 45.3% and an output power density of 105 mW/mm. This is the highest power density ever reported by power transistors for the PHS. State-of-the-art results for the PHS operating at 2.0 V were achieved by the S-doped power HEMT for the first time.

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An InP HEMT W-band amplifier with monolithically integrated HBT bias regulation

K.W. Kobayashi, H. Wang, R. Lai, L.T. Tran, T.R. Block, P.H. Liu, J. Cowles, Y.C. Chen, T.-W. Huang, A.K. Oki, H.C. Yen and D.C. Streit. "An InP HEMT W-band amplifier with monolithically integrated HBT bias regulation." 1997 Microwave and Guided Wave Letters 7.8 (Aug. 1997 [MGWL]): 222-224.

This paper presents the results of the first W-band InP-based high electron mobility transistor-heterojunction bipolar transistor (HEMT-HBT) monolithic microwave integrated circuit (MMIC). The InP-based HBT and HEMT devices are monolithically integrated using selective molecular beam epitaxy (MBE). The amplifier demonstrates the highest frequency performance MMIC so far obtained with this technology. A single-stage HBT op amp current regulator is integrated with a single-stage HEMT amplifier in order to regulate and self-bias the MEMT device over process, temperature, and age variations. The HBT regulates the HEMT bias to within 3% of the bias current while consuming only a small fraction of the total dc power. The HEMT W-band amplifier achieves a radio frequency (RF) gain of 8.25 and 5.9 dB at 77 and 94 GHz, respectively. A minimum noise figure of 4.2 dB was also recorded at 93.5 GHz. The RF performance achieved from the HEMT amplifier using the InP-based HEMT-HBT integrated technology is comparable to that of InP-based single-technology HEMT performance.

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Microwave filtering realized through incoherent optical processing

C. Fraser and M.J. Lancaster. "Microwave filtering realized through incoherent optical processing." 1997 Microwave and Guided Wave Letters 7.8 (Aug. 1997 [MGWL]): 225-226.

Analogue microwave filters can be produced using optical components when the microwave signal is modulated onto an optical carrier wave, processed optically, and then recovered electrically. The fiber-optic network presented here displays a bandpass filter response to the modulating signal. The processing operation is based on the transversal tapped delay line technique forming an infinite impulse response structure. By employing an incoherent optical carrier wave for signal transmission, the structure's responses are modelled using linear discrete signal processing techniques.





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A miniature MMIC double doubly balanced mixer using lumped dual balun for high dynamic receiver application

Hwain-Kaeo Chiou and Hao-Hsiung Lin. "A miniature MMIC double doubly balanced mixer using lumped dual balun for high dynamic receiver application." 1997 Microwave and Guided Wave Letters 7.8 (Aug. 1997 [MGWL]): 227-228.

A simple dual-balun structure is proposed for a miniature monolithic microwave integrated circuit (MMIC) double doubly balanced mixer (DDBN) design. The dual balun is realized by using two out-of-phase power splitters in parallel, which are then applied in a DDBM mixer. The measured conversion loss of the mixer is less than 10 dB for a radio frequency (RF) bandwidth of 2-5.5 GHz and fixed intermediate frequency (IF) output frequency of 2 GHz. The mixer achieves a high input IP3 of 24 dBm and a 1-dB compression input power of 13 dBm at 17-dBm local oscillator (LO) drive. The chip area of the mixer is less than 1.0/spl times/1.4 mm/sup 2/, which is the smallest size ever reported for monolithic DDBM mixers.

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Miniaturized three-dimensional MMIC K-band upconverter

K. Nishikawa, I. Toyoda and T. Tokumitsu. "Miniaturized three-dimensional MMIC K-band upconverter." 1997 Microwave and Guided Wave Letters 7.8 (Aug. 1997 [MGWL]): 230-232.

A miniaturized K-band balanced upconverter that effectively uses the three-dimensional monolithic microwave integrated circuit (MMIC) structure is presented in this paper. This upconverter consists of two unit mixers with stacked matching circuits and a newly developed Marchand balun. This balun is composed of two broad-side couplers and realizes a great reduction in circuit area. Each component's area is less than 0.13 mm, resulting in a total area of only 0.55 mm². This three-dimensional MMIC upconverter achieves conversion gains of greater than 1 dB and local oscillator (LO) leakage suppression rates of greater than 30 dB over the 17-18.5-GHz frequency band.

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A 20-GHz-band subharmonically injection-locked oscillator MMIC with wide locking range

K. Kamogawa, T. Tokumitsu and I. Toyoda. "A 20-GHz-band subharmonically injection-locked oscillator MMIC with wide locking range." 1997 Microwave and Guided Wave Letters 7.8 (Aug. 1997 [MGWL]): 233-235.

A monolithic subharmonically injection-locked oscillator (ILO) with wide frequency tuning range using a shunted varactor diode inserted to the oscillation loop is presented. A 20-GHz-band ILO is fabricated that achieves the wide injection locking range of more than 700 MHz at each subharmonic factor up to 32. In addition, the phase-noise degradation rate of the ILO against the subharmonic factor is close to 6 db/oct. The ILO configuration is extremely suitable for realizing low cost and low-phase-noise millimeter-wave monolithic microwave integrated circuit (MMIC) sources.

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High-performance planar inductor on thick oxidized porous silicon (OPS) substrate

Choong-Mo Nam and Young-se Kwon. "High-performance planar inductor on thick oxidized porous silicon (OPS) substrate." 1997 Microwave and Guided Wave Letters 7.8 (Aug. 1997 [MGWL]): 236-238.

To obtain a high-performance planar inductor, we used the oxidized porous silicon (OPS) layer with 25-/spl mu/m-thick SiO/sub 2/ as substrate. The measured radio frequency (RF) performances of the planar Inductor on the OPS layer are comparable to those on the semi-insulating GaAs substrate. For a 6.29 nH inductor, resonant frequency of 13.8 GHz and maximum quality factor (Q) of 13.3 are obtained. These results show that the utilisation of the OPS layer can push silicon passive monolithic microwave integrated circuit (MMIC) technology at least up to 12 GHz.

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Abstracts

A monolithic single-crystal yttrium iron garnet/silicon X-band circulator

S.A. Oliver, P.M. Zavracky, N.E. McGruer and R. Schmidt. "A monolithic single-crystal yttrium iron garnet/silicon X-band circulator." 1997 Microwave and Guided Wave Letters 7.8 (Aug. 1997 [MGWL]): 239-241.

Production of truly monolithic microwave integrated circuits that incorporate ferrite passive control elements has been hindered by the material property mismatches between ferrites and semiconductors. In this work, monolithic Y-junction circulators were fabricated by bonding 100- μm -thick single-crystal yttrium iron garnet films to silicon at 195 $^{\circ}\text{C}$, and then removing the gadolinium gallium garnet substrate. S-parameter measurements on the circulator and matching microstrip circuit yield an isolation of 20 dB over a 1 GHz bandwidth at 9 GHz, with a minimum insertion loss near 1 dB. Improvements in circuit design and fabrication techniques may yield monolithic circulators that are fully compatible with large-scale semiconductor manufacturing methods.



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Automated electromagnetic optimization method for microwave devices

S. Bila, D. Baillargeat, S. Verdeyme and P. Guillon. "Automated electromagnetic optimization method for microwave devices." 1997 Microwave and Guided Wave Letters 7.8 (Aug. 1997 [MGWL]): 242-244.

We present a relevant automated electromagnetic (EM) optimization method which combines a fast analytical model deduced from a rigorous and accurate EM analysis and the global analysis of the device performed with a finite element method (FEM). We apply the automated method to the optimization of a volumic dielectric resonator filter. First, we present the definition of the analytical coarse model, then we use this model as a starting point for the EM optimization of structure dimensions. The accuracy of this automated method is then demonstrated, considering the good agreement between theoretical optimization results and experimental ones.

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Abstracts

Analysis of the X-junction between two rectangular waveguides and a circular waveguide

G.G. Gentili and A. Melloni. "Analysis of the X-junction between two rectangular waveguides and a circular waveguide." 1997 Microwave and Guided Wave Letters 7.8 (Aug. 1997 [MGWL]): 245-247.

The paper describes a method for the analysis of the four-port junction (X-junction) between two rectangular waveguides and a circular waveguide. The method is based on the computation by an efficient technique of the generalized admittance matrix (GAM) of the structure (conveniently divided into subblocks) with no restrictions on the geometrical dimensions, a typical analysis with about 100 modes in the overall structures requires 1-4 s per frequency point on a typical medium-power workstation.



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Lumped-element compensated high/low-pass balun design for MMIC double-balanced mixer

Hwann-Kaeo Chiou, Hao-Hsiung Lin and Chi-Yang Chang. "Lumped-element compensated high/low-pass balun design for MMIC double-balanced mixer." 1997 Microwave and Guided Wave Letters 7.8 (Aug. 1997 [MGWL]): 248-250.

We report a novel lumped element balun structure for both monolithic and hybrid circuit applications. The proposed structure utilizes two filters to compensate the amplitude and phase errors at the two balance outputs of a traditional out-of-phase power splitter. This circuit requires no multilayer or suspended substrates techniques; therefore, wide applications on many circuits operated especially, in the low microwave band, are expected. Two monolithic microwave integrated circuit (MMIC) mixers were built to demonstrate the electrical feasibility.

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A high-performance Ka-band monolithic variable-gain amplifier using dual-gate HEMTs

T. Kashiwa, T. Katoh, T. Ishida, Y. Kojima and Y. Mitsui. "A high-performance Ka-band monolithic variable-gain amplifier using dual-gate HEMTs." 1997 Microwave and Guided Wave Letters 7.8 (Aug. 1997 [MGWL]): 251-252.

The author describes the excellent performance of a Ka-band monolithic variable-gain amplifier monolithic microwave integrated circuit (VGA MMIC) using dual-gate AlGaAs-InGaAs pseudomorphic high electron mobility transistors (HEMT's). The dual-gate HEMT can be fabricated by the same process as a single-gate HEMT. To achieve low-noise performance, a single-gate HEMT is employed in the first stage of the VGA MMIC. However, in the second and third stages, dual-gate HEMT's are used for gain control performance with higher gain. The VGA MMIC achieves more than 30-dB gain with more than 50-dB gain control range from 30 to 35 GHz. A noise figure of 1.4 dB with an associated gain of 29.2 dB is achieved at 33 GHz when biased for a low-noise performance.

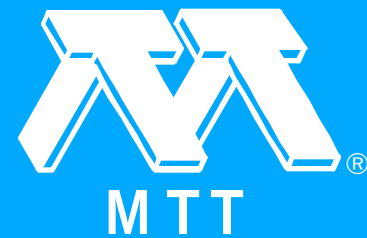


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K-band and high-power/efficiency/breakdown GaInAs/InP composite channel HEMTs

J.B. Shealy, M. Matloubian, T. Liu, R. Virk, J. Pust and C. Ngo. "K-band and high-power/efficiency/breakdown GaInAs/InP composite channel HEMTs." 1997 Microwave and Guided Wave Letters 7.9 (Sep. 1997 [MGWL]): 261-263.

The authors report the power performance of Ga/sub 0.47/In/sub 0.53/As/InP composite channel InP HEMT's at 18 GHz. Devices with 0.15-/spl mu/m gatelength exhibit a peak transconductance of 720 mS/mm and full channel current of 500 mA/mm while achieving a two-terminal (three-terminal) breakdown voltage of 13.3 V (10.4 V) at 1 mA/mm. Devices with 450-/spl mu/m gatewidth exhibit 0.75-W/mm output power with 53% power-added efficiency (PAE) and 11.9-dB gain. The highest efficiency achieved was 57% at 5.0 V (V/sub ds/) for 600-/spl mu/m-wide devices producing an output power density of 0.5 W/mm. Further, devices with 900-/spl mu/m gatewidth exhibit 0.59-W/mm output power with 53% PAE and 10.5-dB gain.

Perfectly matched layer absorbing boundary condition for dispersive medium

T. Uno, Yiwei He and S. Adachi. "Perfectly matched layer absorbing boundary condition for dispersive medium." 1997 Microwave and Guided Wave Letters 7.9 (Sep. 1997 [MGWL]): 264-266.

Berenger's perfectly matched layer (PML) absorbing boundary condition (ABC) has been found very effective for truncating the unbounded spatial domain in the finite-difference time-domain (FDTD) computation. The PML ABC was originally introduced for a free-space spatial domain and later extended to a lossy medium using the stretched coordinates. In this paper, we propose a novel PML ABC for a dispersive medium in an ordinary Cartesian coordinate. It is also shown that the PML for the lossy medium can be easily derived from our formulation.





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Degenerate parametric amplification in an optoelectronic GaAs CPW-to-slotline ring resonator

Jong-Chul Lee, H.F. Taylor and Kai Chang. "Degenerate parametric amplification in an optoelectronic GaAs CPW-to-slotline ring resonator." 1997 Microwave and Guided Wave Letters 7.9 (Sep. 1997 [MGWL]): 267-269.

Nonlinear optical-microwave mixing is performed in an uniplanar CPW-to-slotline ring resonator on a semi-insulating GaAs substrate, in which a Schottky photodetector is monolithically integrated as a coupling gap. The parametric amplification effect of the mixer occurs when the capacitive reactance of the detector is modulated. In this structure, a parametric amplification gain of 20 dB, without the applied bias in the radio frequency (RF) signal, is obtained. This microwave optoelectronic mixer can be used in fiber-optic communication links.

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The Pospieszalski noise model and the imaginary part of the optimum noise source impedance of extrinsic or packaged FET's

L. Boglione, R.D. Pollard and V. Postoyalko. "The Pospieszalski noise model and the imaginary part of the optimum noise source impedance of extrinsic or packaged FET's." 1997 Microwave and Guided Wave Letters 7.9 (Sep. 1997 [MGWL]): 270-272.

The imaginary part $X(S/\text{sub opt/})$ of the optimum noise impedance for extrinsic or packaged devices is investigated. The analysis modifies the well-known Pospieszalski noise model by applying a series feedback to the source port. A simple expression for $X(S/\text{sub opt/})$ is developed and is verified for extrinsic and packaged devices with a decreasing level of accuracy. The results give further insights into the way the parasitic inductors $L/\text{sub g/}$ and $L/\text{sub s/}$ affect the noise performance of the transistor and can help to design low-noise amplifier with simultaneous signal and noise power match at the input port.

Click on title for a complete paper.



Abstracts

A locally conformal finite-difference time-domain (FDTD) algorithm for modeling three-dimensional perfectly conducting objects

S. Dey and R. Mittra. "A locally conformal finite-difference time-domain (FDTD) algorithm for modeling three-dimensional perfectly conducting objects." 1997 Microwave and Guided Wave Letters 7.9 (Sep. 1997 [MGWL]): 273-275.

A novel conformal finite-difference time-domain (CFDTD) technique for locally distorted contours that accurately model curved metallic objects is presented in this paper. This approach is easy to implement and is numerically stable. Several examples are presented to demonstrate that the new method yields results that are far more accurate than those generated by the conventional staircasing approach. Example geometries include cylindrical and spherical cavities, and a circular microstrip patch antenna. Accuracy of the scheme is demonstrated by comparing the results derived from analytical and Method of Moments (MoM) techniques.



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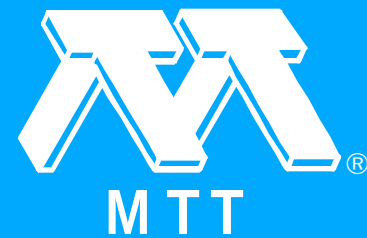


Abstracts

A new tool for slot-microstrip transition simulation

G. Duchamp, L. Casadebaig, S. Gauffre and J. Pistre. "A new tool for slot-microstrip transition simulation." 1997 Microwave and Guided Wave Letters 7.9 (Sep. 1997 [MGWL]): 276-278.

We present the specific modelization with the MDS software and its MOMENTUM module, the technology brought into operation, and the obtained measurements for different structures involving the slot-microstrip transition. The experimental results are compared to those achieved by simulation. These works, as a whole, make it possible to evidence the interest of such a topology and the advantages of its simulation.



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Time-domain simulation of electromagnetic field using a symplectic integrator

T. Hirono, W.W. Lui and K. Yokoyama. "Time-domain simulation of electromagnetic field using a symplectic integrator." 1997 Microwave and Guided Wave Letters 7.9 (Sep. 1997 [MGWL]): 279-281.

A new high-order-accurate method for time-domain simulation of a electromagnetic field is proposed. This method is analogous to the one used in classical mechanics for continuous system analysis. The symplectic integrator in classical mechanics is utilized to calculate the time dependence of the field. Using the same grid spacing and time step, it is demonstrated that the proposed method is more accurate than the conventional finite-difference time-domain (FDTD) method for a two-dimensional problem. This method is also applicable to full-vectorial Maxwell's equations in three dimensions.

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Multiple-frequency generation of sub-terahertz radiation by multimode LD excitation of photoconductive antenna

M. Tani, S. Matsuura, K. Sakai and M. Hangyo. "Multiple-frequency generation of sub-terahertz radiation by multimode LD excitation of photoconductive antenna." 1997 Microwave and Guided Wave Letters 7.9 (Sep. 1997 [MGWL]): 282-284.

Multiple-frequency coherent radiation in the sub-terahertz region was generated by excitation of a photoconductive antenna with a commercially available multimode laser diode (LD). The origin of the radiation was the current modulations in the photoconductive antenna caused by the optical beats between the longitudinal modes of the LD. An interferometric spectral measurement showed line spectra at frequency multiples of 52 GHz beyond 400 GHz. This result indicates that the photoconductive antenna with a multimode LD excitation can achieve a wavelength-selectable coherent radiation source in the sub-terahertz region with a very simple and compact device configuration.

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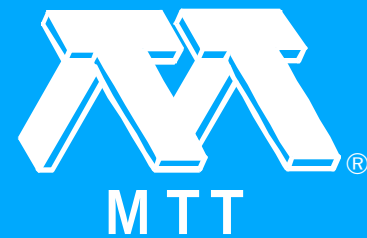


Abstracts

PML-FDTD in cylindrical and spherical grids

F.L. Teixeira and W.C. Chew. "PML-FDTD in cylindrical and spherical grids." 1997 Microwave and Guided Wave Letters 7.9 (Sep. 1997 [MGWL]): 285-287.

Perfectly matched layers (PMLs) are derived for cylindrical and spherical finite-difference time-domain (FDTD) grids. The formulation relies on the complex coordinate stretching approach. Two-dimensional (2-D) cylindrical and three-dimensional (3-D) spherical staggered-grid FDTD codes are written based on the time-domain versions of the equations. Numerical simulations validate the formulation by showing very good agreement between the perfectly matched layer-finite-difference time-domain (FDTD) results and the free-space analytic solutions.



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High-power high-efficiency X-band AlGaAs/GaAs heterojunction bipolar transistors with undercut collectors

Hin-Fai Chau, G. Wilcox, Wenliang Chen, M. Tutt and T. Henderson. "High-power high-efficiency X-band AlGaAs/GaAs heterojunction bipolar transistors with undercut collectors." 1997 Microwave and Guided Wave Letters 7.9 (Sep. 1997 [MGWL]): 288-290.

We report on the power performance of X-band AlGaAs/GaAs heterojunction bipolar transistors with undercut collectors for reduced base-collector capacitance. A 10/spl times/(2.8/spl times/50) /spl mu/m/sup 2/ HBT unit cell exhibited 2.09 W continuous wave (CW) output power (4.18 W/mm power density), 62.2% power-added efficiency, and 7.13 dB associated gain at 10 GHz at a collector bias voltage of 10 V. When tuned for maximum efficiency, the same transistor delivered a CW output power of 1.36 W, a power-added efficiency of 74.2%, and an associated gain of 7.32 dB at the same frequency and collector bias voltage. To our knowledge, this is the first demonstration of high-power (>1.3 W), high-efficiency (>74%) AlGaAs/GaAs HBT's using a simple collector undercut technique without the need for significant modifications of baseline HBT process.





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Polynomial representations of split-phase constants of gyromagnetic waveguides with electric and magnetic walls

J. Helszajn and J. Sharp. "Polynomial representations of split-phase constants of gyromagnetic waveguides with electric and magnetic walls." 1997 Microwave and Guided Wave Letters 7.9 (Sep. 1997 [MGWL]): 291-293.

Two classic circular waveguides met in the design of nonreciprocal Faraday rotation devices and waveguide junction circulators are the gyromagnetic ones with electric and magnetic walls. The purpose of this letter is to present some polynomial representations of the split-phase constants in the gyrotropy of each problem region and to compare the opening between the split branches for the two situations. A polynomial representation of the cutoff space of the lower split branch of the magnetic wall problem region is separately computed.

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A low-cost W-band MIC mixer using flip-chip technology

R.S. Virk, S.A. Maas, M.G. Case, M. Matloubian, P. Lawyer, H.C. Sun, C. Ngo and D.B. Rensch. "A low-cost W-band MIC mixer using flip-chip technology." 1997 Microwave and Guided Wave Letters 7.9 (Sep. 1997 [MGWL]): 294-296.

The authors describe a novel mixer fabricated using a unique low-cost approach to achieve effective conversion performance. By utilizing flip-chip GaAs Schottky diodes mounted on a duroid substrate, this radio frequency (RF) probable mixer achieves 11.3-dB conversion loss at 77 GHz with an IF frequency of 500 MHz. This new technology demonstrates an affordable alternative to standard millimeter-wave circuit fabrication while offering the capability to integrate a variety of device technologies in the same circuit.





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Design of a planar array transponder with broad responding beam

Hung-Tu Chen and Shyh-Jong Chung. "Design of a planar array transponder with broad responding beam." 1997 Microwave and Guided Wave Letters 7.9 (Sep. 1997 [MGWL]): 297-299.

A new planar array transponder, including four active receiving-transmitting microstrip antenna pairs, were demonstrated by using the Van Atta array design. The fields retransmitted by all the antenna pairs spatially combine in the wave-incidence direction while interfere with each other in other directions, so that the transponder responds the signal only to the on-line interrogator. The measured 10 dB (5 dB) responding beamwidth for the array transponder is 106/spl deg/(80/spl deg/), which is approximately the same as that of a transponder with a single antenna pair. Also, the measured radar cross section (RCS) patterns for the transponder at the on state (with bias) and off state (without bias) were compared. More than 20-dB difference between the patterns of these two states has been observed.

Click on title for a complete paper.



Abstracts

A new class of dual-mode directional couplers for compact dual-polarization beam-forming networks

F. Alessandri and R. Ravanelli. "A new class of dual-mode directional couplers for compact dual-polarization beam-forming networks." 1997 Microwave and Guided Wave Letters 7.9 (Sep. 1997 [MGWL]): 300-301.

A new class of directional couplers for the realization of compact dual-polarization beam-forming networks is presented. This component functions as two independent directional couplers for the TE/sub 01/ mode and the TE/sub 10/ mode of a rectangular waveguide. The two modes are not coupled. Different values of the coupling for the two modes can be obtained. This coupler can be used twice for two orthogonal polarizations. Therefore a considerable reduction of size and complexity of the overall network can be obtained. Experimental data for a 3-dB dual mode coupler are also presented here.



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Extension of Berenger's absorbing boundary conditions to match dielectric anisotropic media

I. Villo Perez, S. Gonzalez Garcia, R. Gomez Martin and B. Garcia Olmedo. "Extension of Berenger's absorbing boundary conditions to match dielectric anisotropic media." 1997 Microwave and Guided Wave Letters 7.9 (Sep. 1997 [MGWL]): 302-304.

The authors propose an extension of Berenger's perfectly matched layer (PML) absorbing boundary conditions (ABCs) to achieve a perfect matching of waves propagating in anisotropic media. Although the procedure to obtain the matching conditions is valid for any kind of anisotropic material, it has been validated with a lossless two-dimensional uniaxial medium, in which the optical axis is not contained in its plane section. The finite difference time domain method, with an alternative scheme for anisotropic media, is used to simulate the problem and to obtain the numerical reflection coefficient.

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High-gain frequency-tunable low-noise amplifiers for 38-42.5-GHz band applications

A. Miras and E. Legros. "High-gain frequency-tunable low-noise amplifiers for 38-42.5-GHz band applications." 1997 Microwave and Guided Wave Letters 7.9 (Sep. 1997 [MGWL]): 305-307.

High-performance tunable low-noise amplifiers for 38-42.5 GHz applications are presented based on a fully stabilized GaAs pseudomorphic high electron mobility transistor (PHEMT) 0.2 μm technology. A single 1.5 $\times$ 3 mm chip, incorporating six amplifying stages, shows a measured gain of 36-42 dB depending on the center frequency. Both maximum gain frequency and input impedance of the amplifier are accurately tunable on the chip. This means that the amplifier provides a narrow-band filtering function and can be matched to a fast p-i-n photodiode as well as to a 50 Ω load. This is the first time such performances are reported for single chip narrow-band tunable amplifiers using a GaAs PHEMT technology.

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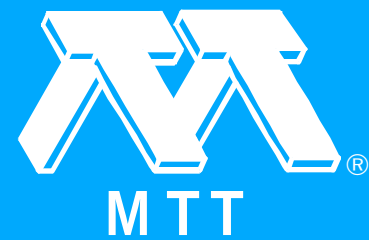


Abstracts

A stable algorithm for modeling lumped circuit source across multiple FDTD cells

Jie Xu, An Ping Zhao and A.V. Raisanen. "A stable algorithm for modeling lumped circuit source across multiple FDTD cells." 1997 Microwave and Guided Wave Letters 7.9 (Sep. 1997 [MGWL]): 308-310.

Incorporating lumped-circuit elements into finite-difference time-domain (FDTD) simulation greatly enhances the FDTD method's capability to model both distributed structures and lumped circuitries. The multiple-cell formulation proposed by C.H. Durney et al. (see *ibid.*, vol. 6, p. 85-7, Feb. 1996) is only numerically stable for modeling structures with large permittivity. A stable algorithm for modeling material with both large and small permittivity is presented in this letter. Verification data is given together with detailed derivations.



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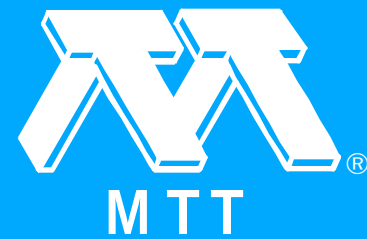


Abstracts

A design approach for mass producible high-bit-rate MMIC transimpedance amplifiers

E.M. Bastida, V. Corso, C.A. Finardi, R.A. Fischer and V. Patiri. "A design approach for mass producible high-bit-rate MMIC transimpedance amplifiers." 1997 Microwave and Guided Wave Letters 7.10 (Oct. 1997 [MGWL]): 317-319.

A full design approach for developing very highspeed transimpedance amplifier (TIA) monolithic microwave integrated circuits (MMICs) to be economically produced in large quantities is described. As an application example, the letter reports design, experimental performances, yield, and size data for a 5-Gb/s MMIC TIA using a low-cost 0.5- μm GaAs field-effect transistor (FET) technology, showing outstanding experimental performances and optimized for a large-volume industrial production.



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High saturation power 1.3- μ m MQW electroabsorption waveguide modulators on GaAs substrates

K.K. Loi, L. Shen, H.H. Wieder and W.S.C. Chang. "High saturation power 1.3- μ m MQW electroabsorption waveguide modulators on GaAs substrates." 1997 Microwave and Guided Wave Letters 7.10 (Oct. 1997 [MGWL]): 320-322.

An analog InGaAs-InAlAs multiple-quantum-well electroabsorption waveguide modulator operating at 1.32- μ m wavelength has been designed, fabricated, and characterized for the first time on a GaAs substrate. A typical 3- μ m-wide 115- μ m-long device exhibits a high optical saturation power in excess of 17 mW and a 3-dB electrical bandwidth of 20 GHz. An equivalent half-wave voltage V_{π} of 2.8 V has also been achieved.



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A high-performance AlInAs/InGaAs/InP DHBT K-band power cell

R.S. Virk, M.Y. Chen, Chanh Nguyen, Takyiu Liu, M. Matloubian and D.B. Rensch. "A high-performance AlInAs/InGaAs/InP DHBT K-band power cell." 1997 Microwave and Guided Wave Letters 7.10 (Oct. 1997 [MGWL]): 323-325.

In this work the device design and power performance of several AlInAs/InGaAs/InP double heterojunction bipolar transistors (DHBTs) are reported for 18 GHz. The power cells utilize a wet chemical etching technique to create a micro-airbridge base connection and to remove extrinsic collector material from beneath the base which both contribute to a reduced base-collector capacitance and improved $f_{\text{sub max}}$ and power gain. For class B operation, the eight-finger $2 \times 30 \mu\text{m}$ power cells achieved 1.17-W output power, which indicates 4.88-W/mm emitter length, with 54% power-added efficiency (PAE) and 7.3-dB gain. This is believed to be the best combination of PAE and output power reported for this power density at K-band frequencies.



Abstracts

Rapid calculation of the Green's function in the shielded planar structures

Myun-Joo Park and Sangwook Nam. "Rapid calculation of the Green's function in the shielded planar structures." 1997 Microwave and Guided Wave Letters 7.10 (Oct. 1997 [MGWL]): 326-328.

A rapid summation method is proposed for the potential Green's function in shielded planar multilayered structures. Most terms of the Green's function series are converted into the space domain static image series and are calculated efficiently using the Ewald sum technique. Numerical results show the efficiency and accuracy of the proposed method.



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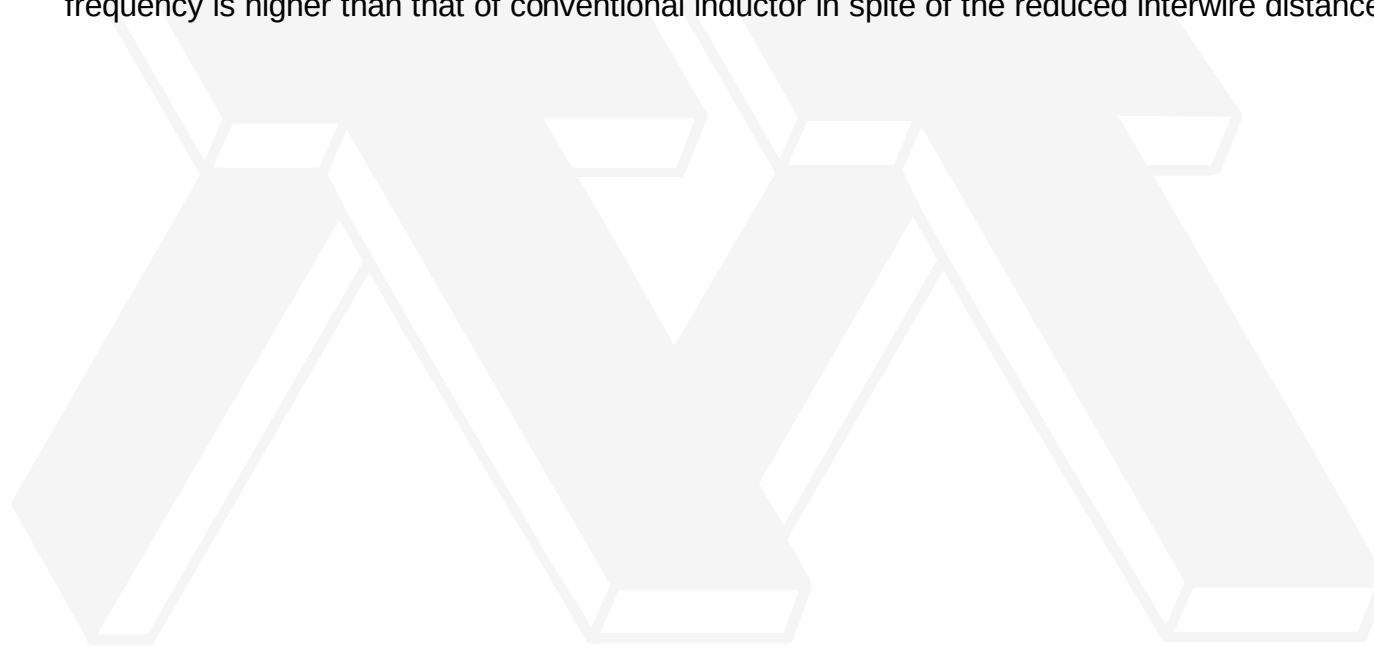
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Air-gap stacked spiral inductor

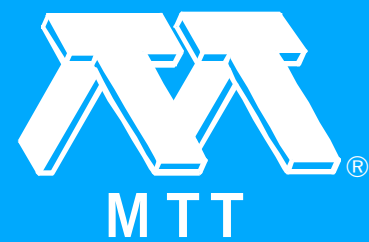
Seung Won Paek and Kwang Seok Seo. "Air-gap stacked spiral inductor." 1997 Microwave and Guided Wave Letters 7.10 (Oct. 1997 [MGWL]): 329-331.

In this letter, we propose an air-gap stacked spiral inductor using air-bridge technology. By stacking metal lines, inductor area can be reduced by 25%-5% compared with conventional spiral inductors. The air-gap structure yields low parasitic capacitance, so that the resonance frequency is higher than that of conventional inductor in spite of the reduced interwire distance.



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Electromagnetic scattering from agricultural vegetation in clusters using Monte Carlo simulation

Shu-Qing Li and Wen-Bing Wang. "Electromagnetic scattering from agricultural vegetation in clusters using Monte Carlo simulation." 1997 Microwave and Guided Wave Letters 7.10 (Oct. 1997 [MGWL]): 332-334.

An electromagnetic scattering model for agricultural vegetation where leaves occur in clusters is developed in this letter. By applying the Monte Carlo simulation technique, the backscattering properties of vegetation are studied for two different cases where the position distribution of clusters is regular or random. The results show that the position distribution of clusters plays an important role in determining the observed coherent effects. The incoherent scattering parts in the two different cases are almost equal and the regular position distribution of clusters can lead to a strong coherent part despite the random orientation of leaves. The work of this letter indicates that it is necessary for theoretical scattering models to take the position distribution of clusters into account.

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PML absorbing boundary condition for noncubic cell time-domain method

N. Harada and M. Hano. "PML absorbing boundary condition for noncubic cell time-domain method." 1997 Microwave and Guided Wave Letters 7.10 (Oct. 1997 [MGWL]): 335-337.

Conventional absorbing boundary conditions (ABC's) are used for cubic-cell finite-difference time-domain (FDTD) grids, but not in noncubic cell time-domain grids. We propose an algorithm to apply perfectly matched layer (PML) ABC to the noncubic cell time-domain method. The numerical experiments are conducted on the accuracy of the PML in a regular triangle cell grid versus standard second-order Mur and PML ABC's in a square-cell FDTD grid. The PML global error is about 10^{-3} of the former and about three times of the latter. According to the convergent characteristics this algorithm is equivalent to that of applying PML ABC to the FDTD method.

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Beam propagation analysis of fast mode-conversion evolution bent waveguides with apexes-linked microprisms

Ching-Ting Lee and Ping-Lin Fan. "Beam propagation analysis of fast mode-conversion evolution bent waveguides with apexes-linked microprisms." 1997 Microwave and Guided Wave Letters 7.10 (Oct. 1997 [MGWL]): 338-340.

A fast mode-conversion evolution and wide-angle low-loss abrupt bent waveguide with apexes-linked microprisms is proposed and compared with the conventional single prism structure. For the proposed bent waveguide with bend angle 10/spl deg/, the transmitted power efficiency of 96.06% and a mode-conversion length of 40 /spl mu/m can be achieved.

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Local stability analysis of microwave oscillators based on Nyquist's theorem

V. Rizzoli, A. Neri and D. Masotti. "Local stability analysis of microwave oscillators based on Nyquist's theorem." 1997 Microwave and Guided Wave Letters 7.10 (Oct. 1997 [MGWL]): 341-343.

The numerical implementation of Nyquist's theorem for the local stability analysis of forced nonlinear microwave circuits operating in a time-periodic electrical regime is well established. However, the straightforward application of the same algorithm to the stability investigation of autonomous circuits, such as oscillators, may lead to paradoxical results lacking in physical meaning. After demonstrating this by a typical example, we discuss the correct extension of Nyquist's stability analysis to autonomous nonlinear circuits and illustrate the application of the new algorithm to a simple microwave dielectric resonator oscillator (DRO).



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Dispersion characteristics of microstrip transmission line on glass microwave IC's

N. Jain and B. Brown. "Dispersion characteristics of microstrip transmission line on glass microwave IC's." 1997 Microwave and Guided Wave Letters 7.10 (Oct. 1997 [MGWL]): 344-346.

Measurement of the effective dielectric constant of microstrip transmission line on glass for the frequency range of 5-35 GHz are presented. These measurements indicate that there is very little dispersion in 200- μ m-thick glass for frequencies up to 35 GHz. Further, electromagnetic analysis shows that the dielectric constant of glass changes from 4.05 to 4.00 when the frequency varies from 5 to 35 GHz, somewhat compensating for the dispersion.

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Transparent absorbing boundary (TAB) for the truncation of the computational domain

J. Peng and C.A. Balanis. "Transparent absorbing boundary (TAB) for the truncation of the computational domain." 1997 Microwave and Guided Wave Letters 7.10 (Oct. 1997 [MGWL]): 347-349.

A new approach to domain truncation without reflection is proposed for finite methods. The open-space Maxwell's equations, along with boundary conditions, are transformed to an equivalent system with a homogeneous closed boundary; the latter is then solved numerically. Like the popular perfectly matched layer (PML), the new method is independent of frequency and incident angle. Its uniqueness is that it does not need the extra absorption region, since the field attenuation takes place in the domain of the subject.

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Abstracts

A 2.4-GHz silicon-on-sapphire CMOS low-noise amplifier

R.A. Johnson, C.E. Chang, P.R. de la Houssaye, M.E. Wood, G.A. Garcia, P.M. Asbeck and I. Lagnado. "A 2.4-GHz silicon-on-sapphire CMOS low-noise amplifier." 1997 Microwave and Guided Wave Letters 7.10 (Oct. 1997 [MGWL]): 350-352.

A low-noise amplifier operating at 2.4 GHz has been fabricated with MOSFETs in silicon-on-sapphire technology. The amplifier has a 2.8-dB noise figure, 10-dB gain, and 14-dBm output referred IP3 with 14-mW power dissipation. The amplifier was matched for minimum noise with on-chip spiral inductors and capacitors.



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A 50-MHz-55-GHz multidecade InP-based HBT distributed amplifier

K.W. Kobayashi, J. Cowles, L.T. Tran, A. Gutierrez-Aitken, T.R. Block, A.K. Oki and D.C. Streit. "A 50-MHz-55-GHz multidecade InP-based HBT distributed amplifier." 1997 Microwave and Guided Wave Letters 7.10 (Oct. 1997 [MGWL]): 353-355.

The authors report on a 50-MHz-55-GHz multidecade bandwidth InP-based heterojunction bipolar transistor (HBT) MMIC distributed amplifier (DA) which achieves the widest bandwidth and highest frequency of operation so far demonstrated for a bipolar amplifier. The HBT MMIC DA was fabricated using a high-speed 1- μm InAlAs-InGaAs-InP HBT base-undercut technology with peak $f_{\text{sub T}}$'s and $f_{\text{sub max}}$'s of 80 and 200 GHz, respectively, in order to obtain broad-band gain. Key to this work is the successful employment of HBT active load terminations used on both the input and output DA transmission lines in order to extend the low-frequency gain performance down to baseband. With only 82 mW of DC power consumption, the amplifier obtains measured gains of 7.6 dB at 50 MHz, 5.7 dB at 30 GHz, 5.8 dB at 50 GHz, and 3.1 dB at 55 GHz. Simulations of a monolithically integrated InGaAs p-i-n photodetector predicts a baseband 47-GHz photoreceiver response with an effective transimpedance of 38-dB/spl Ω . The baseband millimeter-wave capability of the InP-based HBT DA and its compatibility with InGaAs photodetectors makes this technology attractive for future generation (>40 Gb/s) high-data-rate light-wave applications.

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Analyses of the optimal power load impedances measured in MMIC and hybrid configuration in the Ka band

C. Gaquiere, E. Bourcier, S. Piotrowicz and Y. Crosnier. "Analyses of the optimal power load impedances measured in MMIC and hybrid configuration in the Ka band." 1997 Microwave and Guided Wave Letters 7.10 (Oct. 1997 [MGWL]): 356-358.

The authors deal with the main different behaviors of the optimal power load impedances for two devices (PHEMT) studied in two configurations (called "probing" or "hybrid") in power condition with an active load pull bench in Ka band (26-40 GHz). Contrary to what would be expected, the difference is not only a phase shift, which is usually the case at lower frequencies, but a gap in phase and magnitude between the optimal impedances. This behavior is presented. A linear electrical simulation has been achieved in order to explain these behaviors.



Abstracts

Fast and robust inexact Newton approach to the harmonic-balance analysis of nonlinear microwave circuits

V. Rizzoli, F. Mastri, C. Cecchetti and F. Sgallari. "Fast and robust inexact Newton approach to the harmonic-balance analysis of nonlinear microwave circuits." 1997 Microwave and Guided Wave Letters 7.10 (Oct. 1997 [MGWL]): 359-361.

The authors discuss a novel approach to nonlinear microwave circuit simulation by the harmonic-balance (HB) technique. The nonlinear system is solved by an inexact Newton method, and the GMRES iteration is used at each step to find a suitable inexact Newton update. The peculiar structure of the Jacobian matrix allows the basis vectors of the Krylov subspace to be computed mostly by the FFT. The resulting simulation tool is fast and robust, and outperforms conventional HB techniques when applied to large-size nonlinear analysis problems.



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Abstracts

A passive double-layer microstrip array for the construction of millimeter-wave spatial power-combining amplifiers

T. Ivanov, S. Ortiz, A. Mortazawi, E. Schlecht and J. Hubert. "A passive double-layer microstrip array for the construction of millimeter-wave spatial power-combining amplifiers." 1997 Microwave and Guided Wave Letters 7.11 (Nov. 1997 [MGWL]): 365-367.

A passive double-layer microstrip array for the construction of millimeter-wave quasioptical amplifiers has been demonstrated. A total insertion loss of 3.1 dB was measured for a 138 element divider/combiner at 35.1 GHz. The 3-dB bandwidth is larger than 1 GHz. The array incorporates microstrip-slot-microstrip transitions with an insertion loss of 0.2 dB at the design frequency and microstrip patch antennas with an estimated efficiency of approximately 72%.



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An improved unimodal absorbing boundary condition for waveguide problems

Kyung-Young Jung, Hyeongdong Kim and Kwang-Cheol Ko. "An improved unimodal absorbing boundary condition for waveguide problems." 1997 Microwave and Guided Wave Letters 7.11 (Nov. 1997 [MGWL]): 368-370.

An improved unimodal absorbing boundary condition (ABC) is proposed by using one-dimensional (1-D) mode finite-difference time-domain (FDTD). In the unimodal ABC, an uniform auxiliary waveguide of input-output port should be introduced so that evanescent waves attenuate sufficiently. In this letter, the uniform auxiliary waveguide is simulated by 1-D mode FDTD rather than three-dimensional (3-D) FDTD which is used in the conventional unimodal ABC. Memory storage and CPU time are significantly reduced by applying the proposed ABC. A WG-90 rectangular waveguide with a thick asymmetric iris is analyzed by FDTD with the conventional modal ABC and the proposed ABC, and scattering parameters and computational efficiency are compared.

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Systematic derivation of anisotropic PML absorbing media in cylindrical and spherical coordinates

F.L. Teixeira and W.C. Chew. "Systematic derivation of anisotropic PML absorbing media in cylindrical and spherical coordinates." 1997 Microwave and Guided Wave Letters 7.11 (Nov. 1997 [MGWL]): 371-373.

A simple and systematic derivation of anisotropic perfectly matched layers (PMLs) in cylindrical and spherical coordinates is presented. The derivation is based on the analytic continuation of Maxwell's equations to complex space. Through field transformations, results for Cartesian anisotropic PML media are recovered and, more importantly, a generalization of the anisotropic PML to cylindrical and spherical systems is obtained, providing further clarification on the PML concept. As expected, these new PML media are cylindrically and spherically layered, respectively.

Click on title for a complete paper.



Abstracts

A general mapping technique for Fourier transform computation in nonlinear circuit analysis

P.J.C. Rodrigues. "A general mapping technique for Fourier transform computation in nonlinear circuit analysis." 1997 Microwave and Guided Wave Letters 7.11 (Nov. 1997 [MGWL]): 374-376.

A mapping technique that can handle any number of fundamental frequencies in multitone nonlinear circuit analysis is presented. In this technique, almost-periodic spectrum truncated using the box scheme is mapped onto an equivalent periodic spectrum which is dense with no missing harmonic. The Fourier transform (or its inverse) is then implemented by a single one-dimensional fast Fourier transform. Characteristics of the mapping technique are illustrated by some results. Due to its good combination of flexibility and speed, this mapping technique should be considered as an alternative to the multidimensional discrete Fourier transform in general-purpose harmonic-balance simulators.



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Lightly doped emitter HBT for low-power circuits

C.E. Chang, P.F. Chen, P.M. Asbeck, L.T. Tran, D.C. Streit and A.K. Oki. "Lightly doped emitter HBT for low-power circuits." 1997 Microwave and Guided Wave Letters 7.11 (Nov. 1997 [MGWL]): 377-379.

We report an approach to reduce the base-emitter capacitance in AlGaAs-GaAs heterojunction bipolar transistors (HBT's) by adding a lightly doped emitter (LDE) region together with appropriate planar (δ) doping region to a conventional base-emitter junction. This improves both the f_t and β for low collector current density (J_c) operation while preserving the high peak f_t at high J_c . When applied to a current mode logic 128/129 programmable prescaler, the LDE HBT results in a reduction in power dissipation and improved bandwidth without any circuit modifications.

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Low-noise monolithic Ku-band VCO using pseudomorphic HEMT technology

J. Portilla, M.L. de la Fuente, J.P. Pascual and E. Artal. "Low-noise monolithic Ku-band VCO using pseudomorphic HEMT technology." 1997 Microwave and Guided Wave Letters 7.11 (Nov. 1997 [MGWL]): 380-382.

A low-noise pseudomorphic HEMT Ku-band oscillator with varactor frequency tuning and voltage power control is reported. The circuit size, including the varactor and the pads for on-wafer testing, is less than 0.7 mm/sup 2/. On-wafer oscillator measurements show a frequency tuning bandwidth of 600 MHz centered at /spl sim/15.2 GHz and an output power up to 17 dBm with more than 15 dB of power control. Phase noise of -87 dBc/Hz at 100 kHz has been obtained, which is an excellent result for a fully monolithic integrated Ku-band voltage-controlled oscillator (VCO).

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"Back Cover (Nov. 1997 [MGWL])." 1997 Microwave and Guided Wave Letters 7.11 (Nov. 1997 [MGWL]): 0_3-0_4.



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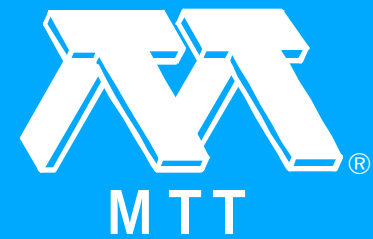
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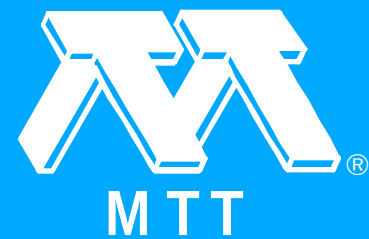
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Chained function filters

M. Guglielmi and G. Connor. "Chained function filters." 1997 Microwave and Guided Wave Letters 7.12 (Dec. 1997 [MGWL]): 390-392.

In this work we describe a new family of filter transfer functions called Chained Function (CF) filters that have the property of having a reduced sensitivity to manufacturing errors. The reduction is achieved by controlling the position of the return loss zeros while maintaining a given maximum ripple in the inband response. The formulation is given in detail together with an example of application confirming the achieved reduction. The CF family of filters can be used effectively to extend the range of applicability of state-of-the-art tuningless implementations toward higher frequencies or narrower bandwidths.

Click on title for a complete paper.



Abstracts

Mode transitions between bound and leaky regimes in lossy dielectric waveguides: a numerical investigation

G.B. Athanasoulas and N.K. Uzunoglu. "Mode transitions between bound and leaky regimes in lossy dielectric waveguides: a numerical investigation." 1997 Microwave and Guided Wave Letters 7.12 (Dec. 1997 [MGWL]): 393-395.

The authors present a novel numerical study of mode transitions between bound and leaky regimes in a lossy-substrate dielectric rib waveguide. An entire-domain basis Galerkin's method is employed to determine the wavenumbers of the transmission line modes. The obtained results show that as the loss tangent gradually increases from zero to infinity, the plots of the attenuation constants alter between regions of constant and linear variation. In the progress of this behavior the modes evolve from leaky to bound state, or the inverse, and their corresponding poles in the spectral plane cross the real axis.



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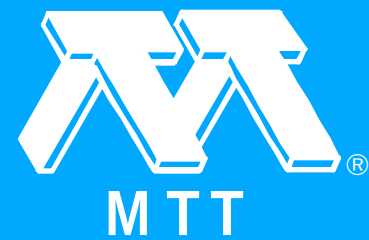


Abstracts

Introduction of artificial boundary conditions in the spectral moments method

E. Bachelier, G. Poussigue, P. Borderies and C. Benoit. "Introduction of artificial boundary conditions in the spectral moments method." 1997 Microwave and Guided Wave Letters 7.12 (Dec. 1997 [MGWL]): 396-398.

The overall objective of this paper is to demonstrate the ability of the spectral moments method, a new method in electromagnetism, to incorporate absorbing boundary conditions. This demonstration is done successfully with plane pulse propagation in free space, and through a comparison with finite-difference time-domain (FDTD) results. The very good agreement of the results leads to the conclusion that the spectral moments method application for electromagnetic propagation and diffraction problems should be further investigated.



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Use of an active retrodirective antenna array as a multipath sensor

S.L. Karode and V.F. Fusco. "Use of an active retrodirective antenna array as a multipath sensor." 1997 Microwave and Guided Wave Letters 7.12 (Dec. 1997 [MGWL]): 399-401.

The use of an active retrodirective antenna as an indicator of multipath propagation effects is investigated by the authors. It is shown that the flat azimuthal gain response normally associated with a retrodirective antenna array can be significantly modified by the presence of multipath signals. These signals act as secondary sources impinging on the retrodirective antenna array and give rise to amplitude perturbations in its azimuthal gain response. Using a retrodirective antenna array, the relative amplitude and phase components for the multipath signals can be recovered. In this way, the retrodirective antenna can be used as a low-cost multipath sensor.





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Path integral computation of lowest order modes in arbitrary-shaped inhomogeneous waveguides

V. Galdi, V. Pierro and I.M. Pinto. "Path integral computation of lowest order modes in arbitrary-shaped inhomogeneous waveguides." 1997 Microwave and Guided Wave Letters 7.12 (Dec. 1997 [MGWL]): 402-404.

A general numerical algorithm for the computation of the fundamental modes and related cutoff wavenumbers in arbitrary shaped inhomogeneous waveguides is presented. The method exploits a generalized Donsker-Kac formula to express the lowest order modes in terms of asymptotic generalized Wiener-Ito integrals, whose computation is carried out by means of Monte Carlo methods. Comparison with known solutions and computational budget indicate that the proposed method is indeed accurate, versatile, as well as computationally efficient.

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Abstracts

Approximate upper and lower bounds on the VSWR of a 3-port circulator with nonideal loads

J. Helszajn. "Approximate upper and lower bounds on the VSWR of a 3-port circulator with nonideal loads." 1997 Microwave and Guided Wave Letters 7.12 (Dec. 1997 [MGWL]): 405-407.

The upper and lower bounds on the voltage standing wave ratio (VSWR) at port 1 of a 3-port circulator with a complex load under any phase conditions at port 2 and a nonideal termination at port 3 is of some interest in microwave engineering. The purpose of this letter is to give a solution to this problem under some simplifying conditions. The lower bound obtained here is in keeping with the definition of the complex gyrator circuit of this sort of junction when either port 2 or port 3 is terminated in its complex conjugate load.



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Direct extraction of the series equivalent circuit parameters for the small-signal model of SOI MOSFETs

J.P. Raskin, G. Dambrine and R. Gillon. "Direct extraction of the series equivalent circuit parameters for the small-signal model of SOI MOSFETs." 1997 Microwave and Guided Wave Letters 7.12 (Dec. 1997 [MGWL]): 408-410.

A new extraction scheme is proposed which allows to determine all the series equivalent circuit elements values from S-parameters measurements at a single bias point in saturation. Exploiting the specific shape of a set of impedance loci, the new scheme uses linear regression techniques to solve the extraction problem. The resulting algorithm is very simple and efficient when compared to optimizer-driven approaches.



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High-accuracy assigned power excitation for the FDTD technique

G. Bellanca. "High-accuracy assigned power excitation for the FDTD technique." 1997 Microwave and Guided Wave Letters 7.12 (Dec. 1997 [MGWL]): 411-413.

When the finite-difference time-domain (FDTD) technique is used in continuous wave excitation, the control of the effectively excited power is not allowed by classical approaches. In this letter two possible solutions, working also for nonuniform sampling of the computational domain, are proposed and illustrated. Examples of successfully applications for a metallic rectangular waveguide are, finally, reported.

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FDTD analysis of submillimeter-wave CPW with finite-width ground metallization

Ngoc-Hoa Huynh and W. Heinrich. "FDTD analysis of submillimeter-wave CPW with finite-width ground metallization." 1997 Microwave and Guided Wave Letters 7.12 (Dec. 1997 [MGWL]): 414-416.

The dispersion and attenuation characteristics of conductor-backed coplanar transmission lines with finite-width ground metallizations are studied in the frequency range up to 1 THz. The finite-difference time-domain (FDTD) method is used for analysis. Open boundaries are described by means of Berenger's perfectly matched layer. The results are compared to electrooptic measurements. They show that introducing ground metallizations of finite width causes distinct changes in attenuation and dispersion characteristics.

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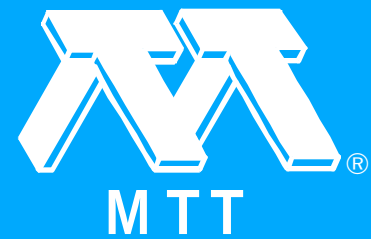


Abstracts

Asia-Pacific Abstracts (Dec. 1997 [MGWL])

H. Ogawa and S.-J. Xu. "Asia-Pacific Abstracts (Dec. 1997 [MGWL])." 1997 Microwave and Guided Wave Letters 7.12 (Dec. 1997 [MGWL]): 417-466.

Compiled by Dr. Hiroyo Ogawa, NTT Wireless Systems Laboratories, 1-1 Hikarinooka, Yokosuka-shi, Kanagawa-ken, 239 Japan, and Prof. S.-J. Xu, Department of Radio and Electronics, the University of Science and Technology of China, Hefei, Anhui, 230026 P.R.C.



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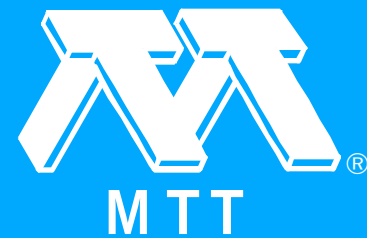


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Index, IEEE Microwave and Guided Wave Letters, Vol. 7, 1997

"Index, IEEE Microwave and Guided Wave Letters, Vol. 7, 1997." 1997 Microwave and Guided Wave Letters 7.12 (Dec. 1997 [MGWL]): 1-19.

This index covers all technical items - papers, correspondence, reviews, etc. - that appeared in this periodical during 1997, and items from previous years that were commented upon or corrected in 1997.



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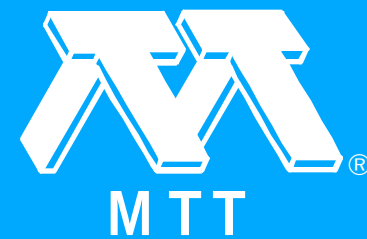
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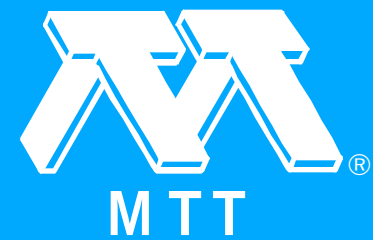
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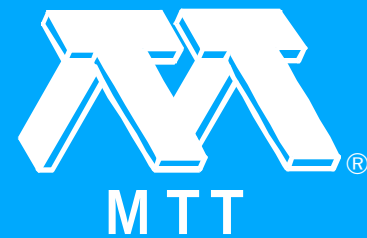


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Welcome (1997 Vol. I [MWSYM])

C.M. Weil, M. Kanda and R.B. Marks. "Welcome (1997 Vol. I [MWSYM])." 1997 MTT-S International Microwave Symposium Digest 1. (1997 Vol. I [MWSYM]).

The three volumes of this Digest, as well as the associated CD-ROM, contain the archival record of papers presented at the 1997 IEEE MTT-S International Microwave Symposium (IMS), held at the Colorado Convention Center in Denver, CO, USA on 8-13 June 1997.



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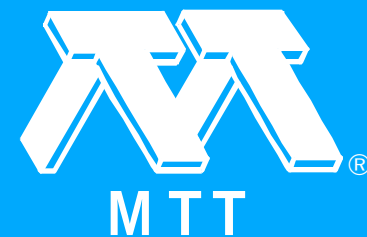


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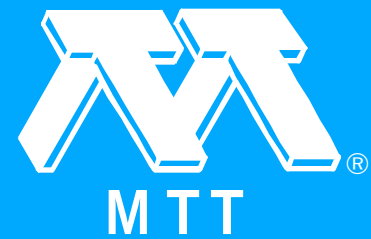


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Technical Program Co-Chairs' Message (1997 Vol. I [MWSYM])

K.C. Gupta and Z. Popovic. "Technical Program Co-Chairs' Message (1997 Vol. I [MWSYM])." 1997 MTT-S International Microwave Symposium Digest 1. (1997 Vol. I [MWSYM]).

Welcome to Denver and the 1997 MTT "Microwave Week". We hope that the '97 International Microwave Symposium provides the best possible opportunity for you to keep up-to-date on our rapidly changing field.



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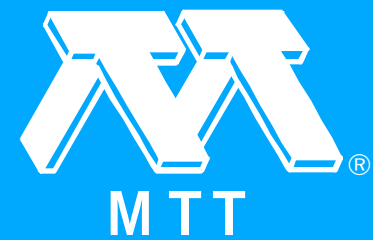
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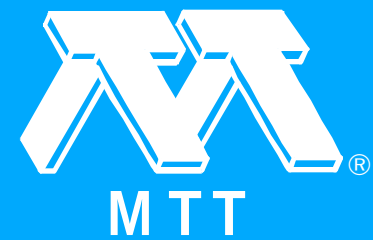
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Silicon RF GCMOS performance for portable communications applications (1997 Vol. I [MWSYM])

E. Spears, D. Ngo, Jun Ma, Han-Bin Liang, D. Spooner, J. Ford, S. Cheng, B. Courson, B. Yeung, J. Avalrez, J. Bhalla and D. Lamey. "Silicon RF GCMOS performance for portable communications applications (1997 Vol. I [MWSYM])." 1997 MTT-S International Microwave Symposium Digest 1. (1997 Vol. I [MWSYM]): 1-4.

A submicron silicon Radio Frequency Graded Channel MOS (RFGCMOS) technology has been developed for portable communications applications. A 12 mm device at 900 MHz has +29 dBm output power with 12 dB gain and 78% power added efficiency (PAE) at a drain to source voltage of 3.4 V, and drain to source quiescent current of 150 mA. A 256 /spl mu/m device at 900 MHz has 18.9 dB of small signal gain and an associated noise figure of 1.1 dB at VDS=3.0 volts and IDS=2 mA.



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High dynamic range variable gain amplifier for CDMA applications (1997 Vol. I [MWSYM])

M. Kasashima, S. Tachi and K. Tanaka. "High dynamic range variable gain amplifier for CDMA applications (1997 Vol. I [MWSYM])." 1997 MTT-S International Microwave Symposium Digest 1. (1997 Vol. I [MWSYM]): 5-8.

A new attenuator and threshold voltage (V_{th}) compensation circuits using GaAs MESFETs were designed and developed and this circuit was applied to develop a variable gain amplifier (VGA) for CDMA cellular phone systems. This VGA is packaged in an 8 pin plastic package and demonstrated high dynamic variable gain range (80 dB/100 MHz 70 dB/250 MHz 55 dB/500 MHz). High gain of 60 dB is observed for 85 MHz with low power consumption ($V_{dd}=+2.7$ V, $I_{dd}=6$ mA). Since depletion mode MESFETs are used no negative supply is needed for gain control.

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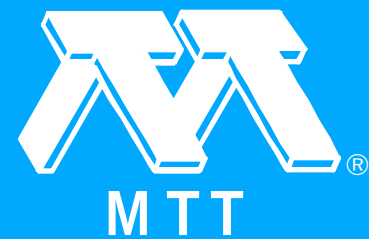


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A novel integrated microwave bias network for low cost multistage amplifiers (1997 Vol. I [MWSYM])

H. Morkner, M. Frank, K. Negus and Tsong-Ming Kao. "A novel integrated microwave bias network for low cost multistage amplifiers (1997 Vol. I [MWSYM])." 1997 MTT-S International Microwave Symposium Digest 1. (1997 Vol. I [MWSYM]): 9-12.

A novel MMIC bias network topology utilizing FETs has been developed. The bias network is very compact, providing low DC path loss with high, broad band RF isolation. This bias network consists of two FETs and a capacitor, and is implemented in pseudomorphic HEMT. The bias network is useful in multi-stage amplifiers where stage-to-stage RF isolation is critical to system stability and performance. A VGA (Variable gain amplifier) is shown with measured results as a application example of the bias network. There is no other known published information or patents on this bias network topology.



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MMIC GaAs transimpedance amplifiers for optoelectronic applications (1997 Vol. I [MWSYM])

P. Dueme, M. Schaller, D. Mathoorasing, S. Bouchoule, C. Kazmierski, S. Maricot and C. Rumelhard. "MMIC GaAs transimpedance amplifiers for optoelectronic applications (1997 Vol. I [MWSYM])." 1997 MTT-S International Microwave Symposium Digest 1. (1997 Vol. I [MWSYM]): 13-16.

This paper demonstrates the feasibility of MMICs able to improve the global performances of an optical link, over a typical 1 to 20 GHz frequency range. A distributed laser driver and a photodiode bootstrap follower provide active matching between 50 Ω and optoelectronic transducers.



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Ka-band ultra low noise MMIC amplifier using pseudomorphic HEMTs (1997 Vol. I [MWSYM])

S. Fujimoto, T. Katoh, T. Ishida, T. Oku, Y. Sasaki, T. Ishikawa and Y. Mitsui. "Ka-band ultra low noise MMIC amplifier using pseudomorphic HEMTs (1997 Vol. I [MWSYM])." 1997 MTT-S International Microwave Symposium Digest 1. (1997 Vol. I [MWSYM]): 17-20.

A Ka-band monolithic low noise two stage amplifier has been developed using an AlGaAs-InGaAs-GaAs pseudomorphic HEMTs with a gate length of 0.15 μm . For a superior noise figure, the MMIC was optimized by inserting a low loss resonator type stabilizing circuit without sacrificing the gain performance. The amplifier has achieved a 1.0 dB noise figure with an associated gain of 18.0 dB at 32 GHz. These results are the best of AlGaAs-InGaAs-GaAs P-HEMT MMICs ever reported to date.

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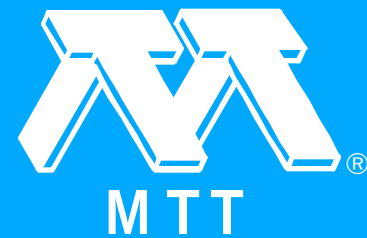


Abstracts

Broadband wireless access using millimetre-wave over fibre systems

A.J. Seeds. "Broadband wireless access using millimetre-wave over fibre systems." 1997 MTT-S International Microwave Symposium Digest 1. (1997 Vol. I [MWSYM]): 23-25.

The paper reviews technologies for providing broadband wireless access using millimetre-wave over fibre systems. Recent advances in modulated signal generation using optical phase lock loop techniques and in signal detection using optically controlled heterojunction phototransistors are also described.



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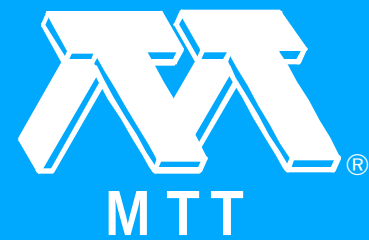


Abstracts

Wideband millimeter wave/optical network applications in Japan

N. Imai, H. Kawamura, K. Inagaki and Y. Karasawa. "Wideband millimeter wave/optical network applications in Japan." 1997 MTT-S International Microwave Symposium Digest 1. (1997 Vol. 1 [MWSYM]): 27-30.

This paper describes work on wideband millimeter-wave/optical network applications in Japan, especially projects being pursued at ATR. Results of fundamental transmission experiments demonstrate the feasibility of digital signal transmission at 118 Mbps with a BER of less than 10^{-6} . In addition, an advanced system considered suitable for future high-speed mobile communications is proposed. This system employs an intelligent multibeam antenna and the direction of each sharp beam can be controlled adaptively. An optical signal processing array antenna is found to be suitable for this system, and several key technologies for system construction are described.



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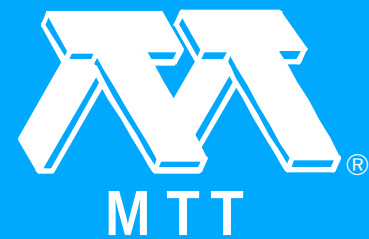


Abstracts

Outdoor and indoor applications for broadband local loop with fibre supported mm-wave radio systems

M. Goloubkoff, E. Penard, D. Tanguy, P. Legaud, D. Mathoorasing, F. Devaux and C. Minot. "Outdoor and indoor applications for broadband local loop with fibre supported mm-wave radio systems." 1997 MTT-S International Microwave Symposium Digest 1. (1997 Vol. I [MWSYM]): 31-34.

Radio over fiber is emerging as an attractive option for the delivery of broadband services. Two outdoor systems, in "FRANS", an ACTS European project, will demonstrate the integration of bilateral point/multipoint mm-wave radio system over a Passive Optical Network (PON) system and over an Hybrid Fiber Coax (HFC) system. These hybrid approaches can suit local access network operators future needs. For indoor systems, Radio over Fiber introduces restricted mobility. Thank to expected low cost transducers, bit rates of few tens of MBit/s have been demonstrated for Residential Broadband Applications.



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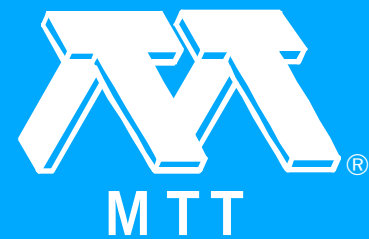


Abstracts

An optical link for W-band transmit/receive applications

E.C. Niehenke and P. Herczfeld. "An optical link for W-band transmit/receive applications." 1997 MTT-S International Microwave Symposium Digest 1. (1997 Vol. I [MWSYM]): 35-38.

This paper describes the design, fabrication, and evaluation of a low noise optical link for W-band transmit/receive applications. The optical link is at Ku-band with an input power of 5 mW, compatible with the direct frequency coherent synthesizer, followed with low-cost MMIC /spl times/6 for W-band output of 70 mW and /spl times/3 for the W-band /spl times/2 subharmonic mixer with an output power of 32 mW. A diode pumped YAG laser at 1319 nm is modulated with a Mach-Zehnder modulator at Ku band and detected with PIN diode photodetector. The measured Ku band phase noise floor of -145 dBc/Hz was obtained with a projected W-band phase noise of -129.4 dBc/Hz.



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A 60 GHz 120 Mb/s QPSK fibre-radio transmission experiment incorporating an electroabsorption modulator transceiver for a full duplex optical data path

D. Wake, L. Noel, D.G. Moodie, D.D. Marcenac, L.D. Westbrook and D. Nessel. "A 60 GHz 120 Mb/s QPSK fibre-radio transmission experiment incorporating an electroabsorption modulator transceiver for a full duplex optical data path." 1997 MTT-S International Microwave Symposium Digest 1. (1997 Vol. I [MWSYM]): 39-42.

A high capacity millimetre-wave fibre-radio system with an elegant return path has been demonstrated for the first time using a number of novel techniques. A 60 GHz carrier signal was generated using a master/slave DFB laser configuration and a remote upconversion scheme was used to provide a fully transparent link for the data signal (120Mb/s QPSK and 20 FM TV channels). Furthermore, an electroabsorption modulator was used as a full duplex transceiver to provide an attractive strategy for the return path.



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The operation of microwave power amplifiers fabricated from wide bandgap semiconductors

R.J. Trew. "The operation of microwave power amplifiers fabricated from wide bandgap semiconductors." 1997 MTT-S International Microwave Symposium Digest 1. (1997 Vol. I [MWSYM]): 45-48.

There are a variety of RF and microwave electronic devices that can be fabricated from wide bandgap semiconductors such as SiC and GaN. These semiconductors have many properties that make them near ideal for electronic devices intended for high temperature, high frequency, high power, and radiation hard applications. Prototype SiC and GaN-based electronic devices with very good DC and RF performance have been demonstrated and devices such as diodes are commercially available, while RF and high frequency transistors are rapidly approaching the commercialization stage. In this work the performance of microwave power amplifiers fabricated using SiC and GaN-based MESFET's are discussed and investigated. It is demonstrated that these amplifiers can produce RF output power on the order of 4-6 W/mm of gate periphery with near ideal power-added efficiency.

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Abstracts

Wide dynamic range RF mixers using wide-bandgap semiconductors

C. Fazi and P.G. Neudeck. "Wide dynamic range RF mixers using wide-bandgap semiconductors." 1997 MTT-S International Microwave Symposium Digest 1. (1997 Vol. I [MWSYM]): 49-51.

This paper describes how wide-bandgap semiconductors, such as silicon carbide or gallium nitride, can be useful in developing a wide dynamic range RF mixer with low intermodulation distortion products, instead of using conventional narrow bandgap semiconductors, such as silicon and gallium arsenide junctions, which have limited dynamic range. A wider dynamic range mixer allows for the reception of weak RF signals, even in the presence of strong undesired signals. This feature also permits closer location of RF sources and receivers with less severe interference. Using an improved high-level mixer can lead to better communications, radar, and navigational equipment for aircraft, maritime, and other applications that share an overcrowded RF spectrum.



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Recent application of silicon carbide to high power microwave

A.W. Morse, P.M. Esker, S. Sriram, J.J. Hawkins, L.S. Chen, J.A. Ostop, T.J. Smith, C.D. Davis, R.R. Barron, R.C. Clarke, R.R. Siergiej and C.D. Brandt. "Recent application of silicon carbide to high power microwave." 1997 MTT-S International Microwave Symposium Digest 1. (1997 Vol. I [MWSYM]): 53-56.

Silicon carbide is emerging semiconductor material which is now proven to be especially well suited for high power, high frequency applications. Recent results verify the superiority of silicon carbide over both silicon or gallium arsenide for fabrication of high power transistors from DC through X-band. A silicon carbide UHF television module has demonstrated good signal fidelity at the 2000 W PEP level. S-band transistors show well over 200 watts peak for radar applications, and over 6 W has been obtained at X-band in a silicon carbide MESFET.



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Silicon carbide MESFETs for high-power S-band applications

S.T. Allen, R.A. Sadler, T.S. Alcom, J.W. Palmour and C.H. Carter. "Silicon carbide MESFETs for high-power S-band applications." 1997 MTT-S International Microwave Symposium Digest 1. (1997 Vol. I [MWSYM]): 57-60.

Silicon carbide MESFETs with 0.7 μm gates and 18 mm of total periphery had a $P_{\text{sub 1db}}$ of 15 watts CW at 2.1 GHz with a power-added efficiency of 54%. These FETs were optimized for S-band power and had an $f_{\text{sub T}}$ of 8.5 GHz and an $f_{\text{sub max}}$ of 25 GHz. Similar devices with 0.45 μm gate lengths had an $f_{\text{sub T}}$ of 22 GHz and an $f_{\text{sub max}}$ as high as 50 GHz, demonstrating the potential of this technology to extend to much higher frequencies.

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Transient electromagnetic analysis and model complexity reduction using the partial element equivalent circuit formulation

W. Pinello, A. Cangellaris and A. Ruehli. "Transient electromagnetic analysis and model complexity reduction using the partial element equivalent circuit formulation." 1997 MTT-S International Microwave Symposium Digest 1. (1997 Vol. 1 [MWSYM]): 63-66.

Nonlinear electromagnetic field simulation is becoming essential for mixed signal (RF/microwave and digital) circuit design applications. So far, direct analysis of such nonlinear electromagnetic circuits has been demonstrated successfully only within the context of the the FDTD and the TLM method. In this paper, it is shown that time-domain integral equation techniques can be used also for nonlinear electromagnetic circuit analysis. In particular, the application of the so-called Partial Element Equivalent Circuit formulation of the time-domain electric field integral equation leads to a very convenient SPICE-compatible approximation of the electromagnetic problem. Furthermore, it has the important attribute of lending itself to a very systematic and physical model complexity reduction on the basis of the electrical size of the various portions of the system under study. Numerical experiments are used to demonstrate these special attributes of this formulation.

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Nonlinear analysis of a microwave diode mixer using the extended FDTD

Min Chen, Siou Teck Chew and T. Itoh. "Nonlinear analysis of a microwave diode mixer using the extended FDTD." 1997 MTT-S International Microwave Symposium Digest 1. (1997 Vol. 1 [MWSYM]): 67-70.

The application of the extended Finite-Difference Time-Domain (FDTD) method to the analysis of microwave diode mixers is presented in this paper. Using equivalent current-sources and equivalent circuit models, nonlinear active devices can be incorporated into FDTD simulation. An X-band singly balanced diode mixer is analyzed. Good agreement between the experimental and theoretical results verifies the validity of the FDTD algorithm.

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A magnetic current formulation for modelling discrete components using the FDTD method

R. Gillard, K. Moustadir, F. Le Bolzer and J. Citerne. "A magnetic current formulation for modelling discrete components using the FDTD method." 1997 MTT-S International Microwave Symposium Digest 1. (1997 Vol. I [MWSYM]): 71-74.

A new formulation is proposed to simulate discrete components using the FDTD method. It uses the equivalence principle to replace the volume occupied by a component with its equivalent circuit. The actual size of the component can so be taken into account without performing any microscopic modelling. The parasitic elements traditionally associated with lumped representations are also suppressed.

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Abstracts

An FDTD impedance boundary condition and its application to waveguide discontinuity analyses

T. Shibata, Yongxi Qian and T. Itoh. "An FDTD impedance boundary condition and its application to waveguide discontinuity analyses." 1997 MTT-S International Microwave Symposium Digest 1. (1997 Vol. I [MWSYM]): 75-78.

A new method for calculating the scattering parameters of metal waveguide structures based on the FDTD field simulation is presented. In this method, a type of the boundary condition called the Impedance Boundary Condition (IBC) is adopted at the circuit terminating ports. It allows us to excite the circuit with an arbitrary mode and terminate all ports by well-defined impedances. This implementation enables us to calculate the scattering parameters efficiently and rigorously.



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Abstracts

Physical simulation of complete millimeter-wave amplifiers using full-wave FDTD technique

S.M.S. Imtiaz and S.M. El-Ghazaly. "Physical simulation of complete millimeter-wave amplifiers using full-wave FDTD technique." 1997 MTT-S International Microwave Symposium Digest 1. (1997 Vol. 1 [MWSYM]): 79-82.

In this paper, the characterization of high frequency microwave amplifiers using a full-wave analysis coupled with physical modeling of the semiconductor device is presented. The simulation includes the input and output matching networks and the transistor as well. The entire amplifier is simulated with FDTD algorithm which also solves for the electromagnetic fields inside the transistor. The frequency dependence of the scattering parameters for the amplifier is presented.



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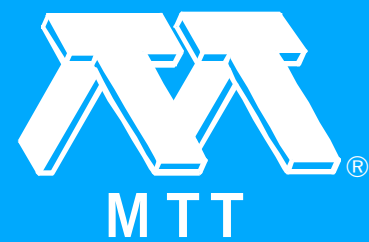
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Relationship between the compact complex and real variable 2-D FDTD methods in arbitrary anisotropic dielectric waveguides

An Ping Zhao, J. Juntunen and A.V. Raisanen. "Relationship between the compact complex and real variable 2-D FDTD methods in arbitrary anisotropic dielectric waveguides." 1997 MTT-S International Microwave Symposium Digest 1. (1997 Vol. 1 [MWSYM]): 83-87.

The relationship between the compact complex and real variable 2-D FDTD methods used for the analysis of guided modes of arbitrary anisotropic dielectric waveguides is investigated. Situations for the permittivity tensor with different non-zero elements are discussed. It is found that in certain cases the complex 2-D FDTD method cannot be reduced to the real variable one. This, in turn, reveals that the real variable 2-D FDTD method has limitation when applied to arbitrary anisotropic dielectric waveguides. In addition, numerical results show that using the complex impulse in the excitation is not an essential condition, even for a purely complex 2-D FDTD method.

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Abstracts

A hybrid full-wave analysis of via hole grounds using finite difference and finite element time domain methods

Dongsoo Koh, Hong-bae Lee and T. Itoh. "A hybrid full-wave analysis of via hole grounds using finite difference and finite element time domain methods." 1997 MTT-S International Microwave Symposium Digest 1. (1997 Vol. I [MWSYM]): 89-92.

A hybrid full-wave analysis using FDTD (finite difference time domain) and FETD (finite element time domain) methods has been developed to analyze microwave devices with locally arbitrarily shaped three-dimensional structures. This method is applied to calculate the scattering parameters of cylindrical via hole grounds. The comparison of the results with the mode matching data and FDTD staircasing data verifies the accuracy of this analysis.



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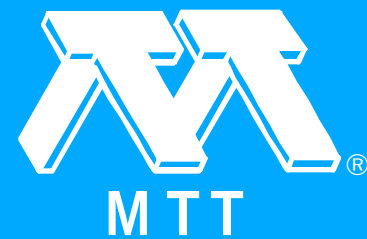


Abstracts

Human organs dosimetry for transient electromagnetic fields

M. Mrozowski, M. Okoniewski, E. Okoniewska and M.A. Stuchly. "Human organs dosimetry for transient electromagnetic fields." 1997 MTT-S International Microwave Symposium Digest 1. (1997 Vol. I [MWSYM]): 95-97.

A fast, flexible and accurate technique for evaluation of the induced electric fields and SAR in various organs and tissues of the human body is presented for exposure to arbitrarily long transient fields. The technique reduces the simulation times by several orders of magnitude as compared with previously used techniques, such as the finite-difference time-domain technique (FDTD). The computational efficiency and speed are obtained by building a parametric digital filter model of the object-transient field interaction. Very small errors have been demonstrated for transients having vastly different spectral composition from the pulse used to obtain the model.



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Modeling of interaction of electromagnetic fields from a cellular telephone with hearing aids (1997 Vol. I [MWSYM])

M. Okoniewski, M.A. Stuchly and S.S. Stuchly. "Modeling of interaction of electromagnetic fields from a cellular telephone with hearing aids (1997 Vol. I [MWSYM])." 1997 MTT-S International Microwave Symposium Digest 1. (1997 Vol. I [MWSYM]): 99-101.

The use of digital modulation in the new generation of cellular telephones and other personal communication services (PCS) poses new problems and challenges in interactions with the human body. Among them is electromagnetic interference (EMI) with medical devices. We have evaluated the electric and magnetic fields in the ear canal at 900 MHz for a typical monopole antenna on a metallic handset, an equivalent dipole and a plane wave using the FDTD method. The results are of importance and used in developing performance standards and practical testing methods for various types of hearing aids.



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Theoretical analysis of voltage-gated membrane channels under GSM and DECT exposure

F. Apollonio, G. D'Inzeo and L. Tarricone. "Theoretical analysis of voltage-gated membrane channels under GSM and DECT exposure." 1997 MTT-S International Microwave Symposium Digest 1. (1997 Vol. 1 [MWSYM]): 103-106.

In this work the response of a theoretical model of voltage-dependent membrane channels is analyzed for EM fields used in GSM and DECT cellular phones. A comparison between the effects of the two different communication protocols is performed, as well as an evaluation of the response of the model to temperature variations. In the simulations the conditions of exposure to EM fields generated by GSM and DECT mobile equipments, has been set starting from existing safety standards. Microscopic effects are investigated at the ionic channel's level inside cellular membranes. The obtained results show that both GSM and DECT signals have an evident effect on the behaviour of ionic channels, and seem to induce nonthermal effects. Maximum variations of around 30% in the open probability have been observed for sodium and potassium channels, and around 60% for calcium. The DECT signal seems to be more perturbing than the GSM signal on the calcium channel.

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Measurements of complex permittivity of biological and organic liquids up to 110 GHz

F. Duhamel, I. Huynen and A. Vander Vorst. "Measurements of complex permittivity of biological and organic liquids up to 110 GHz." 1997 MTT-S International Microwave Symposium Digest 1. (1997 Vol. I [MWSYM]): 107-110.

A new procedure for measuring the complex permittivity of liquids has been set up. It is based on measuring the scattering parameters of waveguide two-ports, up to 110 GHz, and on an original calibration method previously developed by the authors. Measurements describe the complex permittivity of biological and organic liquids at frequencies above 20 GHz, up to 110 GHz. The liquids are methanol, dioxane, and blood. Comparisons with the well established Debye equations have been made and some parameters have been recalculated when necessary.

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Coupling parameters of a concentric multi-element waveguide array

K.S. Nikita and N.K. Uzunoglu. "Coupling parameters of a concentric multi-element waveguide array." 1997 MTT-S International Microwave Symposium Digest 1. (1997 Vol. I [MWSYM]): 111-114.

The coupling between the rectangular waveguide applicators of a multi-element annular array looking into a layered lossy cylinder of circular cross section is analyzed theoretically. To this end, a system of coupled integral equations is derived in terms of the electric fields developed on the waveguide apertures, which is solved by expanding the unknown electric field on each aperture into waveguide normal modes and by applying a Galerkin's procedure. The self reflection coefficient and the mutual coupling coefficients are then determined and numerical results for a thirty (30) element waveguide array are computed and presented.

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Abstracts

An attempt of high-speed imaging of the chirp radar-type microwave computed tomography

M. Miyakawa and T. Hayashi. "An attempt of high-speed imaging of the chirp radar-type microwave computed tomography." 1997 MTT-S International Microwave Symposium Digest 1. (1997 Vol. I [MWSYM]): 115-118.

Methods for high speed imaging of the chirp radar-type microwave computed tomography have been investigated to show the feasibility of biological imaging. Electronic scan of the array antennas is a major scheme to reduce the data acquisition time. However, quick sweep of the chirp pulse microwave signal and data acquisition in time domain are also useful for the purpose. By adopting those techniques, data acquisition time of the chirp radar-type microwave computed tomography can be reduced to approximately one fortieth of the prototype system.



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Silicon RF-GCMOS IC technology for RF mixed-mode wireless applications (1997 Vol. I [MWSYM])

Jun Ma, Han-Bin Liang, D. Ngo, E. Spears, B. Yeung, B. Courson, D. Spooner, D. Lamey, J. Alvarez, T. Teraji, J. Ford and S. Cheng. "Silicon RF-GCMOS IC technology for RF mixed-mode wireless applications (1997 Vol. I [MWSYM])." 1997 MTT-S International Microwave Symposium Digest 1. (1997 Vol. I [MWSYM]): 123-127.

A submicron silicon Radio Frequency Graded-Channel MOS (RF-GCMOS) IC technology has been developed for wireless communication applications. The technology is based on a low power, low cost GCMOS VLSI technology with fully integrated passive components and optimized GC-MOSFETs for RF mixed-mode operations. For the first time, excellent RF and mixed-mode performance is demonstrated by the highly integrated RF GCMOS technology. The results show that this technology is most promising for battery-powered system-on-a-chip applications.



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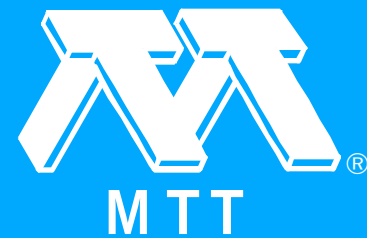


Abstracts

Optimization of high Q CMOS-compatible microwave inductors using silicon CMOS technology (1997 Vol. I [MWSYM])

Min Park, Seonghearn Lee, Hyun Kyu Yu and Kee Soo Nam. "Optimization of high Q CMOS-compatible microwave inductors using silicon CMOS technology (1997 Vol. I [MWSYM])." 1997 MTT-S International Microwave Symposium Digest 1. (1997 Vol. I [MWSYM]): 129-132.

We present the extensive experimental results showing the important dependences of layout parameters on RF performance of rectangular spiral inductors, in order to determine the optimized layout parameters for designing the high Q inductors used in RF ICs at 2 GHz. The detailed comparative analysis is also carried out to investigate substrate effects by varying the substrate resistivity.



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Low-frequency noise characteristics of self-aligned AlGaAs/GaAs HBTs with a noise corner frequency below 3 kHz (1997 Vol. I [MWSYM])

Jin-Ho Shin, Jiyoung Kim, Yujin Chung, Joonwoo Lee, Kyu Hwan Ahn and Bumman Kim. "Low-frequency noise characteristics of self-aligned AlGaAs/GaAs HBTs with a noise corner frequency below 3 kHz (1997 Vol. I [MWSYM])." 1997 MTT-S International Microwave Symposium Digest 1. (1997 Vol. I [MWSYM]): 133-136.

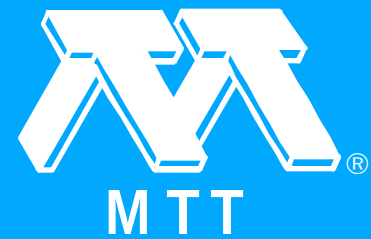
We have investigated the surface recombination and its $1/f$ noise properties of AlGaAs/GaAs HBT's as a function of the emitter-base structure and the surface passivation condition. It is found that the surface recombination $1/f$ noise can be significantly reduced by the heterojunction launcher of the abrupt junction with 30% Al mole fraction emitter. The depleted AlGaAs ledge surface passivation further suppresses the surface recombination currents. Consequently, we have achieved a very low $1/f$ noise corner frequency of 2.8 kHz at the collector current density of 10 kA/cm². The dominant noise source of the HBT is not a surface recombination current, but a bulk current noise. This is the lowest $1/f$ noise corner frequency among the III-V compound semiconductor devices, and comparable to those of low-noise Si BJTs.

Abstracts

28 V low thermal impedance HBT with 20 W CW output power (1997 Vol. I [MWSYM])

D. Hill and Tae Kim. "28 V low thermal impedance HBT with 20 W CW output power (1997 Vol. I [MWSYM])." 1997 MTT-S International Microwave Symposium Digest 1. (1997 Vol. I [MWSYM]): 137-140.

AlGaAs/GaAs heterojunction bipolar transistors have been fabricated which exhibit record output power for GaAs flip-chip technology, and record operating voltage for GaAs microwave power devices. Transistors with 2 mm emitter length readily achieve 20 W CW output power at 2 GHz when biased at 28 V, with typical power-added efficiencies of 62% (typical collector efficiencies of 70%). Maximum CW output power of 25 W has been obtained, corresponding to a power density of 12.5 W/mm.



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High-reliability GaAs HBT monolithic microwave amplifier (1997 Vol. I [MWSYM])

F.M. Yamada, A.K. Oki, D.C. Streit, D.K. Umemoto, L.T. Tran, T.R. Block, D.T. Okazaki, M.M. Hoppe and E.A. Rezek. "High-reliability GaAs HBT monolithic microwave amplifier (1997 Vol. I [MWSYM])." 1997 MTT-S International Microwave Symposium Digest 1. (1997 Vol. I [MWSYM]): 141-144.

High-reliability performance of an X-band high-intercept MMIC amplifier fabricated using a production GaAs/AlGaAs HBT process technology is reported. Operating at 20 kA/cm² quiescent collector current density, the single-stage balanced amplifier with on-chip regulation has a projected median-time-to-failure (MTF) of 4/spl times/10/sup 7/ hours at a 125/spl deg/C junction temperature. MTF was determined by three-temperature constant-stress accelerated lifetest using $|S_{21}| > 1.0$ dB as the failure criterion. Additionally, an activation energy (Ea) of 1.2 eV and log-standard deviation (σ) of 0.7 was measured. This is the first report of HBT reliability based on small-signal microwave characteristics of HBT MMIC amplifiers under lifetest.



Abstracts

Systematic investigations on MESFETs and passive components transplanted by epitaxial lift off onto host materials with various resistivities (1997 Vol. I [MWSYM])

T. Morf, C. Biber and W. Bachtold. "Systematic investigations on MESFETs and passive components transplanted by epitaxial lift off onto host materials with various resistivities (1997 Vol. I [MWSYM])." 1997 MTT-S International Microwave Symposium Digest 1. (1997 Vol. I [MWSYM]): 145-148.

In this paper we present RF measurements on MESFETs and spiral inductors fabricated on GaAs and transplanted by epitaxial lift off (ELO). ELO is a technology by which epitaxially grown layers are lifted off from their growth substrate and are subsequently reattached to a new host substrate.



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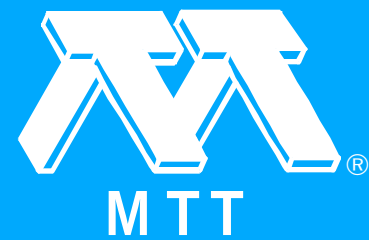


Abstracts

Electromagnetic interfacing of semiconductor devices and circuits

S.M. El-Ghazaly and T. Itoh. "Electromagnetic interfacing of semiconductor devices and circuits." 1997 MTT-S International Microwave Symposium Digest 1. (1997 Vol. I [MWSYM]): 151-154.

This paper discusses the interactions between semiconductor devices and electromagnetic waves and the possible ways to interface modern devices and circuits in the mm-wave range. This topic is very important for advancing current MMIC designs and for developing futuristic devices and applications. The electromagnetic wave propagation through semiconductor devices is modeled by coupling a physical electron-transport model, or a circuit approach, with Maxwell's equations. The solution is developed in time-domain using Finite-Difference Time-Domain (FDTD) technique. Examples of device and circuit simulations are presented.



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Abstracts

Characterization and modelling of microwave and millimeter-wave large-signal device-circuit interaction based on electro-thermal physical models

C.M. Snowden. "Characterization and modelling of microwave and millimeter-wave large-signal device-circuit interaction based on electro-thermal physical models." 1997 MTT-S International Microwave Symposium Digest 1. (1997 Vol. I [MWSYM]): 155-158.

This paper describes a comprehensive approach to modelling the large-signal behaviour of microwave and millimeter-wave transistor circuits based on electro-thermal physical device models with harmonic-balance or time-domain simulators. MESFET oscillator and pHEMT MMIC power amplifier designs have been used to validate the method, achieving excellent agreement between simulated and measured data.



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Full wave BIE analysis of travelling waves in unbiased/velocity saturated FET structures with linearly controlled current density

W. Schroeder, W. Prost and I. Wolff. "Full wave BIE analysis of travelling waves in unbiased/velocity saturated FET structures with linearly controlled current density." 1997 MTT-S International Microwave Symposium Digest 1. (1997 Vol. 1 [MWSYM]): 159-162.

The Hybrid Wave Boundary Integral Equation method is applied to analyze wave propagation along the width of a linearized InGaAs/InAlAs HFET model with accurate description of all geometrical details. Special consideration is given to the influence of operating conditions on propagation characteristics by introducing separate linear models for unbiased operation, channel depletion and velocity saturated operation. Results are given for the gate and drain mode in the passive device and for the mixed mode in presence of a linearly controlled channel current density.

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Abstracts

Far field radiation in sub-picosecond systems

K.A. Remley, A. Weisshaar, S.M. Goodnick and V.K. Tripathi. "Far field radiation in sub-picosecond systems." 1997 MTT-S International Microwave Symposium Digest 1. (1997 Vol. I [MWSYM]): 163-166.

FDTD and Monte Carlo methods are combined to simulate the terahertz radiation fields from a coplanar photoconducting structure. Two techniques are considered for modeling the far field radiation. One uses Maxwell equations directly with an approximation made regarding the source term. As an improvement to the first technique, we propose the use of a near-to-far-field FDTD transformation with the use of equivalent surface current densities. Computational results showing the far field radiation are in agreement with published experimental results.



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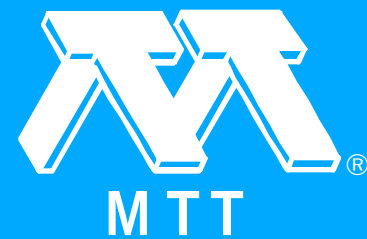


Abstracts

Recent progress in SAW filters at GHz frequencies

D. Penunuri. "Recent progress in SAW filters at GHz frequencies." 1997 MTT-S International Microwave Symposium Digest 1. (1997 Vol. I [MWSYM]): 169-172.

The wide availability of inexpensive cellular telephones and pagers has made possible world-wide, instantaneous communication for any person within range of a base station. The recent introduction of hand-held and even "wearable" telephone technology has been made practical, in some cases, by the use of miniature Surface Acoustic Wave (SAW) filters. This paper discusses the application of SAW RF filters for use in mobile communication products. We focus on the RF front end of mobile radios for which the band pass filters must provide low insertion loss and high selectivity in very small packages.



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Design, fabrication, and application of GHz SAW devices

U. Knauer, J. Machui and C.C.W. Ruppel. "Design, fabrication, and application of GHz SAW devices." 1997 MTT-S International Microwave Symposium Digest 1. (1997 Vol. I [MWSYM]): 1821-1824.

To meet the increasing demand of high performance filters in GHz radio communication systems, we have improved design techniques and fabrication processes. Different types of filters in the range of 1 to 3 GHz, a 2.45 GHz resonator with 18 dB insertion attenuation and a quality factor of 1500, wideband delay lines at 2.45 GHz, with 400 MHz and 600 MHz bandwidth, identification tags at 2.45 GHz, and ladder type bandpass filters for PCS and WLAN applications at 1.9 GHz and 2.45 GHz, were developed and manufactured. It will be shown, that these devices with submicron linewidth transducers down to 0.3 μm can be manufactured with tight process tolerances.

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Recent and future RF SAW technology for mobile communications

M. Hikita, N. Shibagaki, A. Isobe, K. Asai and K. Sakiyama. "Recent and future RF SAW technology for mobile communications." 1997 MTT-S International Microwave Symposium Digest 1. (1997 Vol. 1 [MWSYM]): 173-176.

Surface acoustic wave (SAW) technology has been widely applied to VHF/UHF radio communications to reduce the volume of transceivers. In this paper, not only recent new SAW devices but also future SAW technology to achieve much higher-performance devices are investigated. First, the latest status of 0.8-1.5-GHz SAW antenna duplexers for cellular radios and a miniature SAW-VCO are presented. Second, new SAWs with extremely high velocities and fine submicron process techniques are examined. Finally, a future SAW-based chip-type receiver is discussed.

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Abstracts

High frequency SAW devices

J.H. Kines and D.C. Malocha. "High frequency SAW devices." 1997 MTT-S International Microwave Symposium Digest 1. (1997 Vol. I [MWSYM]): 177-180.

This paper will discuss some of the technology approaches currently being pursued to extend the SAW device operating frequencies to the 1-6 GHz range. This range of frequencies has become commercially interesting in the past few years due to the large increase in wireless applications, especially cellular and mobile communications. This range of frequencies is challenging because it pushes the limits of the currently available technology implementations. In order to achieve the higher frequencies, research and development continues on the improvement of current SAW components and the development of new structures, examining new types of wave propagation, and exploring new materials.



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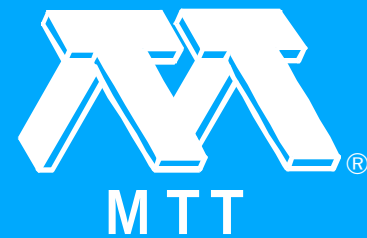


Abstracts

Thin film ZnO based bulk acoustic mode filters

C.W. Seabury, P.H. Kobrin, R. Addison and D.P. Havens. "Thin film ZnO based bulk acoustic mode filters." 1997 MTT-S International Microwave Symposium Digest 1. (1997 Vol. I [MWSYM]): 181-184.

We have used thin film ZnO bulk mode resonators on an acoustically reflecting solid glass substrate to produce a variety of filters in the 1-3 GHz frequency bands. Power handling is large ($>2W$). Overall filter dimensions are very small ($\sim 1\text{ mm}$), while lithography requirements are undemanding ($>10\text{ }\mu\text{m}$). A range of ladder filters has been produced with an average rejection to insertion loss ratio of ~ 10 . Monolithic inductors have also been used to improve characteristics over specified bands.



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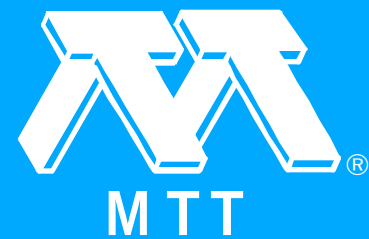
Novel 24 GHz FMCW front-end with 2.45 GHz SAW reference path for high-precision distance measurements

M. Nalezinski, M. Vossiek and P. Heide. "Novel 24 GHz FMCW front-end with 2.45 GHz SAW reference path for high-precision distance measurements." 1997 MTT-S International Microwave Symposium Digest 1. (1997 Vol. 1 [MWSYM]): 185-188.

A new 24 GHz non-linear FMCW radar is reported, which features a high-precision 2.45 GHz SAW (Surface Acoustic Wave) reference and adaptively compensates for phase errors by software. Kernel functions are implemented at a 2.45 GHz IF level reducing the expense of critical RF components in order to realize a fully planar front-end.

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Double vector-integral-equation method for microstrip-lines on photonic band-gap substrates

H.Y.D. Yang. "Double vector-integral-equation method for microstrip-lines on photonic band-gap substrates." 1997 MTT-S International Microwave Symposium Digest 1. (1997 Vol. I [MWSYM]): 191-194.

This paper presents a double vector-integral-equation (DOVIE) method for the modeling of integrated circuit components on artificial (photonic band-gap) substrates. The proposed computational method deals with the interaction of circuit components (continuous plane wave spectrum) and artificial materials (discrete plane wave spectrum, Floquet modes). The method of solution involves two stages of vector integral-equations. The first integral equation formulation is to find the Green's function for a PBG structure. A spectral-domain moment-method is applied to the second vector integral-equation to determine the fields or currents on the circuit components and the associated parameters of interest. Field solutions of microstrip lines on PBG substrates are discussed. The results of this work initiate research for many innovated microwave and millimeter-wave integrated components and devices.

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A finite element-generalized network analysis of finite thickness photonic crystals

R. Coccioli, T. Itoh and G. Pelosi. "A finite element-generalized network analysis of finite thickness photonic crystals." 1997 MTT-S International Microwave Symposium Digest 1. (1997 Vol. 1 [MWSYM]): 195-198.

A Generalized Network Formulation for the analysis electromagnetic diffraction from a photonic crystal is proposed. The Finite Element method is employed to compute the impedance matrix which characterizes propagation through the unit cell. From this matrix, the bulk dispersion characteristic for the infinitely extending crystal, as well as the transmission and reflection coefficients for the case of a finite thickness sample of the crystal can be derived.

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Accurate calculation of the modes of the circular multiridge waveguide

A. Morini, T. Rozzi, A. Angeloni and M. Guglielmi. "Accurate calculation of the modes of the circular multiridge waveguide." 1997 MTT-S International Microwave Symposium Digest 1. (1997 Vol. 1 [MWSYM]): 199-202.

Circular multiridge waveguides (CMRW) have been recently considered for their promise in application to tuningless dual mode filters. We propose an accurate method for characterizing such structures that is based on a combination of the Boundary Integral Method, in a form leading to a standard eigenvalue problem, with a proper choice of the current distributions on the ridges, which takes into account the edge effects. The resulting code permits to calculate very accurately several tens of modes by inverting only once a reasonably small matrix.

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Abstracts

A new modal approach for planar transmission line to waveguide three-port transition

B. Storer, H. Aubert and H. Baudrand. "A new modal approach for planar transmission line to waveguide three-port transition." 1997 MTT-S International Microwave Symposium Digest 1. (1997 Vol. I [MWSYM]): 203-206.

A new modal approach for deriving the admittance matrix of a waveguide to planar transmission line probe transition is presented. The proposed rigorous formulation considerably reduce computation time compared with finite elements method. The junction was fabricated and measured in the case of a waveguide to microstrip line probe transition. Numerical and experimental results are compared with success.



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Scattering properties of asymmetric rectangular iris in a circular waveguide using edge-conditioned basis functions

T. Lenadan, S. Amari, R. Vahldieck and J. Bornemann. "Scattering properties of asymmetric rectangular iris in a circular waveguide using edge-conditioned basis functions." 1997 MTT-S International Microwave Symposium Digest 1. (1997 Vol. 1 [MWSYM]): 207-210.

The scattering properties of asymmetric rectangular irises in circular waveguides are accurately determined from an integral equation formulation using basis functions which include the edge conditions. The inclusion of the edge conditions results in a reduction of the size of the matrix as compared to the standard mode-matching technique. Numerical results are presented and compared with previously published data and measurements to demonstrate the accuracy of the approach.



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Generalized Y-matrix of arbitrary H-plane waveguide junctions by the BI-RME method

P. Arcioni, M. Bressan, G. Conciauro and L. Perregrini. "Generalized Y-matrix of arbitrary H-plane waveguide junctions by the BI-RME method." 1997 MTT-S International Microwave Symposium Digest 1. (1997 Vol. I [MWSYM]): 211-214.

This paper describes the extension of the BI-RME method to the determination of the generalized Y-matrix of arbitrary H-plane waveguide junctions. The method yields this matrix in the form of a pole expansion in the frequency domain. The generalized matrix is very useful in the wideband analysis of complex structures that include the junction as a building block. An example demonstrates the advantages of this extension of the BI-RME method.

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Abstracts

Wireless distribution via fiber-optic technology

J.K. Plourde. "Wireless distribution via fiber-optic technology." 1997 MTT-S International Microwave Symposium Digest 1. (1997 Vol. I [MWSYM]): 217-220.

Fiber-optic technology is expected to continue its explosive growth into the next decade as communications service providers expand capacity. This paper presents an overview of one of these applications for fiber-optic technology, the distribution of wireless signals. Both analog and digital transmission methods can be used. The analog transmission method is emphasized here, and falls into the subcarrier multiplexed category, where the carrier is the optical signal. Digital transmission is briefly reviewed only sufficiently to put the analog method into context.



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Stable and high-power laser diode module for millimeter-wave generation

T. Kuri and K.-I. Kitayama. "Stable and high-power laser diode module for millimeter-wave generation." 1997 MTT-S International Microwave Symposium Digest 1. (1997 Vol. 1 [MWSYM]): 221-224.

A 60 GHz-band millimeter (MM)-wave signal generation using a long-term frequency-stabilized 60 GHz mode-locked laser diode (MLLD) module is presented. The output optical power of the MLLD module is more than 6.0 dBm. The generated 60 GHz MM-wave signal with the 3 dB linewidth of less than 300 Hz over 2.9 km-long optical fiber link is successfully demonstrated.

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Abstracts

Fibreoptic microwave generation for bidirectional broadband mobile communications

R.-P. Braun, G. Grosskopf, R. Hentges, S. Loch, D. Rohde and F. Schmidt. "Fibreoptic microwave generation for bidirectional broadband mobile communications." 1997 MTT-S International Microwave Symposium Digest 1. (1997 Vol. I [MWSYM]): 225-228.

Bidirectional errorfree 140 Mbit/s OQPSK-signal transmission with optically generated microwaves in the 18-19 GHz-band is reported. Two microwave carriers one for the radio link to the mobile receiver (down link) and one for the uplink-microwave mixer in the base station are generated by a simple optical upconversion technique.



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Nd:LiNbO₃ microchip laser with 20 GHz subcarrier

A.J.C. Vieira, P.R. Herczfeld and V.M. Contarino. "Nd:LiNbO₃ microchip laser with 20 GHz subcarrier." 1997 MTT-S International Microwave Symposium Digest 1. (1997 Vol. 1 [MWSYM]): 229-232.

This paper reports on the development of a 20 GHz mode-locked Nd:LiNbO₃ microchip laser operating at 1.084 μm with an output power greater than 35 mW (CW). With this configuration, a single device simultaneously generates the optical carrier and the microwave subcarrier. A modulation index of 96% was obtained for a driving microwave power of 12.6 dBm at 20 GHz. An information signal up to 8 GHz was also superimposed on the 20 GHz subcarrier using an external modulator.

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Abstracts

Experimental 20 Gbit/s modules for optical fiber links

G. Hanke. "Experimental 20 Gbit/s modules for optical fiber links." 1997 MTT-S International Microwave Symposium Digest 1. (1997 Vol. I [MWSYM]): 233-236.

For an experimental optical fiber transmission system working at 20 Gbit/s electronic transmitter and receiver modules were developed. To guarantee reliable and error free operation, unpackaged GaAs- and Si-chips on ceramic thin film substrates in combination with a sophisticated interconnection technique had to be used.



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Input impedance conditions for minimizing the noise figure of an analog optical link (1997 Vol. I [MWSYM])

E. Ackerman, C. Cox, G. Betts, H. Roussel, K. Ray and F. O'Donnell. "Input impedance conditions for minimizing the noise figure of an analog optical link (1997 Vol. I [MWSYM])." 1997 MTT-S International Microwave Symposium Digest 1. (1997 Vol. I [MWSYM]): 237-240.

It has been previously shown that 3 dB is the lowest noise figure attainable for an amplifierless optical link with perfect lossless impedance matching to the RF source. In a prior experimental link with near-perfect impedance matching, dissipative loss in our input matching circuit prevented us from achieving a measured noise figure of less than 4 dB. Investigation of the effects of input impedance mismatch indicates that mismatch can actually lower the noise figure to below 3 dB even in the presence of some dissipative loss in the input circuit. We have verified this theory by using the mismatch effect to reduce the measured noise figure of our link to 2.5 dB at 130 MHz. We believe this is the first demonstration of amplifierless link noise figure of less than 3 dB. We confirmed the validity of our measurement technique by also measuring the noise figure of a 2.5 dB RF attenuator to be 2.5 dB.



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A 6 watt Ka-band MMIC power module using MMIC power amplifiers (1997 Vol. I [MWSYM])

D.L. Ingram, D.I. Stones, T.W. Huang, M. Nishimoto, H. Wang, M. Siddiqui, D. Tamura, J. Elliott, R. Lai, M. Biedenbender, H.C. Yen and B. Allen. "A 6 watt Ka-band MMIC power module using MMIC power amplifiers (1997 Vol. I [MWSYM])." 1997 MTT-S International Microwave Symposium Digest 1. (1997 Vol. I [MWSYM]): 1183-1186.

In this paper we present the development of a 6 Watt 24% PAE Ka-band power module with an associated power gain of 21.5 dB. The power module consists of a driver amplifier and two power amplifier chips. These MMIC amplifiers were fabricated with a 2-mil thick substrate using 0.15-/spl mu/m InGaAs/AlGaAs/GaAs HEMT technology. The driver amplifier is a fully matched single-ended design with an output power of 27.5 dBm, a 10.7 dB power gain and 27% PAE. We use a hybrid approach for the output power amplifier which consists of two partially-matched MMIC chips and a 8-way Wilkinson combiner fabricated on alumina substrate. The MMIC power amplifiers delivered a record power of 35.4 dBm (3.5 W) with a PAE of 28% and an associated power gain of 11.5 dB. The 8-way combiner has an insertion loss of 0.6 dB. We believe this is a new benchmark for power module using monolithic approach at this frequency range.

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Compact integrated coplanar T/R-modules for automotive applications (1997 Vol. I [MWSYM])

L. Verweyen, A. Bangert, H. Massler, T. Fink, M. Neumann, R. Osorio, T. Krems, T. Jakobus, W.H. Haydl and M. Schlechtweg. "Compact integrated coplanar T/R-modules for automotive applications (1997 Vol. I [MWSYM])." 1997 MTT-S International Microwave Symposium Digest 1. (1997 Vol. I [MWSYM]): 243-246.

Integrated transmit and receive MMICs for automotive applications have been realized in coplanar waveguide technology, using a 0.15 μm PHEMT process. The transmitter chip delivers an output power of 10 dBm at the antenna and the LO-ports. The receiver has an overall conversion gain of 10 dB for an LO-power of -10 dBm. Both chips only require an area of 3/spl times/2 mm/sup 2/. For an improved higher power version of the transmitter, a new nonlinear HEMT-model has been used for the design of a power amplifier, resulting in excellent agreement between predicted and measured output performance at 76 GHz.

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Abstracts

A V-band GaAs MMIC chip set on a highly reliable WSi/Au refractory gate process (1997 Vol. I [MWSYM])

J. Mizoe, T. Matsumura, K. Unosawa, Y. Akiba, K. Nagai, H. Sato, T. Saryo and T. Inoue. "A V-band GaAs MMIC chip set on a highly reliable WSi/Au refractory gate process (1997 Vol. I [MWSYM])." 1997 MTT-S International Microwave Symposium Digest 1. (1997 Vol. I [MWSYM]): 247-250.

A compact V-band GaAs MMIC chip set consisting of 1) a single highly integrated receiver MMIC with 6.5 dB N.F. and 2 dB conversion gain using a subharmonically pumped mixer and 2) a transmitter MMIC having a state-of-the-art 30-60 GHz doubler with 14.3 dB maximum conversion gain, 17.7 dBm output power and broadband RF characteristics has been successfully implemented with a refractory WSi/Au gate for high reliability. The HJFETs of these MMICs exhibited an MTTF of 4E7 hours at a channel temperature (Tch) of 130/spl deg/C. This result demonstrates high potential of our MMIC technology and to enable highly reliable and highly integrated V- and W-band systems.



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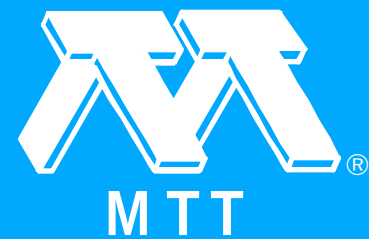


Abstracts

A D-LDD (double lightly-doped drain) structure H-MESFET for MMIC applications (1997 Vol. I [MWSYM])

Y. Yamane, K. Onodera, T. Nittono, K. Nishimura, K. Yamasaki and A. Kanda. "A D-LDD (double lightly-doped drain) structure H-MESFET for MMIC applications (1997 Vol. I [MWSYM])." 1997 MTT-S International Microwave Symposium Digest 1. (1997 Vol. I [MWSYM]): 251-254.

This paper proposes a new D-LDD (Double Lightly-Doped Drain) structure for InGaP-InGaAs H-MESFETs (Heterostructure-MESFET). A D-LDD H-MESFET has three kinds of low resistant layers in the drain region, while a conventional H-MESFET has two layers. This structure improves MAG accompanied by R_d reduction with minimized gate-breakdown-voltage degradation and C_{gd} increase. These trade-offs between R_d and breakdown voltage are discussed in detail. Consequently, a typical MAG at 50 GHz exhibits 8.9 dB S21 in a MESFET and 7.7 dB S21 in a 1-stage amplifier. The high-frequency circuit operation proves that this technology is one of the most promising for MMIC applications.



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Low phase noise Ka-band VCOs using InGaP/GaAs HBTs and coplanar waveguide (1997 Vol. I [MWSYM])

M.S. Heins, D.W. Barlage, M.T. Fresina, D.A. Ahmari, Q.J. Hartmann, G.E. Stillman and M. Feng. "Low phase noise Ka-band VCOs using InGaP/GaAs HBTs and coplanar waveguide (1997 Vol. I [MWSYM])." 1997 MTT-S International Microwave Symposium Digest 1. (1997 Vol. I [MWSYM]): 255-258.

Ka-band voltage controlled oscillators (VCOs) have been designed using InGaP/GaAs HBT technology. The best measured VCO shows a phase noise of -95 dBc/Hz at 100 kHz offset and -112 dBc/Hz at 1 MHz offset, delivering 5.3 dBm output power at 40.8 GHz. Variations of circuit topology and resonator type were fabricated to evaluate their contribution to phase noise and tuning range.



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1 Watt, 65% PAE K-band AlGaAs/GaAs heterojunction bipolar transistors using emitter air-bridge technology (1997 Vol. I [MWSYM])

Hin-Fai Chau, D. Hill, R. Yarborough and Tae Kim. "1 Watt, 65% PAE K-band AlGaAs/GaAs heterojunction bipolar transistors using emitter air-bridge technology (1997 Vol. I [MWSYM])." 1997 MTT-S International Microwave Symposium Digest 1. (1997 Vol. I [MWSYM]): 259-262.

We report on the state-of-the-art power performance of K-band AlGaAs-GaAs heterojunction bipolar transistors (HBTs) which had emitter air-bridges to connect individual emitter fingers within the unit cells to reduce the emitter inductance and device thermal impedance. A 8/spl times/(1.6/spl times/30) /spl mu/m/sup 2/ HBT achieved 1.04 W CW output power and 65.7% power-added efficiency with 6.3 dB associated gain at 20 GHz. The maximum power-added efficiency measured was 67.5% at an output power level of 0.93 W.



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Air-gap transmission lines for OEICs and MMICs using glass substrates

J. Chuang, S.M. El-Ghazaly, D.K. Schroder, Y.H. Zhang, G.N. Maracas and A.C. Reyes. "Air-gap transmission lines for OEICs and MMICs using glass substrates." 1997 MTT-S International Microwave Symposium Digest 1. (1997 Vol. 1 [MWSYM]): 265-268.

This paper describes transmission-line structures for optoelectronic integrated circuits (OEICs) and monolithic microwave integrated circuits (MMICs) using glass processing assisted microbump bonding (GPAMBB). Two different configurations of air-gap transmission lines are fabricated using this interconnection technique. Because the field distributions are mainly in air, these structures have the advantages of low losses, and low dispersion. Theoretical and experimental results of both structures are presented in this paper. The attenuation of the two air-gap transmission lines and the conventional CPW are compared over the 2 GHz-20 GHz range.

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W-band micromachined finite ground coplanar (FGC) line circuit elements

K.J. Herrick, T. Schwarz and L.P.B. Katehi. "W-band micromachined finite ground coplanar (FGC) line circuit elements." 1997 MTT-S International Microwave Symposium Digest 1. (1997 Vol. 1 [MWSYM]): 269-272.

This paper describes the development and characterization of Si-micromachined Finite Ground Coplanar (FGC) circuit components between 2 and 110 GHz. FGC lines are micromachined to eliminate the dielectric in the aperture regions, where the electromagnetic fields concentrate, in an effort to further improve their propagation characteristics and to provide loss levels only demonstrated by membrane lines. Measured results have shown a loss improvement of 1 dB/cm at 94 GHz. A micromachined FGC bandpass filter has shown a .8 dB improvement in insertion loss at 94 GHz over a conventional FGC line. Therefore, this approach offers an excellent alternative to the membrane technology, exhibiting very low loss, no dispersion, and mode free operation without using membranes to support the metallic structures.

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Uniplanar hybrid couplers using asymmetrical coplanar strip lines

Lu Fan, B. Heimer and Kai Chang. "Uniplanar hybrid couplers using asymmetrical coplanar strip lines." 1997 MTT-S International Microwave Symposium Digest 1. (1997 Vol. 1 [MWSYM]): 273-276.

This paper presents two uniplanar 3-dB hybrid couplers using asymmetrical coplanar strip (ACPS) for MIC and MMIC applications. The uniplanar ratrace hybrid coupler has less than 0.5 dB insertion loss, greater than 22 dB isolation, and 22.5 dB return loss over a 25% bandwidth centered at 3 GHz. The 180/spl deg/ reverse-phase hybrid coupler provides better performance as compared to conventional microstrip hybrid couplers. Experimental results show that the 180/spl deg/ hybrid coupler has a bandwidth of more than one octave from 2 to 4 GHz with /spl plusmn/0.2 dB power dividing imbalance and /spl plusmn/1.5/spl deg/ phase imbalance.

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Improved compaction of multilayer MMIC/MCM baluns using lumped element compensation

R.H. Jansen, J. Jotzo and R. Engels. "Improved compaction of multilayer MMIC/MCM baluns using lumped element compensation." 1997 MTT-S International Microwave Symposium Digest 1. (1997 Vol. 1 [MWSYM]): 277-280.

A novel lumped impedance matched type of Marchand balun in MMIC/MCM technology is described which is compact enough even for the low-GHz frequency range. Broadband performance and balance of this component are sufficient for the use in many wireless applications.

Click on title for a complete paper.



A compact MMIC 90/spl deg/ coupler for ISM applications

G.F. Avitabile, A. Cidronali, C. Salvador and M. Speciale. "A compact MMIC 90/spl deg/ coupler for ISM applications." 1997 MTT-S International Microwave Symposium Digest 1. (1997 Vol. 1 [MWSYM]): 281-284.

In this paper, a new GaAs MMIC quadrature hybrid is described which is based on a lumped element approach. The MMIC makes use of interleaved spiral inductors in a transformer-like configuration and MIM capacitors. A design technique is proposed. The resulting 90/spl deg/ coupler is characterised by a reduced size (500 /spl mu/m/spl times/500 /spl mu/m). An analytical derivation of the hybrid design parameters is discussed and results are compared with experiments.





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Arbitrary termination impedances, arbitrary power divisions and small-sized ring hybrids (1997 Vol. I [MWSYM])

Hee Ran Ahn, I. Wolff and Ik-soo Chang. "Arbitrary termination impedances, arbitrary power divisions and small-sized ring hybrids (1997 Vol. I [MWSYM])." 1997 MTT-S International Microwave Symposium Digest 1. (1997 Vol. I [MWSYM]): 285-288.

If a ring hybrid is terminated by arbitrary impedances, design equations can not be derived with conventional methods because symmetry planes for even and/or odd symmetries are not available. Therefore, under these conditions new design equations for ring hybrids have been derived. They can be applied to both ring hybrids with arbitrary termination impedances and arbitrary power division ratios. Also, new design equations for small sized ring hybrids have been developed. They allow that arbitrary power divisions, arbitrary termination impedances and specially small sized ring hybrids can be designed. On the basis of these derived design equations, a simulation of ring hybrids with 4 arc lengths of 75/spl deg/, arbitrary termination impedances and a power split ratio of 4 dB was performed using ideal CPS crossover.

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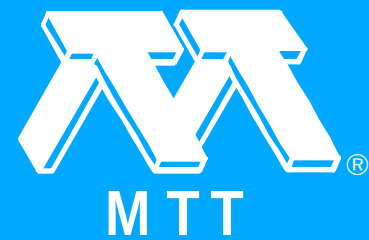


Abstracts

Line-to-ring coupling circuit model and its parametric effects for optimized design of microstrip ring circuits and antennas

Lei Zhu and K. Wu. "Line-to-ring coupling circuit model and its parametric effects for optimized design of microstrip ring circuits and antennas." 1997 MTT-S International Microwave Symposium Digest 1. (1997 Vol. 1 [MWSYM]): 289-292.

New de-embedding technique developed with a field-theoretical framework is applied to precisely characterizing line-to-ring coupling structure in the form of a circuit model. This circuit model is able to account for various dynamic parametric effects including frequency-related dispersion, radiation and leakage losses. Results are given for dispersive electrical characteristics of loose and enhanced line-to-ring coupling schemes in terms of susceptance-related J-inverter network. The accurate prediction confirmed by a set of experiments provides a guideline for optimally designing ring-resonators with the distributed transmission line model.



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HTS diplexer and low noise amplifier rf module

G.L. Hey-Shipton, N.O. Fenzi and K.F. Raihn. "HTS diplexer and low noise amplifier rf module." 1997 MTT-S International Microwave Symposium Digest 1. (1997 Vol. I [MWSYM]): 295-298.

The design and performance of a 77 K, thin film HTS diplexer and low noise amplifier subassembly is described. The diplexer circuit is an all planar design with a 50 /spl Omega/ match at the filter/diplexer manifold interconnect. The low noise amplifier has very low noise figure (0.2 dB) and simultaneously good input/output VSWR when operated at 77 K.



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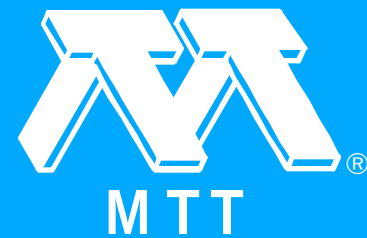


Abstracts

A novel split-resonator high power HTS planar filter

Shen Ye and R.R. Mansour. "A novel split-resonator high power HTS planar filter." 1997 MTT-S International Microwave Symposium Digest 1. (1997 Vol. 1 [MWSYM]): 299-302.

A novel microstrip filter design employing split-resonators and inserted I/O line coupling structures is proposed for high power high-temperature-superconductive (HTS) thin film filters. The use of split-resonators together with the inserted I/O coupling helps to redistribute the current more evenly over the resonators. The inserted line coupling structure also eliminates the sharp corners and narrow gaps associated with conventional I/O coupling structures. A 3-pole HTS filter was designed and tested. Excellent measurement results were obtained which demonstrate the advantages of the proposed design.



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Tunable superconducting resonators using ferrite substrates

D.E. Oates and G.F. Dionne. "Tunable superconducting resonators using ferrite substrates." 1997 MTT-S International Microwave Symposium Digest 1. (1997 Vol. I [MWSYM]): 303-306.

Tunable superconducting resonators have been demonstrated using microstrip circuits of YBCO at 77 K and niobium at 4 K coupled to polycrystalline magnetic garnet substrates. At X band and 77 K, a tuning range $\Delta f/f$ of greater than 3% and Q of 2500 have been demonstrated in applied fields of 100 Oe for YBCO. The figure of merit $2Q/\Delta f/f$ is 175. For niobium at 4 K a Q of 5000 has been demonstrated and a figure of merit of 288. An analytical model gives good agreement with the measurements.

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Novel phase noise reduction technique using HTSC-limiters

F. Massin, H. Christange and R. Knochel. "Novel phase noise reduction technique using HTSC-limiters." 1997 MTT-S International Microwave Symposium Digest 1. (1997 Vol. 1 [MWSYM]): 307-310.

This work presents a novel technique for reducing oscillator phase noise. A high-temperature superconducting (HTSC) limiter is implemented in a feedback oscillator in order to operate the amplifier in its linear region. Less 1/f-noise is upconverted by the amplifier which leads to reduced phase noise in the oscillator. A decrease of phase noise up to 10 dB at 1 kHz offset from the carrier could be measured. The new device is well suited for integration in an HTSC microstrip resonator layout.

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Abstracts

A new high-temperature superconducting double-hybrid coupler with wide bandwidth

T. Bechteler, B. Mayer and R. Weigel. "A new high-temperature superconducting double-hybrid coupler with wide bandwidth." 1997 MTT-S International Microwave Symposium Digest 1. (1997 Vol. I [MWSYM]): 311-314.

We report on the design and performance of new high-temperature superconducting couplers fabricated in microstrip technology. We present experimental results for a 3 dB- and a 0 dB-coupler (i.e. a crossover device) at 10 GHz. The planar coupler structures were patterned into YBaCuO thin films deposited on MgO substrates on both sides. As a design tool, we employed a commercial microwave simulation program. Verification was done using special test chips. We attained extremely low insertion loss values over bandwidths of 45 per cent (3 dB-coupler) and 30 per cent (0 dB-coupler), respectively.



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Special 3D-TLM corner nodes for singular field regions

G. Tardioli, L. Cascio, M. Righi and W.J.R. Hoefer. "Special 3D-TLM corner nodes for singular field regions." 1997 MTT-S International Microwave Symposium Digest 1. (1997 Vol. 1 [MWSYM]): 317-320.

A novel procedure to incorporate the static field configuration at field singularities into a 3D-TLM mesh is proposed. The procedure is systematic and consists in a modification of the scattering algorithm of the corner node. The modified cell imposes the correct singular field in the vicinity of a conducting edge using the information of the surrounding field evolution. The results for canonical resonators are consistent with those obtained with standard TLM simulation with cell size five to six times smaller.

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Electromagnetic analysis of planar circuitry and the dimensionality argument

L. Albasha and C.M. Snowden. "Electromagnetic analysis of planar circuitry and the dimensionality argument." 1997 MTT-S International Microwave Symposium Digest 1. (1997 Vol. 1 [MWSYM]): 321-324.

In this paper evaluations are carried out on the EM simulation accuracy of microstrip circuits using 2D and 3D Electromagnetic solvers, employing the TLM method. Different aspects of microstrip modelling are addressed including a new simplified excitation methodology. Illustrated simulations, supported by measured data, identify the advantages and disadvantages of modelling planar circuitry in both domains. The 3D domain provides greater accuracy due to its ability in representing more realistically the physical layout of these circuits.

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Modal boundary conditions for waveguides of arbitrary cross-section with SCN TLM

J.L. Herring, M. Righi and W.J.R. Hoefer. "Modal boundary conditions for waveguides of arbitrary cross-section with SCN TLM." 1997 MTT-S International Microwave Symposium Digest 1. (1997 Vol. 1 [MWSYM]): 325-328.

Modal absorbing boundary conditions are applied to a graded mesh using the hybrid node, and to homogeneous waveguides of arbitrary cross-section. The best performance is obtained with rectangular waveguides but examples show that the method can also be used for other geometries. A T-junction circular-to-sidecoupled rectangular waveguide example is given.

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Abstracts

The TLM-equivalent FD-TD analysis of antenna radiation problems with the PML absorbing conditions

Jian Xu and Zhizhang Chen. "The TLM-equivalent FD-TD analysis of antenna radiation problems with the PML absorbing conditions." 1997 MTT-S International Microwave Symposium Digest 1. (1997 Vol. 1 [MWSYM]): 329-332.

This paper presents the applications of the TLM-equivalent FD-TD method to analysis of a three-dimensional antenna problems by using the modified perfectly matched layer (MPML). The calculations of a cavity-back antennas mounted on a conducting plane are performed and the radiation patterns of the antennas are obtained. The results demonstrate the effectiveness and efficiency of the MPML in the TLM based algorithm.



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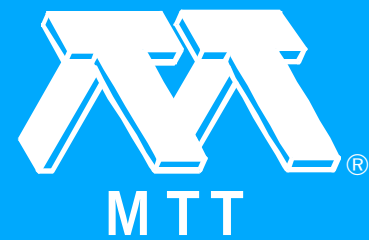


Abstracts

Applications of multiresolution based FDTD multigrid

K. Goverdhanam, L.P.B. Katehi and A. Cangellaris. "Applications of multiresolution based FDTD multigrid." 1997 MTT-S International Microwave Symposium Digest 1. (1997 Vol. 1 [MWSYM]): 333-336.

A Multigrid 2-D Finite Difference Time Domain (FDTD) technique based on Multiresolution analysis with Haar wavelets is used to analyze structures such as an empty waveguide and a shielded stripline. The results obtained are compared with those computed using a finer resolution regular FDTD mesh. This comparative study illustrates the benefits of using wavelets in FDTD analysis.



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Space- and time-adaptive gridding using MRTD technique

E.M. Tentzeris, R.L. Robertson, L.P.B. Katehi and A. Cangellaris. "Space- and time-adaptive gridding using MRTD technique." 1997 MTT-S International Microwave Symposium Digest 1. (1997 Vol. I [MWSYM]): 337-340.

The MRTD scheme is applied to the analysis of waveguide problems. Specifically, the field pattern and the S-parameters of a dielectric-loaded parallel-plate waveguide are calculated. The use of wavelets enables the implementation of a space- and time-adaptive gridding technique. The results are compared to those obtained by use of the conventional FDTD scheme to indicate considerable savings in memory and computational time.



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Efficient ARMA modeling of FDTD time sequences for microwave resonant structures

A.K. Shaw and K. Naishadham. "Efficient ARMA modeling of FDTD time sequences for microwave resonant structures." 1997 MTT-S International Microwave Symposium Digest 1. (1997 Vol. 1 [MWSYM]): 341-344.

The finite-difference time-domain (FDTD) method requires computation of very long time sequences (TS) to accurately characterize the slowly decaying transient tail of resonant and/or electrically large structures. Therefore, it becomes critical to investigate methods of reducing the computational time for such objects. In this paper, we present a new signal processing algorithm, which uses significantly lower model orders than those employed in existing Prony-based algorithms, to extrapolate the late-time signature accurately from the moderately early-time TS. The robustness and accuracy of the new method are illustrated by the FDTD simulation and experimental corroboration of a high-Q microstrip filter, an example of a resonant structure.

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A wideband, fiber-optic, true time-steered array receiver

P.J. Matthews, M.Y. Frankel and R.D. Esman. "A wideband, fiber-optic, true time-steered array receiver." 1997 MTT-S International Microwave Symposium Digest 1. (1997 Vol. I [MWSYM]): 347-350.

The first fiber-optically controlled true time-delay array receiver capable of wide instantaneous bandwidth is demonstrated. The one-dimensional array consists of eight spiral elements arranged in a sparsely populated, unequally-spaced array pattern designed to suppress grating lobes and give a narrow main beam. The receiver exhibited $\pm 60^\circ$ azimuth steering with no observable squint over a microwave component-limited bandwidth of 6-18 GHz.

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MMIC based SOM in optically fed phased array antennas for Ka-band communication satellites

A.S. Daryoush, K. Kamogawa, K. Horikawa, T. Tokumitsu and H. Ogawa. "MMIC based SOM in optically fed phased array antennas for Ka-band communication satellites." 1997 MTT-S International Microwave Symposium Digest 1. (1997 Vol. 1 [MWSYM]): 351-354.

Experimental results are presented for an optically fed MMIC based self-oscillating mixer (SOM) at 19 GHz. A frequency reference, used to subharmonically synchronize the 19 GHz VCO, and FM data signals are optically distributed to generate RF signals for Ka-band communication satellites.

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Electrical characterization and application of very high speed vertical cavity surface emitting lasers (VCSELs)

V.M. Hietala, K.L. Lear, M.G. Armendariz, C.P. Tigges, H.Q. Hou and J.C. Zolper. "Electrical characterization and application of very high speed vertical cavity surface emitting lasers (VCSELs)." 1997 MTT-S International Microwave Symposium Digest 1. (1997 Vol. 1 [MWSYM]): 355-358.

Vertical Cavity Surface Emitting Lasers (VCSELs) offer many benefits over conventional edge-emitting lasers including economical microelectronic batch processing, easy extension to 2-D arrays, and of interest here, very large intrinsic bandwidths due to reduced cavity volume. Results of electrical characterization of a 19 GHz bandwidth 850 nm VCSEL are presented. Small-signal characterization and modeling of the frequency response and device impedance is presented. Large signal performance is studied using two-tone RF and high-speed digital measurements. Appropriate drive conditions for high-speed digital applications are demonstrated.

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Optoelectronic mixing in three-terminal InP/InGaAs heterojunction bipolar transistors

C.P. Liu, Y. Betser, A.J. Seeds, D. Ritter and A. Madjar. "Optoelectronic mixing in three-terminal InP/InGaAs heterojunction bipolar transistors." 1997 MTT-S International Microwave Symposium Digest 1. (1997 Vol. I [MWSYM]): 359-362.

A three-terminal InP/InGaAs heterojunction bipolar transistor (HBT) with optical access has been fabricated and used in an optoelectronic mixer (OEM) configuration. Leakage of the photogenerated RF signal from the HBT base was identified as a cause of reduced mixed IF output power. By using a 3-stub tuner to present a high impedance to the base at signal frequency, over 5 dB improvement in the IF power was obtained resulting in a -4.7 dB system conversion gain. This result is the highest yet reported for a three-terminal HBT OEM and over 16 dB better than for a high quality photodiode/double-balanced mixer combination.

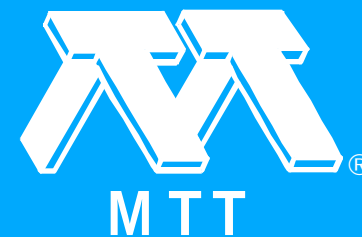
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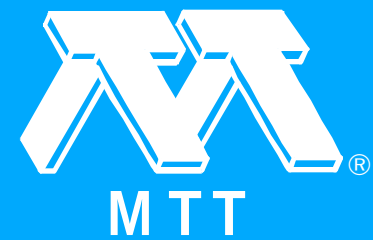
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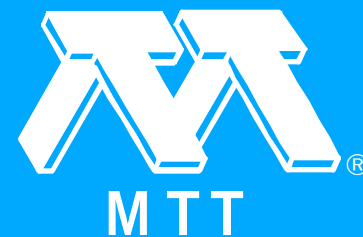
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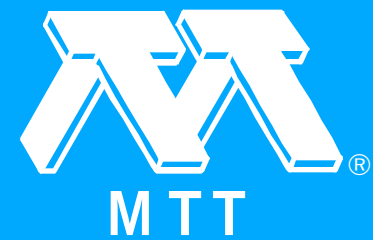
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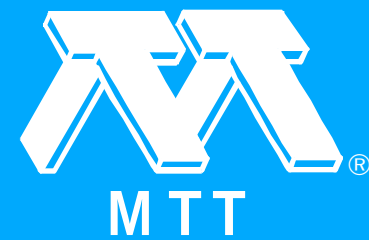
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Analysis of electrothermal transients and digital signal processing in electrically and thermally nonlinear microwave circuits

V. Rizzoli, F. Mastri, A. Neri and A. Lipparini. "Analysis of electrothermal transients and digital signal processing in electrically and thermally nonlinear microwave circuits." 1997 MTT-S International Microwave Symposium Digest 2. (1997 Vol. II [MWSYM]): 367-370.

The paper introduces a new approach to the analysis of nonlinear circuits containing temperature-dependent devices and excited by slowly modulated microwave carriers. For best accuracy and efficiency, the different dynamics of electrical and thermal phenomena are exploited. The electric circuit is simulated by a sequence of HB analyses of equal size, driven by an exact HB analysis loop for the thermal circuit.



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The effect of a variation in tone spacing on the intermodulation performance of Class A and Class AB HBT power amplifiers

P.M. McIntosh and C.M. Snowden. "The effect of a variation in tone spacing on the intermodulation performance of Class A and Class AB HBT power amplifiers." 1997 MTT-S International Microwave Symposium Digest 2. (1997 Vol. II [MWSYM]): 371-374.

The first investigation into the effect of frequency separation on the intermodulation distortion performance of Heterojunction Bipolar Transistor (HBT) power amplifiers is reported. The measured results show that the frequency spacing between the two input tones affects the intermodulation distortion performance of Class AB power amplifiers, but not Class A power amplifiers.



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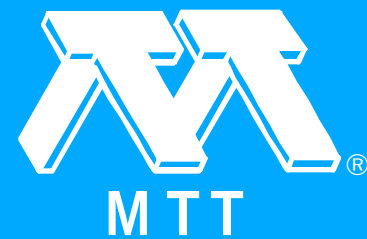


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Comparison of hybrid pi and Tee HBT circuit topologies and their relationship to large signal modeling

D.A. Teeter and W.R. Curtice. "Comparison of hybrid pi and Tee HBT circuit topologies and their relationship to large signal modeling." 1997 MTT-S International Microwave Symposium Digest 2. (1997 Vol. II [MWSYM]): 375-378.

Direct comparison between the HBT small signal Tee model and the hybrid pi topology is made to 100 GHz. It is shown that a one to one correspondence exists between the two topologies, but that some of the pi model parameters exhibit a frequency dependence with respect to the Tee model parameters. Using this analysis, an enhanced Gummel Poon large signal model has been developed which extends the model accuracy (usually up to mm-wave) by properly including collector current delay, self heating, and avalanche breakdown. A collection of measured versus modeled results are given.



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A non-quasi-static model of GaInP/AlGaAs HBT for power applications

J.P. Fraysse, D. Floriot, P. Auxemery, M. Campovecchio, R. Quere and J. Obregon. "A non-quasi-static model of GaInP/AlGaAs HBT for power applications." 1997 MTT-S International Microwave Symposium Digest 2. (1997 Vol. II [MWSYM]): 379-382.

A NonLinear (NL) model of HBT obtained from I(V) and S-parameters pulsed measurements is presented. Besides thermal effects, this model includes also two transcapacitances to take into account the Non-Quasi-Static (NQS) effects. It is shown that contrary to a Quasi-Static (QS) one, this model allows to predict accurately the behavior of the device in the whole power range as well as a broad frequency band.

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Abstracts

Modeling of nonlinear active and passive devices in three-dimensional TLM networks

L. Cascio, G. Tardioli and W.J.R. Hoefer. "Modeling of nonlinear active and passive devices in three-dimensional TLM networks." 1997 MTT-S International Microwave Symposium Digest 2. (1997 Vol. II [MWSYM]): 383-386.

We propose an extension for the TLM-SC node to analyze three-dimensional problems including nonlinear active and passive devices. The nonlinear behavior of the lumped circuit is decoupled from the impulse scattering at the nodes, yielding a general and systematic methodology to embed arbitrary nonlinear devices into the TLM mesh. Two canonical examples are given to demonstrate the versatility of the method. These include a Tunnel diode oscillator with DC biasing network and the modeling of a pn-junction diode.



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Scaleability of DC/AC non-linear dispersion models for microwave FETs

V.I. Cojocaru and T.J. Brazil. "Scaleability of DC/AC non-linear dispersion models for microwave FETs." 1997 MTT-S International Microwave Symposium Digest 2. (1997 Vol. II [MWSYM]): 387-390.

This paper addresses the issue of scaleability in circuit based models for FETs, emphasising for the first time the particularly difficult problems associated with the scaleability of DC/AC dispersion phenomena. Results of a study carried out on both MESFET and PHEMT foundry processes, show that while the differential DC/AC transconductance obeys straightforward scaling rules, the output conductance does not. An equivalent circuit based solution that incorporates a differential DC/AC dispersion modelling methodology is presented. The solution is compact, obeys the required conservation constraints and can account for the scaling inconsistencies observed in the output conductance.

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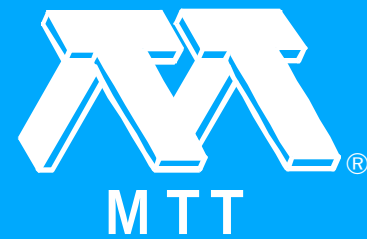


Abstracts

A physical large signal Si MOSFET model for RF circuit design

M.C. Ho, K. Green, R. Culbertson, J.Y. Yang, D. Ladwig and P. Ehnis. "A physical large signal Si MOSFET model for RF circuit design." 1997 MTT-S International Microwave Symposium Digest 2. (1997 Vol. II [MWSYM]): 391-394.

A new physically based Si MOSFET large signal model, BSIM3v3, developed by UC Berkeley, has been evaluated for high-frequency mixed-signal circuit analysis in a frequency domain, harmonic balance simulator. The model is validated using simulated RF power characteristics of automatic load pull measurement at different bias and matching conditions.



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A wide band multiport planar power divider design by radially combining matched sectorial components

Yung-Jinn Chen and Ruey-Beei Wu. "A wide band multiport planar power divider design by radially combining matched sectorial components." 1997 MTT-S International Microwave Symposium Digest 2. (1997 Vol. II [MWSYM]): 397-400.

This paper proposes a new multiport planar power divider design by radially combining the sectorial components and the input and output matching networks. It can achieve good input match over a wide bandwidth without resorting to transformer sections of high impedance lines which are difficult to realize. This approach is applied to design 4-way and 14-way center fed power dividers in microstrip structures with good input match ($VSWR < 1.5$) over a bandwidth of 30% and 15%, respectively. A simple analysis method using the radial transmission line theory to model the microstrip sectorial components is presented to characterize the power divider. The calculated scattering parameters are found to be in good agreement with the measured data.



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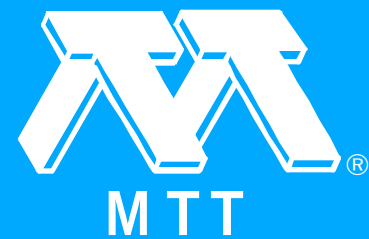
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Design and performance of GaAs MMIC CPW baluns using overlaid and spiral couplers

T. Gokdemir, S.B. Economides, A. Khalid, A.A. Rezazadeh and I.D. Robertson. "Design and performance of GaAs MMIC CPW baluns using overlaid and spiral couplers." 1997 MTT-S International Microwave Symposium Digest 2. (1997 Vol. II [MWSYM]): 401-404.

The design and performance of microwave and MM-wave baluns using multilayer GaAs MMIC technology is presented. For MM-wave designs a compact overlaid coupler is employed. For lower frequencies it is shown that novel spiral couplers can be used. Results for baluns operating at 30-40 GHz and 5-15 GHz are presented.

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An octave bandwidth monopulse processor

N.S. Barker and G.M. Rebeiz. "An octave bandwidth monopulse processor." 1997 MTT-S International Microwave Symposium Digest 2. (1997 Vol. II [MWSYM]): 405-407.

An octave bandwidth monopulse processor has been designed to operate from 2 to 4 GHz. The design is based on a new architecture in which two 90/spl deg/ delay lines and a 0 dB coupler are used in the monopulse circuit. The 2-4 GHz bandwidth is obtained in the difference port in which the dispersion due to the two 90/spl deg/ delay lines cancels. The simulated results demonstrate a 20 dB null depth over a 2 GHz bandwidth and a sum variation of 1 dB when using Lange couplers for the 0/spl deg//90/spl deg/ hybrid. The monopulse processor was fabricated on a 510 /spl mu/m high resistivity silicon substrate. The measured results indicate an 18 dB null over a 2 GHz bandwidth and a 30 dB null over a 0.95 GHz bandwidth centered at 2.6 GHz with a 2 dB variation in the sum pattern. This novel monopulse circuit can be used in millimeter-wave wideband radars (8-16 GHz, 20-40 GHz) or in novel IF-based monopulse systems.

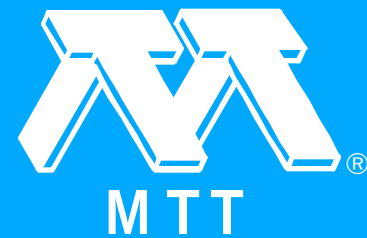


Abstracts

A compact Ku-band power combining network using rectangular coaxial line technology

H. Oh-hashii, H. Yukawa and M. Miyazaki. "A compact Ku-band power combining network using rectangular coaxial line technology." 1997 MTT-S International Microwave Symposium Digest 2. (1997 Vol. II [MWSYM]): 409-412.

A compact Ku-band power combining network with a combining loss less than 0.45 dB has been developed using rectangular coaxial line technology. Novel hybrid couplers using impedance-transforming nonuniform coupled transmission-lines are employed as power combiners to reduce the degradation in the combining network performance due to manufacturing inaccuracy.



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Cavity-type directional couplers with simple structure

T. Kawai, M. Kishihara, Y. Kokubo and T. Ohta. "Cavity-type directional couplers with simple structure." 1997 MTT-S International Microwave Symposium Digest 2. (1997 Vol. II [MWSYM]): 413-416.

This paper treats directional couplers consisting of a rectangular cavity with four waveguide ports. Since the present couplers possess a very simple structure, they are useful for applications at higher microwave and millimeter-wave frequencies, and in a high-power microwave system. Directional couplers with various power-split ratios at X-band are investigated theoretically and experimentally. Furthermore, improvement of their bandwidth is presented.



Analysis and design of H-plane waveguide bends with compact size, wide-band and low return loss characteristics

Zhewang Ma, T. Yamane and E. Yamashita. "Analysis and design of H-plane waveguide bends with compact size, wide-band and low return loss characteristics." 1997 MTT-S International Microwave Symposium Digest 2. (1997 Vol. II [MWSYM]): 417-420.

Accurate and efficient characterization method of compensated H-plane waveguide bends is developed by combining the port reflection coefficient method and the mode-matching method. Convergence properties and reliabilities of the obtained numerical results are verified. Variations of the return loss of three types of compensated bends are investigated with various compensation dimensions. Wide-band and low return loss bends with the obtained optimal compensation dimensions are fabricated and tested, and the measured results agree well with the theoretical predictions.



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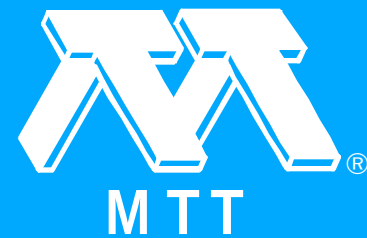


Abstracts

Thin-film microstrip lines for MM and sub-MM/wave on-chip interconnects

H.-M. Heiliger, M. Nagel, H.G. Roskos, H. Kurz, F. Schnieder and W. Heinrich. "Thin-film microstrip lines for MM and sub-MM/wave on-chip interconnects." 1997 MTT-S International Microwave Symposium Digest 2. (1997 Vol. II [MWSYM]): 421-424.

Thin-film microstrip lines with a polymer dielectric between ground and signal conductor are proven to be an attractive alternative to coplanar waveguides for (sub)-MM-wave interconnects. Both simulation and electrooptic characterization reveal negligible modal dispersion up to 1000 GHz and low attenuation even if the lines are realized on low-resistivity substrates.



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A low cost miniature MMIC W-band transceiver with planar antenna

H. Fudem, P. Stenger, E.C. Niehenke, M. Sarantos and C. Schwerdt. "A low cost miniature MMIC W-band transceiver with planar antenna." 1997 MTT-S International Microwave Symposium Digest 2. (1997 Vol. II [MWSYM]): 427-430.

This paper presents design and performance of a unique, low cost, miniature planar all MMIC W-band transceiver. The transceiver incorporates a planar 4-element circularly, polarized patch antenna, a monopulse comparator, two receiver channels, one for the sum and the other for a selectable difference in either azimuth or elevation. Two PIN diode switches provide the TR and difference channel switching. Each receiver has a balanced LNA, an image rejection/image enhancement subharmonic mixer and an IF amplifier. Test circuits are included for system calibration and verification. The double sided transceiver uses an optimal arrangement of quartz, alumina, and LTCC for an overall size less than 1 inch diameter and 0.25 inch thick. The antenna cross pole isolation is typically 15 dB with a monopulse null depth of 25 dB. The receiver gain is 30 dB with a 25 dB image rejection.

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A miniature, MMIC one watt W-band solid-state transmitter

P. Stenger, M. Sarantos, E. Niehenke, H. Fudem, C. Schwerdt, F. Kuss, D. Strack, G. Hall and J. Masti. "A miniature, MMIC one watt W-band solid-state transmitter." 1997 MTT-S International Microwave Symposium Digest 2. (1997 Vol. II [MWSYM]): 431-434.

The design features and performance summary for a fully coherent, miniature (1.3 in/sup 3/), lightweight (2.4 oz.), all MMIC 1-watt W-band transmitter is presented. The design utilizes 16 channels each delivering 90 mW at W-band consisting of a cascaded Ka-band phase shifter, Ka-band amplifier, Ka to W-band tripler and a W-band amplifier. The outputs are efficiently combined with only 1.2 dB loss using two planar radial combiners and an integrated waveguide magic tee.

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A comparison of W-band MMIC mixers using InP HEMT technology

R.S. Virk, Long Tran, M. Matloubian, Minh Le, M.G. Case and C. Ngo. "A comparison of W-band MMIC mixers using InP HEMT technology." 1997 MTT-S International Microwave Symposium Digest 2. (1997 Vol. II [MWSYM]): 435-438.

This paper compares the performance of three different W-band mixer designs in the same InP HEMT technology. A resistive HEMT mixer, an active HEMT mixer, and a rat-race diode mixer are designed and measured for conversion, intermodulation and noise performance for an LO frequency of 94 GHz and IF frequencies ranging from 0.5 to 5 GHz. This is the first direct comparison of three high-performance W-band mixers fabricated in the same InP HEMT technology.

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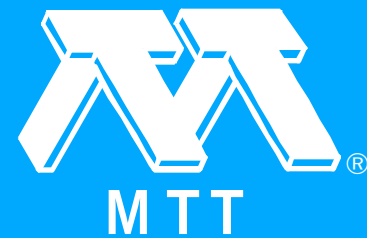


Abstracts

A DC-60 GHz GaAs MMIC switch using novel distributed FET

H. Mizutani and Y. Takayama. "A DC-60 GHz GaAs MMIC switch using novel distributed FET." 1997 MTT-S International Microwave Symposium Digest 2. (1997 Vol. II [MWSYM]): 439-442.

This paper presents the broadest-band distributed FET MMIC switch ever reported for millimeter-wave applications. The developed switch with the novel structure indicated an insertion loss of less than 1.37 dB and an isolation of better than 23.1 dB with monotonous increase up to 39.6 dB from DC to 60 GHz.



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A single-bias diode-regulated 60 GHz monolithic LNA

K. Maruhashi, K. Ohata and M. Madihian. "A single-bias diode-regulated 60 GHz monolithic LNA." 1997 MTT-S International Microwave Symposium Digest 2. (1997 Vol. II [MWSYM]): 443-446.

This paper presents a small-size 60 GHz-band GaAs MMIC LNA with a single bias supply. A diode-regulated self-bias circuit was proposed and demonstrated for suppressing the FET drain current variations due to threshold voltage nonuniformities. The developed three-stage MMIC LNA exhibited an average noise figure of 3.3 dB with 18 dB gain from 58 to 62 GHz. The chip size of the LNA is 1.85 mm/spl times/1.07 mm/spl times/0.04 mm.

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Abstracts

60 GHz flip-chip assembled MIC design considering chip-substrate effect

Y. Arai, M. Sato, H.T. Yamada, T. Hamada, K. Nagai and H.I. Fujishiro. "60 GHz flip-chip assembled MIC design considering chip-substrate effect." 1997 MTT-S International Microwave Symposium Digest 2. (1997 Vol. II [MWSYM]): 447-450.

In this paper, a 60 GHz MICs with flip-chip assembled pseudomorphic-HEMT is demonstrated. With electromagnetic field analysis, the assembly effect was estimated. An amplifier has a gain of 13 dB and a 30/60 GHz frequency doubler has a gain of -3 dB. Measured and simulated results clarify the potential of the structure and design method.



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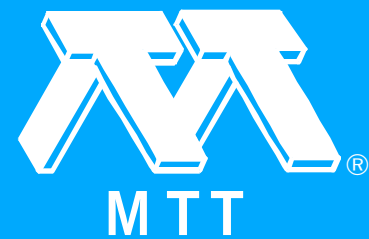
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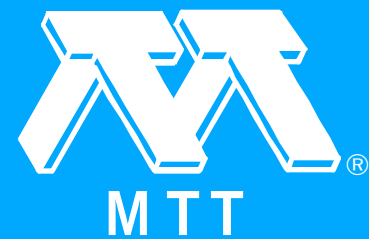
RF performance characteristics of InP millimeter-wave $n^+p^+n^-p^+$ Gunn devices

H. Eisele, G.O. Munns and G.I. Haddad. "RF performance characteristics of InP millimeter-wave $n^+p^+n^-p^+$ Gunn devices." 1997 MTT-S International Microwave Symposium Digest 2. (1997 Vol. II [MWSYM]): 451-454.

A selective etching technology for the fabrication of InP Gunn devices on diamond heat sinks was established recently. Using MOCVD-grown material, state-of-the-art RF power levels of more than 130 mW at 131.7 GHz and more than 60 mW at 151 GHz were obtained in the fundamental mode. No deterioration was observed in one of these devices monitored for more than 6500 hours. Power combining of two devices resulted in an RF output power of 130 mW at 136 GHz with a combining efficiency of more than 85%. After evaluating CBE-grown material with devices on integral heat sinks, different doping profiles for devices operating at D-band frequencies were designed and grown in a CBE system. Preliminary results with RF power levels of more than 100 mW around 130 GHz indicate that CBE can provide the high-quality material required for InP Gunn devices and that RF power levels above 150 GHz can be increased significantly with optimized device structures. No differences in the excellent noise performance of devices fabricated from either MOCVD- or CBE-grown material were found.

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Over-60-GHz operation of SCFL dynamic frequency divider using InP-based HEMTs

Y. Umeda, K. Osafune, T. Enoki, H. Yokoyama, Y. Ishii and Y. Imamura. "Over-60-GHz operation of SCFL dynamic frequency divider using InP-based HEMTs." 1997 MTT-S International Microwave Symposium Digest 2. (1997 Vol. II [MWSYM]): 457-460.

A toggle operation of 39 to 63.5 GHz has been achieved by a digital dynamic frequency divider. The frequency divider employs a pair of clocked inverters with source coupled FET logic (SCFL) and uses 0.1- μm -gate InAlAs/InGaAs/InP HEMTs with high uniformity and performance. On a 2-in. wafer the frequency divider showed a maximum toggle frequency of 59.1/spl plusmn/3.3 GHz with a fabrication yield of 89%. This is the highest operation frequency yet obtained by a broadband digital frequency divider.



Abstracts

A 40-Gbit/s optical repeater circuits using InAlAs/InGaAs HEMT digital IC chip set

M. Yoneyama, A. Sano, K. Hagimoto, T. Otsuji, K. Murata, Y. Imai, S. Yamaguchi, T. Enoki and E. Sano. "A 40-Gbit/s optical repeater circuits using InAlAs/InGaAs HEMT digital IC chip set." 1997 MTT-S International Microwave Symposium Digest 2. (1997 Vol. II [MWSYM]): 461-464.

This paper describes an InAlAs/InGaAs HEMT digital IC chip set which includes a multiplexer, demultiplexer, decision circuit, and frequency divider. Electrically multiplexed and demultiplexed 40-Gbit/s transmission is successfully performed.



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A 40 Gbit/s super-dynamic decision IC using 0.15- μ m GaAs MESFETs

K. Murata, T. Otsuji, M. Yoneyama and M. Tokumitsu. "A 40 Gbit/s super-dynamic decision IC using 0.15- μ m GaAs MESFETs." 1997 MTT-S International Microwave Symposium Digest 2. (1997 Vol. II [MWSYM]): 465-468.

This paper describes a 40 Gbit/s decision IC using 0.15- μ m gate length GaAs MESFETs. A super-dynamic flip-flop circuit and wideband amplifier were applied in order to attain 40 Gbit/s operation. The IC is the first to provide an error-free 40 Gbit/s decision operation.



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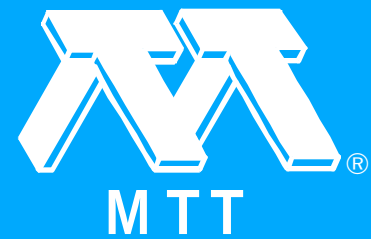


Abstracts

Monobit receiver

J.B.Y. Tsui, J.J. Schamus and D.H. Kaneshiro. "Monobit receiver." 1997 MTT-S International Microwave Symposium Digest 2. (1997 Vol. II [MWSYM]): 469-471.

This paper presents a very simple digital receiver design which can cover approximately 1 GHz bandwidth and process two simultaneous signals. The design has the potential to be fabricated on a single chip.



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A 10 Gb/s package for digital ICs

J.B. Hacker, T.C. Banwell and D.T. Kong. "A 10 Gb/s package for digital ICs." 1997 MTT-S International Microwave Symposium Digest 2. (1997 Vol. II [MWSYM]): 473-476.

Experimental research prototype packages with 26 10 Gb/s I/O ports were designed for two GaAs telecom ICs. The prototypes are based upon a commercially available ceramic microwave package with an exterior size of 0.450" square, and an interior cavity size of 0.250" square. The copper-tungsten base provides excellent heat dissipation and rigidity while providing a close thermal expansion match to GaAs. A 5 mil alumina substrate is used to carry microstrip transmission line circuits from the package edge to the die mounted at the package center. A low-inductance ground ring surrounds the die cavity in the package to provide flexible low-noise grounding of the die without compromising signal integrity on the high-speed lines. Measurements show the package has usable bandwidth to 35 GHz and crosstalk is better than -35 dB for adjacent high-speed signal paths. The results demonstrate that packaging need not be the limiting factor for complex high-speed digital integrated circuits.

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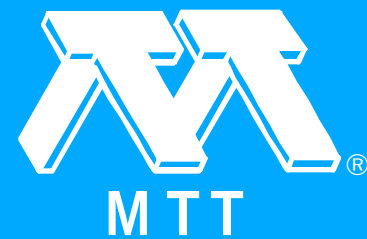


Abstracts

The nature of the spectral gap for leaky waves on a periodic strip grating structure

S. Majumder, D.R. Jackson and M. Guglielmi. "The nature of the spectral gap for leaky waves on a periodic strip grating structure." 1997 MTT-S International Microwave Symposium Digest 2. (1997 Vol. II [MWSYM]): 479-482.

The nature of the spectral gap at forward endfire for a periodic leaky-wave structure consisting of an infinite array of metallic strips on a lossless grounded dielectric layer is studied and compared with that for a simple grounded dielectric layer. One basic difference is that the nature of the spectral gap depends on whether or not a second space harmonic ($n=-2$) begins radiating before the main radiating harmonic ($n=-1$) is scanned to forward endfire. The spectral gap resembles that for a lossy dielectric layer when a second space harmonic is radiating, and resembles that for a lossless dielectric layer otherwise. In addition, an interesting new solution, which has no counterpart in the dielectric layer case, is found to exist when the $n=-2$ harmonic is nonradiating in the scan range of the $n=-1$ harmonic.



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Abstracts

The spectral gap when power leaks into more than one type of surface wave on printed-circuit lines

M. Tsuji, H. Shigesawa, H. Sannomiya and A.A. Oliner. "The spectral gap when power leaks into more than one type of surface wave on printed-circuit lines." 1997 MTT-S International Microwave Symposium Digest 2. (1997 Vol. II [MWSYM]): 483-486.

A new type of spectral gap has been found to exist at the onset of leakage into more than one type of surface wave. The properties of this type of spectral gap have been investigated theoretically and experimentally for conductor-backed coplanar strips.



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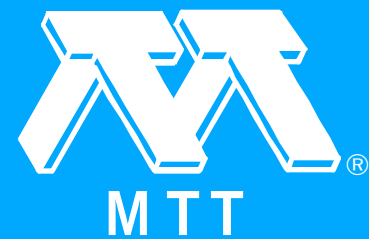
Upper cut-off frequency of the bound wave and new leaky wave on the slotline

J. Zehentner, J. Machac and M. Migliozi. "Upper cut-off frequency of the bound wave and new leaky wave on the slotline." 1997 MTT-S International Microwave Symposium Digest 2. (1997 Vol. II [MWSYM]): 487-490.

This paper contributes to a more profound understanding of uniplanar circuit behaviour. A simple closed-form formula providing the upper cut-off frequency of the bound wave propagating over the slotline is presented. A new leaky wave which brings down this limit due to the overlapping of the bound- and leaky-mode regions is identified and reported. This wave can deteriorate circuit performance, especially in the mm-wave band. Conclusions made for the slotline hold generally for open printed-circuit lines.

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The role of complex waves of proper type in radiative effects of nonreciprocal structures

P. Baccarelli, C. Di Nallo, F. Frezza, A. Galli and P. Lampariello. "The role of complex waves of proper type in radiative effects of nonreciprocal structures." 1997 MTT-S International Microwave Symposium Digest 2. (1997 Vol. II [MWSYM]): 491-494.

Structures of open type based on gyrotropic substrates have shown interesting nonreciprocal radiation characteristics, recently investigated in terms of leaky waves. This subject is studied further in this work, on the basis of accurate theoretical procedures. Our attention is particularly focused on the identification and the interpretation of original forward/backward beam-scanning properties due to isotropic current sources. The contributions to the radiation of excitable proper (or spectral) leaky waves, until now quite disregarded in such type of open structures, is emphasized and discussed with regard to its physical meaning. This analysis makes possible a simple, complete, and effective interpretation of the radiative features in devices that may find application as unconventional antennas.

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Abstracts

Leaky-modes leakage from planar circuits

Kuo-Cheng Chen and C.-K.C. Tzuang. "Leaky-modes leakage from planar circuits." 1997 MTT-S International Microwave Symposium Digest 2. (1997 Vol. II [MWSYM]): 495-498.

Inherent leakages in certain two-dimensional planar circuits are related to the propagation of leaky modes, contrasting to the conventional awareness of the association of leaky modes with the uniform waveguides. Both theoretical and experimental studies confirm that the newly found phenomena exist in proximity-coupled or direct-fed two-dimensional planar circuits of irregular shapes. Hence the leaky modes are indispensable when designing a microwave planar circuit.



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Design and performance of a high density 3D microwave module

R. Sturdivant, Chung Ly, J. Benson and M. Hauhe. "Design and performance of a high density 3D microwave module." 1997 MTT-S International Microwave Symposium Digest 2. (1997 Vol. II [MWSYM]): 501-504.

Microwave packaging involves the electrical interconnection, environmental protection, and thermal management of active components such as MMICs, ASICs, and regulators as well as passive components like resistors, capacitors and substrates. The distinguishing feature between microwave modules and lower frequency modules is that the packaging dimensions are a significant fraction of a wavelength. This requires special care in the design of interconnects and substrate metalization. As packaging densities increase, concerns of coupling and high thermal density often drive the choice of materials and packaging configurations. This work describes the design and performance of a high density microwave module. The development of interconnects, thermal management and coupling reduction are described.



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Using MMIC flip chips and CVD diamond for improved thermal management of microwave modules

R. Sturdivant, Chung Ly, J. Benson and J. Wooldridge. "Using MMIC flip chips and CVD diamond for improved thermal management of microwave modules." 1997 MTT-S International Microwave Symposium Digest 2. (1997 Vol. II [MWSYM]): 505-507.

MMIC flip chips offer several benefits over conventional face-up versions. This includes lower cost, ease of interconnection, self alignment to motherboard, and simultaneous attachment and electrical connection. High power MMIC flip chips use bumps on the FET source to provide for an improved thermal path. When connected to a high thermal conductivity mounting substrate such as aluminum nitride, high power flip chips operate at lower temperatures than conventional flip chips. In fact, modeling has shown that they can have a 15/spl deg/C lower junction temperature compared to conventional MMICs. However, it is often desirable to use lower thermal conductivity mounting substrates such as LTCC. In these cases the junction temperate of a MMIC, flipped or face-up, can be too high for practical use. By using Chemical Vapor Deposition (CVD) diamond substrates, it is possible to reduce the junction temperature to acceptable levels. This work describes the uses of diamond with MMIC flip chips on low thermal conductivity substrates.

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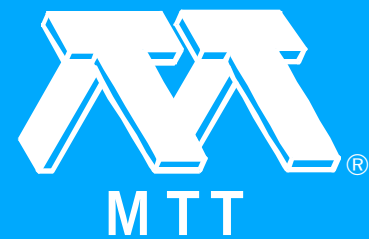


Abstracts

Line-loss and size-reduction techniques for millimeter-wave rf front-end boards by using a polyimide/alumina-ceramic multilayer configuration

M. Nakatsugawa, A. Kanda, H. Okazaki, K. Nishikawa and M. Muraguchi. "Line-loss and size-reduction techniques for millimeter-wave rf front-end boards by using a polyimide/alumina-ceramic multilayer configuration." 1997 MTT-S International Microwave Symposium Digest 2. (1997 Vol. II [MWSYM]): 509-512.

This paper proposes a concept for constructing low-loss and small-size millimeter-wave RF front-end boards by using a polyimide/alumina-ceramic multilayer configuration. This configuration enables us to design wide line-width low-loss microstrip lines. In addition, the board size can be reduced by compactly arranging all RF and DC lines in the intermediate layers of the polyimide/alumina-ceramic substrate. A prototype board designed for the quasi-millimeter-wave region was successfully demonstrated with good performance.



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InP HBT on Si substrates with integral passive components: a wafer scale package

C. Chun, N. Evers, J. Laskar, N.M. Jokerst, H.-F. Chau and E. Beam. "InP HBT on Si substrates with integral passive components: a wafer scale package." 1997 MTT-S International Microwave Symposium Digest 2. (1997 Vol. II [MWSYM]): 513-516.

An InP based HBT is integrated to a Si substrate insulated with BCB by removing the InP substrate and bonding the active device layers. The DC and RF characteristics show minimal degradation after bonding to the Si. Transmission line structures are fabricated and measured on both bare Si and Si coated with BCB. Insertion loss of the CPW lines demonstrate useful high frequency propagation with BCB on the lossy substrate. Utilizing these results, an amplifier is designed to demonstrate InP thin-film integrated high frequency circuits on silicon. These results point to the development of wafer scale packaged high frequency electronics.

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A Si micromachined conformal package for a K-band low noise HEMT amplifier

S.V. Robertson, M. Matloubian, M. Case and L.P.B. Katehi. "A Si micromachined conformal package for a K-band low noise HEMT amplifier." 1997 MTT-S International Microwave Symposium Digest 2. (1997 Vol. II [MWSYM]): 517-520.

A 20 GHz low noise HEMT amplifier is fabricated and tested to demonstrate the application of integrated conformal packaging to MMIC circuit design. Si micromachining is employed to create a conformal shielding cavity for the low noise amplifier, which uses a flip chip InP HEMT. The packaged amplifier demonstrates 5 dB insertion gain at 20 GHz, with performance that closely matches simulations of an ideal line circuit. The results show that Si micromachining can be performed to integrate packaging with circuit design, and that MMICs can be fabricated on Si substrates by using discrete flip-chip devices.

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Silicon-based micromachined packages for discrete components

R.M. Henderson and L.P.B. Katehi. "Silicon-based micromachined packages for discrete components." 1997 MTT-S International Microwave Symposium Digest 2. (1997 Vol. II [MWSYM]): 521-524.

A novel approach has been taken to develop low cost, high frequency (Ka-band), electronic packages. An existing thick film package for a phase shifter chip has been redesigned using silicon as the base material. This paper reports on the fabrication techniques and the measurement improvement found by coupling silicon micromachining techniques with standard IC processing.

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A 6-18 GHz 20 W SPDT switch using shunt discrete PIN diodes

T. Shigematsu, N. Suematsu, N. Takeuchi, Y. Iyama and A. Mizobuchi. "A 6-18 GHz 20 W SPDT switch using shunt discrete PIN diodes." 1997 MTT-S International Microwave Symposium Digest 2. (1997 Vol. II [MWSYM]): 527-530.

A broadband high power SPDT switch using shunt discrete PIN diodes is presented. By using shunt SPDT switch configuration, high power performance can be obtained. A novel structure, in which matching sections are added outside of shunt PIN diodes, provides broadband characteristics. The insertion loss of the fabricated MIC switch is less than 2.0 dB at 6 to 18 GHz, and is less than 1.5 dB at 7 to 17 GHz. The power handling capability is over 20 W CW at 12 GHz.

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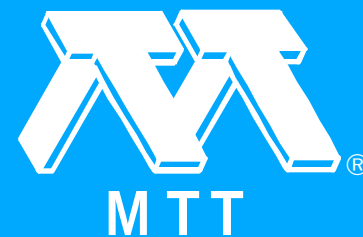


Abstracts

Low cost microwave receiver protectors/AGC's using surface mount components

D. Strack and F. Harris. "Low cost microwave receiver protectors/AGC's using surface mount components." 1997 MTT-S International Microwave Symposium Digest 2. (1997 Vol. II [MWSYM]): 531-534.

As the frequency of commercial systems continues to increase, cost solutions to various microwave functions are needed. A low cost solution to receiver protection and receiver AGC functions is presented. This low cost approach is based on use of surface mount techniques for all components in the assembly.



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Abstracts

An investigation of GaAs MMIC high power limiters for circuit protection

C. Trantanella, M. Pollman and M. Shifrin. "An investigation of GaAs MMIC high power limiters for circuit protection." 1997 MTT-S International Microwave Symposium Digest 2. (1997 Vol. II [MWSYM]): 535-538.

In this paper, we present an investigation of GaAs MMIC semiconductor limiters which can be fabricated on a standard MMIC process. This investigation, which included high power vector measurements of S-parameters over time, led to the design of a highly compact limiter integrated directly onto an FM-CW radar MMIC. As we demonstrate, the limiter significantly improved the lifetime of the FM-CW radar MMIC when exposed to both single and multiple short, high power pulses of microwave energy.



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3-watt Q-band waveguide PHEMT MMIC power amplifier module

J.A. Lester, J. Chi, R. Lai, M. Biedenbender, D. Garske, R. Rordan and P.D. Chow. "3-watt Q-band waveguide PHEMT MMIC power amplifier module." 1997 MTT-S International Microwave Symposium Digest 2. (1997 Vol. II [MWSYM]): 539-542.

Presented is a 3 watt Q-band PHEMT MMIC power amplifier module with a peak efficiency of 25% at 44.5 GHz, believed to be the highest reported at this power level and frequency. The waveguide power amplifier module features the use of thinned 2-mil GaAs MMICs with off-chip output matching and combining on a 5-mil alumina substrate.

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Power combining port impedance model

M.J. Lee and J.A. Faulkner. "Power combining port impedance model." 1997 MTT-S International Microwave Symposium Digest 2. (1997 Vol. II [MWSYM]): 543-546.

A novel way to characterize the port impedances of broadband combining networks has been developed. The impedance of a coupler port in the environment of a fully driven combiner is analyzed to develop a thorough understanding of the interaction of power MMICs and combiners in actual manufacturing environments.

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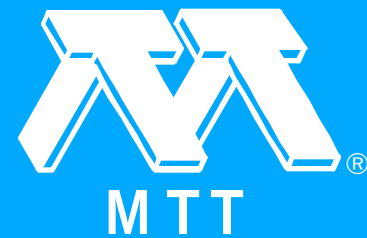


Abstracts

A high conversion efficiency 5.8 GHz rectenna

J.O. McSpadden, Lu Fan and Kai Chang. "A high conversion efficiency 5.8 GHz rectenna." 1997 MTT-S International Microwave Symposium Digest 2. (1997 Vol. II [MWSYM]): 547-550.

A high efficiency rectenna element has been designed and tested at 5.8 GHz for applications involving microwave power transmission. The dipole antenna and filtering circuitry are printed on a thin duroid substrate. A silicon Schottky-barrier mixer diode with a low breakdown voltage is used as the rectifying device; The rectenna element is tested inside a waveguide simulator and achieves an RF to DC conversion efficiency of 82% at an input power level of 50 mW. The antenna and circuit design is based on a full-wave electromagnetic simulator.



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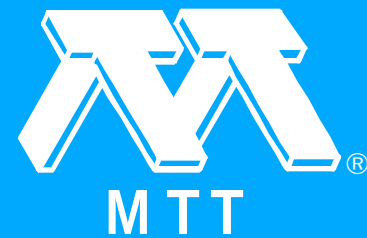


Abstracts

The work of Jagadis Chandra Bose: 100 years of mm-wave research

D.T. Emerson. "The work of Jagadis Chandra Bose: 100 years of mm-wave research." 1997 MTT-S International Microwave Symposium Digest 2. (1997 Vol. II [MWSYM]): 553-556.

Just one hundred years ago, J.C. Bose described to the Royal Institution in London his research carried out in Calcutta at millimeter wavelengths. He used waveguides, horn antennas, dielectric lenses, various polarizers and even semiconductors at frequencies as high as 60 GHz. Some concepts from his original 1897 papers have been incorporated into a new 1.3-mm multi-beam receiver now in use on the NRAO 12 Meter Telescope.



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Abstracts

Sir J.C. Bose and radio science

A.K. Sen. "Sir J.C. Bose and radio science." 1997 MTT-S International Microwave Symposium Digest 2. (1997 Vol. II [MWSYM]): 557-560.

Sir J.C. Bose's pioneering works in quasi-optic millimeter wave research in Calcutta, India about 100 years back during 1890s are highlighted. He developed an elegant millimeter wave spark transmitter, self recovering coherer detector, wire grid polariser, cylindrical diffraction grating, dielectric lens and prism, rectangular waveguide, horn antenna and microwave absorber, for the studies of reflection, refraction, absorption and polarisation of millimeter waves and its application to wireless remote control for firing a gun. All these pioneering activities indicate that he was well ahead of his time and prompted us to call him the father of Radio Science.



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Integrated micro-machined antenna for 200 GHz operation

J.W. Digby, C.E. Collins, B.M. Towlson, L.S. Karatzas, G.M. Parkhurst, J.M. Chamberlain, J.W. Bowen, R.D. Pollard, R.E. Miles, D.P. Steenson, D.A. Brown and N.J. Cronin.

"Integrated micro-machined antenna for 200 GHz operation." 1997 MTT-S International Microwave Symposium Digest 2. (1997 Vol. II [MWSYM]): 561-564.

A new integrated micro-machined slotted horn antenna is reported which has been fabricated on a GaAs substrate. The far-field pattern has been simulated and measured showing good agreement, and the antenna has been used to successfully couple power in and out of a micro-machined rectangular waveguide.

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Single- and dual-polarized slot-ring subharmonic receivers

S. Raman and G.M. Rebeiz. "Single- and dual-polarized slot-ring subharmonic receivers." 1997 MTT-S International Microwave Symposium Digest 2. (1997 Vol. II [MWSYM]): 565-568.

Single- and dual-polarized subharmonic receivers have been developed for operation at W-band frequencies. The receivers are based on dielectric lens-supported, coplanar waveguide-fed slot-ring antennas integrated with uniplanar subharmonic mixers. The slot-ring antenna is capable of supporting two orthogonal modes offering the possibility of dual/multiple receive polarizations. The measured two-port isolation of the dual-polarized slot-ring antenna is better than -25 dB from 86-92 GHz. The measured DSB receiver noise temperature is 4300 K at an LO frequency of 45.0 GHz and an IF of 1.4 GHz. The corresponding DSB conversion loss is 12.2 dB. This includes lens reflection and absorption losses, backside radiation, RF feedline loss, and RF mismatch. When these losses are deembedded the results are in good agreement with the measured performance of the uniplanar subharmonic mixer alone. A matching cap layer on the lens and improved RF matching are expected to result in a DSB noise temperature of 1700-1900 K and conversion loss of 8-9 dB. Potential applications are compact, low-cost millimeter-wave receivers with fixed or variable polarization capabilities.

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Miniature low power submillimeter-wave spectrometer for detection of water in the Solar System

O. Boric-Lubecke, R.F. Denning, M.A. Janssen and M.A. Frerking. "Miniature low power submillimeter-wave spectrometer for detection of water in the Solar System." 1997 MTT-S International Microwave Symposium Digest 2. (1997 Vol. II [MWSYM]): 569-572.

Mass and power for the next generation of NASA's heterodyne spectrometers must be greatly reduced to satisfy the constraints of future small-spacecraft missions. We report on a 220 GHz Schottky-diode receiver, which requires less than 4.8 W, and has a mass of less than 1.5 kg—more than a factor of ten reduction in mass and power compared to current instruments. This significant savings was achieved through minimizing the number of receiver components, without compromising on the functionality necessary for a surface based Mars atmospheric sounding instrument.

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A high-efficiency millimeter-wave holographic power splitter/combiner

M. Shahabadi, K. Schunemann and H.-G. Unger. "A high-efficiency millimeter-wave holographic power splitter/combiner." 1997 MTT-S International Microwave Symposium Digest 2. (1997 Vol. II [MWSYM]): 573-576.

A millimeter-wave power splitter/combiner working on the principles of holography is presented. A hologram which stores the holographic image of a number of beams has the function of a power splitting element. An input beam to this hologram causes the recorded beams to be reconstructed, which is none but a high-efficiency process of beam splitting. A measured efficiency of 93%, high isolation, and a relatively large bandwidth are demonstrated.

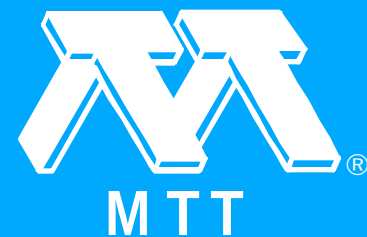


Abstracts

Low cost T/R modules for planar arrays

D. Strack, G. Ferrell, A. Piloto, J. Gipprich, J. Fisher, J. Kennedy, D. Heffernan and S. Caswell. "Low cost T/R modules for planar arrays." 1997 MTT-S International Microwave Symposium Digest 2. (1997 Vol. II [MWSYM]): 579-582.

For phased arrays to be viable in present and future radar systems, T/R module designs will need to be lower cost, lighter weight, and more producible. The T/R module presented in this paper provides a new approach for both module and array design. A planar approach is presented in which individual T/R modules are 'plugged' into the array allowing for easy maintenance of the array.



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Abstracts

Unaccelerated reliability testing for T/R modules: need, methodology and supporting data

B.A. Kopp, T.A. Axness and C.R. Moore. "Unaccelerated reliability testing for T/R modules: need, methodology and supporting data." 1997 MTT-S International Microwave Symposium Digest 2. (1997 Vol. II [MWSYM]): 583-586.

MMIC temperature accelerated test data often does not capture many reliability degradation mechanisms present in transmit/receive (T/R) modules. Unaccelerated T/R module reliability testing can be used to help identify these mechanisms. This paper will identify several T/R module degradation mechanisms, a test methodology to obtain the maximum amount of information from unaccelerated test data, and supporting experimental data.



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Abstracts

Megalithic microwave signal processing for phased-array beam forming and steering

T. Ohira, Y. Suzuki, H. Ogawa and H. Kamitsuna. "Megalithic microwave signal processing for phased-array beam forming and steering." 1997 MTT-S International Microwave Symposium Digest 2. (1997 Vol. II [MWSYM]): 587-590.

A microwave signal processing (MSP) architecture is presented for active phased array beam forming and steering. A large scale network, comprising 63 power dividers and 32 pairs of orthogonal phase-amplitude controllers, has been successfully developed in a single GaAs MMIC. This megalithic chip could mark an epoch in phased-array antenna systems.



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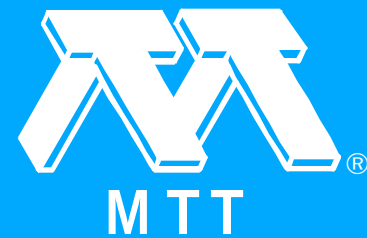


Abstracts

Active antenna oscillator arrays in communication systems

C. Kykkotis, P.S. Hall and H. Ghafouri-Shiraz. "Active antenna oscillator arrays in communication systems." 1997 MTT-S International Microwave Symposium Digest 2. (1997 Vol. II [MWSYM]): 591-594.

Active antenna oscillator arrays have been considered in millimetre-wave communication systems for increased power levels in low cost radio modules. In this paper, we have investigated the data-rate limitations, the modulation effects on the radiation pattern, and the bit error rate performance of antenna oscillator arrays in practical applications.



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A polarization flexible phased array antenna for a mobile communication SDMA field trial

C. Passmann, G. Villino and T. Wixforth. "A polarization flexible phased array antenna for a mobile communication SDMA field trial." 1997 MTT-S International Microwave Symposium Digest 2. (1997 Vol. II [MWSYM]): 595-598.

An 8/spl times/8 element array antenna for 1.71-1.785 GHz frequency range suited for an adaptive antenna system has been built. The elements are broadband microstrip patches, which are optimized for large angular coverage. The antenna can be digitally switched between 16 different polarizations to enhance polarization-diversity-gain. Calibration ports allow precise phase and amplitude adjustment of element coefficients.



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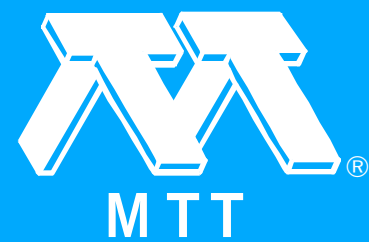
Automatic beam steered active antenna receiver

S. Gupta and V.F. Fusco. "Automatic beam steered active antenna receiver." 1997 MTT-S International Microwave Symposium Digest 2. (1997 Vol. II [MWSYM]): 599-602.

This paper describes the design and behaviour of a novel compact self-phased integrated mixer active antenna receive array. The array performs automatic beam steering at low IF frequencies by the use of a pilot carrier inserted in-channel with the information signal. The phasing considerations, advantages, properties and practical considerations of this type of array are outlined. An experimental array based on this technique has been constructed to verify the principles involved. Experimental results on self-mixing and self-phasing performance are included in order to illustrate the automatic beam steering capability of this type of array.

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Analysis of the propagation and leakage effects for various classes of traveling-wave sources in the presence of covering dielectric layers

C. Di Nallo, F. Frezza, A. Galli and P. Lampariello. "Analysis of the propagation and leakage effects for various classes of traveling-wave sources in the presence of covering dielectric layers." 1997 MTT-S International Microwave Symposium Digest 2. (1997 Vol. II [MWSYM]): 605-608.

The fundamental perturbation effects on the propagation properties (phase and leakage constants) of traveling-wave sources due to the presence of covering dielectric layers with arbitrary permittivity and dimensions are investigated in this work. Our analysis is applicable to several well known and used classes of leaky-wave antennas (slotted rectangular guide, stub-loaded, ridge, stepped, and so forth) when radomes are required for environmental protection. The basic step is given by the quantification of the radiation admittance for the aperture of the coated single-line source via a spectral-domain approach. Through usual transverse resonance techniques, from the straightforward calculation of the phase and leakage constants it is then possible to easily characterize the global radiation properties. Extensions to the case of coated arrays are also carried out. The results show the type and the amount of the modifications that are related to the introduction of radomes in traveling-wave antennas.

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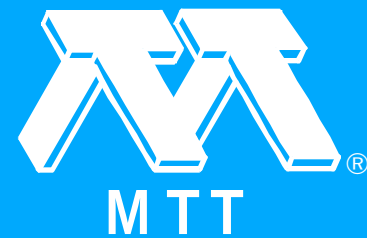


Abstracts

Discontinuity effects on high frequency transistors

M.A. Megahed and S.M. El-Ghazaly. "Discontinuity effects on high frequency transistors." 1997 MTT-S International Microwave Symposium Digest 2. (1997 Vol. II [MWSYM]): 609-612.

The effects of input and output discontinuities on high frequency GaAs MESFET performance are analyzed. The transistor circuit, including both the active and passive elements, is evaluated using full-wave three dimensional physically based model. The S-parameters are simulated for different circuit topologies. Results clearly shows that the effect of these discontinuities is significant.



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Characterization of power loss from discontinuities in guided structures

T.K. Sarkar, Z.A. Maricevic and M. Salazar-Palma. "Characterization of power loss from discontinuities in guided structures." 1997 MTT-S International Microwave Symposium Digest 2. (1997 Vol. II [MWSYM]): 613-616.

This paper is an extension of the work presented by Sarkar et al. (1996). In that work it was shown how to utilize the matrix pencil approach to extract S-parameters of N-port microwave structures. In this paper this earlier approach has been extended to analyze radiation/power loss from the discontinuities of guided structures. Specifically, computed results are presented for the S-parameters of an open ended rectangular waveguide radiating into free space along with experimental results given by Marcuvitz (1951). In addition power loss from rectangular and mitered bends are computed for a microstrip line. The present results are more accurate than what is available in the published literature.

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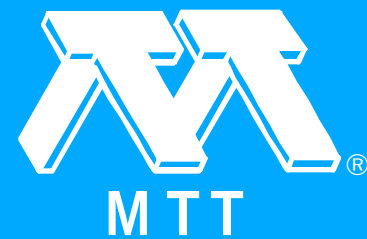


Abstracts

Analysis of unbounded and bounded circuits and antennas considering finite extent and inhomogeneous dielectric

Xiaohong Jiang and K. Wu. "Analysis of unbounded and bounded circuits and antennas considering finite extent and inhomogeneous dielectric." 1997 MTT-S International Microwave Symposium Digest 2. (1997 Vol. II [MWSYM]): 617-620.

A field-theoretical algorithm is presented for characterizing unbounded and bounded circuits and antennas. Finite extent and inhomogeneous dielectric layer are rigorously considered in this method of lines-based model. The unbounded effects are determined with an improved lossy absorbing boundary condition (LABC) which can handle both propagating and evanescent waves. This analysis accounts for all the physical effects including electromagnetic coupling, evanescent higher-order modes, space-wave radiation and surface-wave leakage losses. Examples are given for unbounded loss effects including microstrip open-end deposited on a finite dielectric substrate and gap discontinuities on an inhomogeneous layer. Results indicate that the unbounded loss may be controlled by certain finite extent of the dielectric layer.



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Stability envelope-new tool for generalised stability analysis

T. Narhi and M. Valtonen. "Stability envelope-new tool for generalised stability analysis." 1997 MTT-S International Microwave Symposium Digest 2. (1997 Vol. II [MWSYM]): 623-626.

A new Nyquist-type method for stability analysis is presented. The envelope of the mapping from source and load impedance planes with "normalised determinant function" is determined for all passive terminations. The circuit is unconditionally stable if the origin is not encircled or included within the envelope. A single plot reveals instabilities, caused either by internal poles of the circuit or by arbitrary terminating impedances.

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Abstracts

Knowledge based neural models for microwave design

Fang Wang and Q.J. Zhang. "Knowledge based neural models for microwave design." 1997 MTT-S International Microwave Symposium Digest 2. (1997 Vol. II [MWSYM]): 627-630.

Neural networks have recently gained attention as a fast and flexible vehicle for microwave modeling, simulation and optimization. In this paper a new microwave-oriented knowledge based neural network (KBNN) is proposed, in which microwave knowledge in the form of empirical functions or analytical approximations are incorporated into neural networks. The proposed technique enhances neural model accuracy especially for unseen data and reduces the need of large set of training data. The advantages of the KBNN are demonstrated by MESFET and transmission line modeling examples.



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Abstracts

Recursive causal convolution [passive distributed circuits]

M. AbuShaaban, T.J. Brazil and J.O. Scanlan. "Recursive causal convolution [passive distributed circuits]." 1997 MTT-S International Microwave Symposium Digest 2. (1997 Vol. II [MWSYM]): 631-634.

A new method is presented for implementing discrete numerical convolution in passive circuit simulation which achieves high efficiency by using a recursive formulation. The technique starts with an FIR response obtained by a conventional convolution method and obtains an IIR filter using Pade approximants in the z-domain. The resulting IIR filter is tested for stability using the Lehmer-Schur algorithm and for accuracy by comparing its impulse response to that of the original FIR filter.



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Space mapping optimization of waveguide filters using finite element and mode-matching electromagnetic simulators

J.W. Bandler, R.M. Biernacki, S.H. Chen and D. Omeragic. "Space mapping optimization of waveguide filters using finite element and mode-matching electromagnetic simulators." 1997 MTT-S International Microwave Symposium Digest 2. (1997 Vol. II [MWSYM]): 635-638.

For the first time, we apply aggressive space mapping to automatically align electromagnetic models based on hybrid mode-matching/network theory simulations with models based on finite-element (FEM) simulations in design optimization of microwave circuits. The parameter extraction phase of space mapping is given special attention. A statistical approach to parameter extraction involving $1/\sigma$ and penalty concepts facilitates a key requirement by space mapping for uniqueness and consistency. Electromagnetic optimization of an H-plane resonator filter with rounded corners illustrates the advantages as well as the challenges of our approach.



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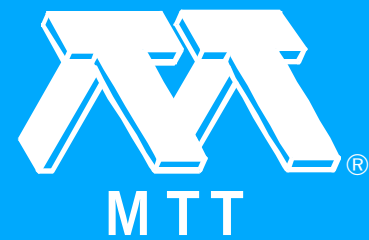


Abstracts

A new design of microwave filters by using continuously varying transmission lines

M. Le Roy, A. Perennec, S. Toutain and L.C. Calvez. "A new design of microwave filters by using continuously varying transmission lines." 1997 MTT-S International Microwave Symposium Digest 2. (1997 Vol. II [MWSYM]): 639-642.

This paper outlines a new original method for microwave filter design. A cubic spline interpolation is used to design a filter with a continuously changing profile. Then, the scattering parameters of a non-uniform transmission line with a cubic polynomial variation of its characteristic impedance are studied in detail in the frequency domain. In order to validate this method, a wideband bandstop filter consisting in a non-uniform microstrip line with continuously varying width was optimized, designed, constructed and measured.



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A procedure for the design of microwave filters based on a distributed parameter model

R. Tascone, P. Savi, D. Trinchero and R. Orta. "A procedure for the design of microwave filters based on a distributed parameter model." 1997 MTT-S International Microwave Symposium Digest 2. (1997 Vol. II [MWSYM]): 643-646.

A synthesis procedure based on a distributed parameter model for both narrow-band and broad-band microwave filters is presented. The frequency response of the filter is described in terms of the characteristic polynomial T_{21}/S_{11} where S_{11} and S_{21} are the scattering parameters of the filter. Starting from the desired polynomial T_{21} , the design scheme directly yields the scattering parameters of the various junctions and the length of the resonators. On the basis of this technique, a Chebyshev-type 8 pole E-plane filter has been designed and built. The excellent agreement between the predicted and the measured data confirm the validity of this synthesis procedure.

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Design of an electronically tunable microwave impedance transformer

J.H. Sinsky and C.R. Westgate. "Design of an electronically tunable microwave impedance transformer." 1997 MTT-S International Microwave Symposium Digest 2. (1997 Vol. II [MWSYM]): 647-650.

A new technique is introduced for designing continuously variable electronically tunable microwave impedance transformers that can be implemented using MIC or MMIC technology. An S-band tunable transformer has been built and measurements demonstrate a circuit which can transform impedances from 50 Ω to a range of 4-392 Ω . A typical transformation from 50 Ω to 162 Ω yields a measured 0.5 dB instantaneous bandwidth of 14-16%, tunable bandwidth of 18%, and insertion loss of 0.6-0.9 dB. Applications for this novel technique include the design of electronically tunable wireless components, solid state power amplifiers, microstrip antennas, and microwave modulated laser transmit/receive systems.

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Monolithic silicon-glass double balanced mixers for wireless communications

J. Putnam, M. Barter and J. Boian. "Monolithic silicon-glass double balanced mixers for wireless communications." 1997 MTT-S International Microwave Symposium Digest 2. (1997 Vol. II [MWSYM]): 653-656.

This paper describes the design, fabrication, and performance of monolithic double balanced mixers designed for cellular applications at 900 and 1800 MHz. The mixers have been fabricated using a process which combines silicon and glass to form a heterolithic microwave integrated circuit (HMIC). The glass provides a low loss substrate for RF or microwave passive structures, while the silicon pedestals embedded in the glass allow the formation of Schottky barrier diodes and vias. The resulting circuits have levels of performance similar to those of hybrid double balanced mixers, but are small, low cost, monolithic die suitable for assembly in a low cost plastic package.

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Fully monolithic integrated even harmonic quadrature ring mixer with an active matched 90 degree power divider for direct conversion receivers

K. Kawakami, K. Tajima, M. Shimosawa, K. Itoh, N. Kasai and A. Iida. "Fully monolithic integrated even harmonic quadrature ring mixer with an active matched 90 degree power divider for direct conversion receivers." 1997 MTT-S International Microwave Symposium Digest 2. (1997 Vol. II [MWSYM]): 657-660.

This paper proposes a novel circuit configuration of an even harmonic quadrature mixer for direct conversion receivers. The proposed configuration employs a ring mixer concept for wide-band reception and active matching circuits for a full integration on a small sized GaAs chip. Highly stable quadrature detecting characteristics over LO power variation can be achieved by the proposed active matched 90 degree power divider. A developed 2 GHz MMIC achieves an extremely small chip size of 1.3 mm/spl times/1.85 mm, and good quadrature detecting characteristics with amplitude error within 0.5 dB and phase error within 5 degrees from 1.7 GHz to 2.3 GHz.

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Push-pull frequency converter for mobile communication

A.V. Thangavelu, H.P. Moyer, M. Ghanevati, A.S. Daryoush and R. Gutierrez. "Push-pull frequency converter for mobile communication." 1997 MTT-S International Microwave Symposium Digest 2. (1997 Vol. II [MWSYM]): 661-664.

This paper demonstrates a push-pull self-oscillating mixer (SOM) for wireless communications at 900 MHz. Both up-conversion and down-conversion experiments are reported using this SOM. The conversion gain of the circuit is ≈ 15 dB, IP3 of -3 dBm, SFDR of 102 dB.Hz/sup 2/3/, and an average power consumption of ≈ 37 mW.

Click on title for a complete paper.



A 2 GHz subharmonic sampler for signal downconversion

A. Parssinen, R. Magoon and S.I. Long. "A 2 GHz subharmonic sampler for signal downconversion." 1997 MTT-S International Microwave Symposium Digest 2. (1997 Vol. II [MWSYM]): 665-668.

Subharmonic sampling is a discrete-time alternative for the signal downconversion problem. It can be used either to replace a traditional continuous-time mixer in a superheterodyne receiver or can be combined with other discrete-time analog signal processing blocks in novel receiver architectures. We present a 2 GHz bandwidth integrated mixer based on subharmonic sampling. The sampler uses a two-diode topology with a 3 V supply. The downconversion loss for the passive sampler is 1 dB and the total system gain 3 dB. The mixer achieves IIP3 of +16 dBm and -1 dB compression +7 dBm for a single-tone input.



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A low power GaAs front-end IC with current-reuse configuration using 0.15 μm gate MODFETs

H. Ishida, H. Koizumi, K. Miyatsuji, H. Takenaka, T. Tanaka and D. Ueda. "A low power GaAs front-end IC with current-reuse configuration using 0.15 μm gate MODFETs." 1997 MTT-S International Microwave Symposium Digest 2. (1997 Vol. II [MWSYM]): 669-672.

We have developed a novel current-reuse configuration of front-end IC, where the current can be reused in the whole circuit blocks such as low noise amplifier, local amplifier and mixer. The power dissipation is reduced by the factor of three. Excellent high frequency performance such as conversion gain of 30 dB and NF of 1.6 dB at 1.5 GHz is attained under the conditions of supply voltage and current of 3.6 V and 3 mA, respectively.

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A bi-directional quasi-optical lens amplifier (1997 Vol. II [MWSYM])

S. Hollung, J. Vian and Z.B. Popovic. "A bi-directional quasi-optical lens amplifier (1997 Vol. II [MWSYM])." 1997 MTT-S International Microwave Symposium Digest 2. (1997 Vol. II [MWSYM]): 675-678.

A 10-element bi-directional quasi-optical lens amplifier array is presented. The amplifier is designed for X-band, and operates in transmission mode. SPDT switches are used to switch between transmit and receive amplifiers. An ON/OFF ratio of 25 dB is measured for both transmitting and receiving modes with associated amplifier gains of 5 and 10 dB.

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A transmit-receive spatial amplifier array

S. Ortiz, T. Ivanov and A. Mortazawi. "A transmit-receive spatial amplifier array." 1997 MTT-S International Microwave Symposium Digest 2. (1997 Vol. II [MWSYM]): 679-682.

A transmit-receive spatial power combining amplifier array is introduced. The amplifier unit cell utilizes one antenna for both transmit and receive modes. Orthogonal ports of a microstrip patch antenna provide isolation between transmitter and receiver ports. Results from a 3/spl times/3 transmit-receive amplifier array design at 10 GHz are presented. The measured gains for transmit and receive modes were 8.2 and 6.9 dB, respectively.

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Abstracts

A terahertz grid frequency doubler (1997 Vol. II [MWSYM])

A. Moussessian, M.C. Wanke, Yongjun Li, Jung-Chih Chiao, F.A. Hegmann, S.J. Allen, T.W. Crowe and D.B. Rutledge. "A terahertz grid frequency doubler (1997 Vol. II [MWSYM])." 1997 MTT-S International Microwave Symposium Digest 2. (1997 Vol. II [MWSYM]): 683-686.

We present a 144-element terahertz quasi-optical grid frequency doubler. The grid is a planar structure with bow-tie antennas as a unit cell each loaded with a planar Schottky diode. The grid has an output power of 5.5 mW at 1 THz for 3.1-/spl mu/s, 500-GHz input pulses with a peak power of 36 W. This is the largest recorded output power for a multiplier at terahertz frequencies.



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Class F power amplifier integrated with circular sector microstrip antenna

V. Radisic, Yongxi Qian and T. Itoh. "Class F power amplifier integrated with circular sector microstrip antenna." 1997 MTT-S International Microwave Symposium Digest 2. (1997 Vol. II [MWSYM]): 687-690.

A high efficiency class F power amplifier integrated with a circular sector microstrip antenna is reported. To obtain the class F operation, the second and third harmonics are shaped through the input impedance of the antenna. At the operating frequency of 2.55 GHz, a power added efficiency of 63% is demonstrated.

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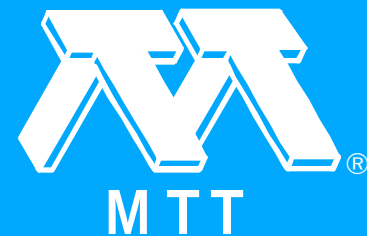


Abstracts

TE surface wave power combining by a planar 10-element active lens amplifier

A.R. Perkons and T. Itoh. "TE surface wave power combining by a planar 10-element active lens amplifier." 1997 MTT-S International Microwave Symposium Digest 2. (1997 Vol. II [MWSYM]): 691-694.

This paper presents power combining of TE surface waves in a dielectric slab by a planar active lens amplifier. An amplifier gain greater than 7 dB over a 56% bandwidth has been demonstrated. Measurements of output power versus input power and surface wave field patterns are also presented.



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Automatic frequency control techniques for microwave active filters

H. Serhan, B. Jarry and P. Guillon. "Automatic frequency control techniques for microwave active filters." 1997 MTT-S International Microwave Symposium Digest 2. (1997 Vol. II [MWSYM]): 697-700.

The paper discusses Phase Locked Loop (PLL) and Magnitude Locked Loop (MLL) techniques based on voltage controlled filter (VCF), for the automatic frequency control (AFC) of active filters. Applications to a microwave planar filter are considered. Theoretical analysis, simulated and measured results are presented for both phase and magnitude control circuits enabling the filter to accurately track a reference signal.





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Narrow X-band tunable MMIC filters employing active resonators as local feedback

F.E. van Vliet, J.L. Tauritz, F.L.M. van den Bogaart and R.G.F. Baets. "Narrow X-band tunable MMIC filters employing active resonators as local feedback." 1997 MTT-S International Microwave Symposium Digest 2. (1997 Vol. II [MWSYM]): 701-704.

Monolithic microwave active inductors have been used to realize very narrow X-band tunable filters. The active inductors were used in local feedback configurations. This results in simple structures that make optimal use of the unloaded resonator quality factor. MMIC band pass and band stop filters were designed, realized and fully characterized.

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Low-noise active recursive MMIC filters

M. Danestig, H. Johansson, A. Ouacha and S. Rudner. "Low-noise active recursive MMIC filters." 1997 MTT-S International Microwave Symposium Digest 2. (1997 Vol. II [MWSYM]): 705-708.

This paper presents a novel design technique that allows the noise figure of active recursive microwave filters to be reduced to a level approaching that of low-noise amplifiers (LNA). The measured noise figure of a MESFET-based 10 GHz first order MMIC filter is 4.3 dB, less than 1 dB higher than that of the LNA included in the filter. The filter is compared to a more conventional recursive filter with respect to noise and power behavior. A fifth-order filter with a simulated noise figure of 5 dB is also presented.

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Enhanced-Q microstrip bandpass filter with coupled negative resistors

A. Romano and R.R. Mansour. "Enhanced-Q microstrip bandpass filter with coupled negative resistors." 1997 MTT-S International Microwave Symposium Digest 2. (1997 Vol. II [MWSYM]): 709-712.

Microstrip technology offers a very compact realization of a microwave filter. Unfortunately, the losses in normal thin-films are usually so excessive that narrow-band microstrip filters are impractical. However, high-Q microstrip filters can be realized by augmenting them with active elements. This paper presents a microstrip bandpass filter with negative resistors coupled to each resonator. The negative resistors negate the losses in each resonator and yield an enhanced-Q. A new theoretical framework for this Q-enhancement technique and a design methodology are presented. The simulated and measured performance of the filter are given.

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Microstrip slow-wave open-loop resonator filters

J.S. Hong and M.J. Lancaster. "Microstrip slow-wave open-loop resonator filters." 1997 MTT-S International Microwave Symposium Digest 2. (1997 Vol. II [MWSYM]): 713-716.

Microstrip slow-wave open-loop resonators allow various filter configurations including those of elliptic or quasi-elliptic function response to be realised. The filters are not only compact in size due to the slow-wave effect, but also have a wider upper stopband resulting from the dispersion effects. These attractive features mean the microstrip slow-wave open-loop resonator filters hold promise for mobile communications, superconducting and other applications.

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Characteristics of $\lambda/4$ CPW resonators with tap-excitation and their application to bandpass filters

K. Wada, I. Awai and Y. Yamashita. "Characteristics of $\lambda/4$ CPW resonators with tap-excitation and their application to bandpass filters." 1997 MTT-S International Microwave Symposium Digest 2. (1997 Vol. II [MWSYM]): 717-720.

The basic characteristics of $\lambda/4$ coplanar waveguide (CPW) resonators are verified by a theoretical analysis using an improved equivalent circuit and a laboratory test. We propose new types of combine BPFs using these resonators and examine their transmission characteristics.

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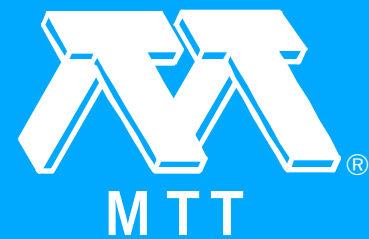
DBIT-direct backside interconnect technology: a manufacturable, bond wire free interconnect technology for microwave and millimeter wave MMICs

T.E. Kazior, H.N. Atkins, A. Fatemi, Y. Chen, F.Y. Colomb and J.P. Wendler. "DBIT-direct backside interconnect technology: a manufacturable, bond wire free interconnect technology for microwave and millimeter wave MMICs." 1997 MTT-S International Microwave Symposium Digest 2. (1997 Vol. II [MWSYM]): 723-726.

A novel, highly manufacturable, low loss interconnect technique-DBIT (Direct Backside Interconnect Technology)-is presented. Polymer bumps are used to provide RF and ground interconnects between the backside of the MMIC chip and the substrate. The RF interconnects have been characterized up to 40 GHz. Measured interconnections have a 24 GHz bandwidth with 0.05 dB insertion loss at 10 GHz. This approach eliminates wire bonds which are known to introduce significant parasitics including a variable series inductance and which constraint the design of microwave MCMs and single chip packages.

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Analysis and design of a vertical CPW transition between microstrip planes

L. Hyden, S. Hagelin, P. Starski and K. Yhland. "Analysis and design of a vertical CPW transition between microstrip planes." 1997 MTT-S International Microwave Symposium Digest 2. (1997 Vol. II [MWSYM]): 727-730.

Different types of vertical connections between microstrip lines on parallel planes have been investigated. A coplanar waveguide (CPW) is used as a vertical connection between the planes. A number of transitions between the horizontal and vertical parts of the connection as well as the influence of the solder are numerically investigated. The most promising transitions have been manufactured and measured with excellent results.

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A flip chip bonding technology using gold pillars for millimeter-wave applications

S. Aoki, H. Someta, S. Yokokawa, K. Ono, T. Hirose and Y. Ohashi. "A flip chip bonding technology using gold pillars for millimeter-wave applications." 1997 MTT-S International Microwave Symposium Digest 2. (1997 Vol. II [MWSYM]): 731-734.

This paper reports a flip chip bonding technology for a millimeter-wave monolithic integrated circuit (MIMIC) using gold micropillars with a controlled air gap instead of conventional wire bonding. We focus on their electrical performance in the W-band and their reliability against stresses expected in automotive radar applications.

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Characteristics of trenched coplanar waveguide for SiMMIC applications

Z.R. Hu, V.F. Fusco, J.A.C. Stewart, Y. Wu, H.S. Gamble, B.M. Armstrong and N.B. Buchanan. "Characteristics of trenched coplanar waveguide for SiMMIC applications." 1997 MTT-S International Microwave Symposium Digest 2. (1997 Vol. II [MWSYM]): 735-738.

A novel low loss trenched aluminium CPW transmission line structure, fabricated on a selection of high, medium and low resistivity silicon substrate materials, is reported. In comparison with conventional aluminium conductor CPW line structures, RF losses are reduced. For 10 K/spl Omega/ cm high resistivity material, this reduction may be as much as 0.5 dB/cm at 30 GHz, achieved by etching longitudinal trenches in the silicon substrate material. For medium resistivity substrates (700-1000 /spl Omega/ cm,) a 13 /spl mu/m deep trench reduces measured line loss from 3.9 dB/cm to 3.4 dB/cm at 30 GHz. For low resistivity silicon substrate material (10-20 /spl Omega/ cm), RF losses can be improved by 36 dB/cm at 30 GHz with 80 /spl mu/m deep trenches. The effect of the trench depth on the characteristic impedance of these CPW lines is reported.

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Abstracts

A novel waveguide-to-microstrip transition for low-cost millimeter-wave and MMIC applications

F.J. Villegas, D.I. Stones and H.A. Hung. "A novel waveguide-to-microstrip transition for low-cost millimeter-wave and MMIC applications." 1997 MTT-S International Microwave Symposium Digest 2. (1997 Vol. II [MWSYM]): 739-742.

A novel waveguide (w/g)-to-microstrip transition has been developed using a new design methodology based on iris coupling. The current design exhibits reduced sensitivity to w/g backshort position and yields a low-cost, hermetically-sealed transition. A 44 GHz-band design on alumina and a 94 GHz-band design on z-cut quartz were implemented, both exhibiting better than 22 dB return loss at their center frequencies with less than 0.3 dB insertion loss, with a greater than 10% bandwidth.



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A power amplifier module with harmonics suppression for digital mobile communication

H. Kayano, S. Obayashi, T. Maeda and Y. Suzuki. "A power amplifier module with harmonics suppression for digital mobile communication." 1997 MTT-S International Microwave Symposium Digest 2. (1997 Vol. II [MWSYM]): 743-746.

A 1.9 GHz miniaturized power amplifier module with a single low voltage supply of 3.0 V, which was able to suppress second and third harmonics outputs, was developed. The volume of the module is 0.039 cc (3.4/spl times/5.8/spl times/2.0 mm). Good RF performance (adjacent channel leakage power of -55.5 dBc in the 600 kHz offset band, second harmonic power of -45.0 dBc, and third harmonic power of -46.2 dBc) was observed during operation at the desired maximum output power of 19.8 dBm. This module makes it possible to produce an RF transmission section without an external filter, i.e. one having a small volume and a thin structure.

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Abstracts

Improvements to the design of the 0-180/spl deg/ rat race coupler and its application to the design of balanced mixers with high LO to RF isolation

J.L.B. Walker. "Improvements to the design of the 0-180/spl deg/ rat race coupler and its application to the design of balanced mixers with high LO to RF isolation." 1997 MTT-S International Microwave Symposium Digest 2. (1997 Vol. II [MWSYM]): 747-750.

An improved rat-race coupler is described which, in the ideal case, has a pair of ports with infinite isolation between them at all frequencies. This improved rat-race coupler is useful in such applications as the design of balanced mixers with high LO to RF isolation.



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A monolithic GaAs PIN switch network for a 77 GHz automotive collision warning radar (1997 Vol. II [MWSYM])

J. Putnam, M. Barter, K. Wood and J. LeBlanc. "A monolithic GaAs PIN switch network for a 77 GHz automotive collision warning radar (1997 Vol. II [MWSYM])." 1997 MTT-S International Microwave Symposium Digest 2. (1997 Vol. II [MWSYM]): 753-756.

This paper presents the design, fabrication, and performance of a 77 GHz monolithic GaAs PIN switch network developed for an automotive collision warning radar. The RF front end of the radar contains three control circuits which were initially realized by a hybrid approach using a duroid circuit and beam lead diodes. These three circuits were successfully integrated into a single 77 GHz MMIC. The MMIC uses vertical GaAs PIN diodes with a switching cutoff frequency of over 3000 GHz, attaining low insertion loss and high isolation. Insertion loss is comparable to that obtained with a hybrid circuit, while the isolation improved from a typical level of 16 dB for a single hybrid switch to over 25 dB in the MMIC. The use of GaAs PIN diodes also allowed switching speeds of less than 2 ns to be attained, a key requirement for the radar.



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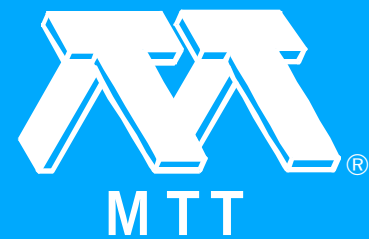
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Temperature analysis and on-chip compensation for an UHF VCO

Y. Sun, H.G. van Veenendaal and J.L. Tauritz. "Temperature analysis and on-chip compensation for an UHF VCO." 1997 MTT-S International Microwave Symposium Digest 2. (1997 Vol. II [MWSYM]): 757-760.

This paper treats the study of on-chip temperature compensation of a broad-band UHF VCO. Analysis, design and evaluation of IC oscillators are described. Excellent agreement between simulation and measurement is demonstrated. The frequency deviation drift specification over a 25/spl deg/C temperature range has been reduced to <0.5 MHz within the frequency range of 470/spl sim/930 MHz.

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Multilayer passive components for uniplanar Si/SiGe MMICs (1997 Vol. II [MWSYM])

T. Gokdemir, U. Karacaoglu, D. Budimir, S.B. Economides, A. Khalid, A.A. Rezazadeh and I.D. Robertson. "Multilayer passive components for uniplanar Si/SiGe MMICs (1997 Vol. II [MWSYM])." 1997 MTT-S International Microwave Symposium Digest 2. (1997 Vol. II [MWSYM]): 761-764.

This paper describes results for novel multilayer passive components, fabricated on silicon substrates for Si/SiGe uniplanar MMICs. Results are compared for high resistivity silicon, high resistivity silicon with an added polyimide layer, and silicon with silicon dioxide (to represent SOI bonded silicon technology). The components that have been characterized include CPW and TFMS transmission lines and couplers, inductors, capacitors, and planar transformers.

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Abstracts

Analysis of ground bond wire arrays for RFICs (1997 Vol. II [MWSYM])

H. Patterson. "Analysis of ground bond wire arrays for RFICs (1997 Vol. II [MWSYM])." 1997 MTT-S International Microwave Symposium Digest 2. (1997 Vol. II [MWSYM]): 765-768.

This paper outlines a method for rapid computation of the inductance of arrays of ground bond wires for RFICs, thus saving a designer considerable time over using inaccurate empirical equations or slowly converging electromagnetic simulators. Results comparable in accuracy to a fully derailed PEEC electromagnetic simulation are shown.



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Accurate passive component models in coplanar waveguide for 50 GHz MMICs

R. Shimon, D. Scherrer, D. Caruth, J. Middleton, H. Hsia and M. Feng. "Accurate passive component models in coplanar waveguide for 50 GHz MMICs." 1997 MTT-S International Microwave Symposium Digest 2. (1997 Vol. II [MWSYM]): 769-772.

Accurate circuit models for several passive components in coplanar waveguide have been developed. These models utilize lumped and distributed circuit elements available in computer-aided design software packages and have element values that are derived from measured S-parameter data, geometrical data and physical process parameters. This work discusses the development of the models and verifies their accuracy by comparing measured and modeled S-parameters to 50 GHz.



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Alignment tolerant stripline directional couplers

T.P. Budka and R.A. Flynt. "Alignment tolerant stripline directional couplers." 1997 MTT-S International Microwave Symposium Digest 2. (1997 Vol. II [MWSYM]): 773-776.

The design methodology for a new type of alignment tolerant, broadside coupled, stripline, directional coupler is developed. The coupler uses an even number of cascaded, asymmetric, broadside coupled line stages that are electrically short ($\leq \lambda/8$) and have been alternately inverted to achieve nearly symmetric coupling and return loss at all ports. The results demonstrate layer to layer alignment insensitivity that enables coupler designs where misalignment between layers is a critical parameter. Measured S-parameter results for 3 dB and 10 dB coupler designs are presented and agree well with theory. Coupling range variations less than 0.5 dB are achieved for a 3 dB alignment tolerant coupler design compared to 0.9 dB for a standard, symmetric 3 dB design with misalignments of ± 0.25 mm (± 0.010 "). An 8.4 dB alignment tolerant directional coupler displays a variation of 0.3 dB over the same layer to layer alignment range compared to an equivalent 10 dB standard design that has a coupling variation of 4.9 dB with similar misalignment between layers.

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Experimental study of wideband uniplanar phase inverters for MICs

Tongqing Wang, Zifei Ou and K. Wu. "Experimental study of wideband uniplanar phase inverters for MICs." 1997 MTT-S International Microwave Symposium Digest 2. (1997 Vol. II [MWSYM]): 777-780.

In this work, a class of novel uniplanar phase inverters are presented for hybrid and monolithic microwave integrated circuits (MICs). An extensive experimental study for characterizing frequency response of insertion loss and phase shift has been made. Measured results show that a CPW phase inverter with slotline transition has more than 2.3:1 bandwidth centered at 3.9 GHz with better than 1 dB insertion loss and 140/spl deg/ phase shift. A compact CPW phase inverter without slotline transition has also been developed that demonstrates better electrical performance than its counterpart with slotline transition. It shows more than 3.1:1 bandwidth centered at 3.5 GHz with better than 10.5 dB insertion loss and 140/spl deg/ phase shift. A new CPW phase inverter with triple strip line transition is proposed. It features more than 2.5:1 bandwidth centered at 6.2 GHz with better than 1 dB insertion loss and 140/spl deg/ phase shift.





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Theory on rotated excitation of a circular dual-mode resonator and filter

I. Awai and T. Yamashita. "Theory on rotated excitation of a circular dual-mode resonator and filter." 1997 MTT-S International Microwave Symposium Digest 2. (1997 Vol. II [MWSYM]): 781-784.

Analysis of a circular dual mode filter without any perturbation in the resonator itself is given, using a branch line model which is generally applicable to all where types of circular resonators. The extended theory for the structure with shunt susceptances to the external circuit is also verified by an experiment on a coplanar ring resonator.

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Design methodology for multilayer coupled line filters

C. Cho and K.C. Gupta. "Design methodology for multilayer coupled line filters." 1997 MTT-S International Microwave Symposium Digest 2. (1997 Vol. II [MWSYM]): 785-788.

This paper presents a methodology for designing asymmetric coupled line band-pass filter circuits in multilayer substrates. Filter specifications are used for deriving normal mode parameters for various asymmetric coupled sections. Method for arriving at filter dimensions is described for the embedded (homogeneous dielectric) configurations. The method developed is verified by comparison with results obtained from a full-wave electromagnetic simulation.

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Abstracts

A miniaturized monolithic dual band filter using ceramic lamination technique for dual mode portable telephones

H. Miyake, S. Kitazawa, T. Ishizaki, T. Yamada and Y. Nagatomi. "A miniaturized monolithic dual band filter using ceramic lamination technique for dual mode portable telephones." 1997 MTT-S International Microwave Symposium Digest 2. (1997 Vol. II [MWSYM]): 789-792.

A miniaturized monolithic dual band filter is developed for dual mode portable telephones. By using a ceramic lamination technique, a 1 mm-thick 900 MHz filter and a 1.9 GHz filter are fabricated and stacked to be co-fired. The performance degradation due to the thickness and the dual band matching network are discussed. An experimental filter is constructed and shows very good performance.



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Bandpass and bandstop filters using dominant $TM_{01\pi}$ mode dielectric rod resonators

Y. Kobayashi and C. Inoue. "Bandpass and bandstop filters using dominant $TM_{01\pi}$ mode dielectric rod resonators." 1997 MTT-S International Microwave Symposium Digest 2. (1997 Vol. II [MWSYM]): 793-796.

A dielectric rod resonator with the dominant $TM_{01\pi}$ mode proposed realizes a strong coupling between the resonator and a waveguide. The design is performed to obtain the best separation from the other higher modes. Bandpass and bandstop filters with excellent spurious characteristics are designed by using these resonators.



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Modeling of conductor loaded resonators and filters in rectangular enclosures

Chi Wang, Hui-Wen Yao and K.A. Zaki. "Modeling of conductor loaded resonators and filters in rectangular enclosures." 1997 MTT-S International Microwave Symposium Digest 2. (1997 Vol. II [MWSYM]): 797-800.

Full wave modeling of conductor loaded resonators in rectangular enclosures and associated coupling structure is presented. The generalized scattering matrices of the planar conductor loaded resonator in rectangular waveguide are obtained. By applying the short condition and cascading procedure, resonant frequency, field distribution of the resonator, and coupling between two cavities through an iris are obtained. The computed results are compared with the measured data and both are in good agreement. A 4-pole dual mode elliptic function filter using a planar structure cavity is designed, constructed and tested. Excellent measured frequency responses of the filter are obtained.

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Tapped-line interdigital filter equivalent circuits

C. Ernst and V. Postoyalko. "Tapped-line interdigital filter equivalent circuits." 1997 MTT-S International Microwave Symposium Digest 2. (1997 Vol. II [MWSYM]): 801-804.

An exact equivalent circuit for the tapped-line interdigital filter geometry is deduced from an exact equivalent circuit of multiple-coupled lines. For a third order filter an analytical expression of the insertion loss function was obtained and compared to the one computed from Cristal's proposed exact equivalent circuit. Cristal's circuit behaved considerably different in the stopband and in particular it does not predict the transmission zero closest to the passband.

Abstracts

The design of band-pass filters made of both dielectric and coaxial resonators

Hee-yong Hwang, Nam-sin Park, Yong-ho Cho, Sang-won Yun and Ik-soo Chang. "The design of band-pass filters made of both dielectric and coaxial resonators." 1997 MTT-S International Microwave Symposium Digest 2. (1997 Vol. II [MWSYM]): 805-808.

Two different kinds of resonators can be used to construct a microwave band-pass filter that has a low spurious response. The band-pass filter made with coaxial resonators and disk dielectric resonators shows a good spurious response.



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A monolithic active notch tunable filter based on the gyrator principle

F. Giannini, E. Limiti, G. Orenco and P. Sanzi. "A monolithic active notch tunable filter based on the gyrator principle." 1997 MTT-S International Microwave Symposium Digest 2. (1997 Vol. II [MWSYM]): 809-812.

A monolithic bandstop active tunable filter has been designed and realised. The filter is based on a gyrator-type active resonator, implemented using only three active devices. The center frequency of the realised notch filter is around 1.9 GHz, with a tuning range of more than 400 MHz. Measured performances include a typical in-band rejection of more than 30 dB all over the operating bandwidth, a stopband span of less than 50 MHz, together with input/output match better than 12 dB. Positive supply only has been employed.





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Comparative performance of three different CPW bandpass filters

Fang-Lih Lin and Ruey-Beei Wu. "Comparative performance of three different CPW bandpass filters." 1997 MTT-S International Microwave Symposium Digest 2. (1997 Vol. II [MWSYM]): 813-816.

This paper addresses the performance comparison between three kinds of coplanar waveguide bandpass filter designs: ribbon-of-brickwall, impedance transformer type; and gap-coupled filters. Several analysis models have been employed to investigate the high frequency characteristics of the three kinds of filters including the scattering parameters and the power loss. The numerical results are in good agreement with the measured data.

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Abstracts

Input harmonics control using non-linear capacitor in GaAs FET power amplifier

Kye-ik Jeon, Young-se Kwon and Song-cheol Hong. "Input harmonics control using non-linear capacitor in GaAs FET power amplifier." 1997 MTT-S International Microwave Symposium Digest 2. (1997 Vol. II [MWSYM]): 817-820.

We address the effect of gate signal distortion arising from capacitance non-linearity on the power added efficiencies of power amplifiers based on FETs. A novel method which can compensate the non-linearity of gate capacitance is proposed. The key idea is that a reversed diode is connected to the gate, where the gate and source part of a FET is simply modeled as a diode. We demonstrated this scheme with the load-pull and source-pull measurement of the circuit. A 7% increase in power added efficiency is achieved.



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Design of SAW expander and compressor on LiTaO/sub 3/ for a TCDMA spread spectrum system

L. Reindl, F. Kalabic, G. Ostermayer, A. Pohl, F. Seifert and R. Weigel. "Design of SAW expander and compressor on LiTaO/sub 3/ for a TCDMA spread spectrum system." 1997 MTT-S International Microwave Symposium Digest 2. (1997 Vol. II [MWSYM]): 821-824.

We report on the design and performance of SAW minimum-shift-keying (MSK) tapped delay lines (TDL's) using pseudonoise (PN) code sequences of length 128 chips. As a substrate, LiTaO/sub 3/-X112/spl deg/-rotY has been used due to the system requirements of a given CDMA/TDMA system (TCDMA). System IF frequency, bandwidth of the major lobe, and integration time were respectively 360 MHz, 63.5 MHz, and 3 /spl mu/s. We used SAW TDL's employing non-weighted as well as cosine-apodized input transducers incorporating split-fingers. We designed both expander as well as compressor filters attaining very similar results. We found insertion loss values down to 16 dB and amplitude ripples of less than 2 db. The close-in selectivity was 28 dB.

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Simulation of electromagnetic effects in SAW RF filters

F.M. Pitschi and J.A. Nossek. "Simulation of electromagnetic effects in SAW RF filters." 1997 MTT-S International Microwave Symposium Digest 2. (1997 Vol. II [MWSYM]): 825-828.

The characteristics of surface acoustic wave (SAW) filters are influenced by the electromagnetic properties of the immediate environment of the acoustically active structures. This paper presents a model for electromagnetic effects caused by the filter environment. Here, the filter environment comprises the setup surrounding the SAW structures, e.g., pads, bonds, pins, etc. The components, which are particularly relevant to the performance of SAW filters, are identified. Measurement and simulation are compared showing good agreement with the characteristics of the filter.



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High frequency SAW filter on diamond

K. Higaki, H. Nakahata, H. Kitabayashi, S. Fujii, K. Tanabe, Y. Seki and S. Shikata. "High frequency SAW filter on diamond." 1997 MTT-S International Microwave Symposium Digest 2. (1997 Vol. II [MWSYM]): 829-832.

Surface acoustic wave (SAW) filters based on diamond which has very high SAW velocity have been investigated. 2.5 GHz low loss narrow-band filter and 1.5 GHz IF filter were demonstrated by the SiO/sub 2//ZnO/diamond structure with zero temperature coefficient of frequency and the ZnO/diamond structure, respectively. The super-high power durability of the ZnO/diamond structure was also confirmed at 2.9 GHz. Diamond SAW filters having high velocity and high power durability, can be expected for broad applications in future high frequency communication systems.

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Abstracts

A sophisticated design procedure for a triple mode SAW filter suppressing adjacent channel interferences in digital mobile telephones

T. Yamada, K. Nishimura, T. Ishizaki and K. Ogawa. "A sophisticated design procedure for a triple mode SAW filter suppressing adjacent channel interferences in digital mobile telephones." 1997 MTT-S International Microwave Symposium Digest 2. (1997 Vol. II [MWSYM]): 833-836.

A triple mode SAW filter is practicably developed as a first mass production model. Although the basic concept had been well known, the effective design procedure has not been reported so far due to the difficulties of the analysis. The authors have developed a sophisticated design procedure for triple mode SAW filter successfully. The filter samples show excellent performances. It will be a key component for digital mobile communication systems.



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A balanced-type SAW filter for PCN and PCS systems

Y. Taguchi, S.-I. Seki, K. Onishi, O. Kawasaki and K. Eda. "A balanced-type SAW filter for PCN and PCS systems." 1997 MTT-S International Microwave Symposium Digest 2. (1997 Vol. II [MWSYM]): 837-840.

A balanced-type RF-band (1.8 GHz) SAW filter for use in PCN and PCS systems is presented. This SAW filter has balanced input and output terminals. The obtained characteristics showed excellent characteristics such as low insertion loss, enough bandwidth for PCN and PCS systems, high shape factor and high attenuation at stopbands in addition to much more flexibility than other types of SAW filter.





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1/f noise modeling of InP HBT-based Schottky diodes for monolithic millimeter-wave mixers

Y.H. Chung, K.F. Sato, C.W. Chan, E.W. Lin, P.C. Grossman, L.T. Tran, J. Cowles, H. Wang, A.K. Oki, K. Najita and M.P. DeLisio. "1/f noise modeling of InP HBT-based Schottky diodes for monolithic millimeter-wave mixers." 1997 MTT-S International Microwave Symposium Digest 2. (1997 Vol. II [MWSYM]): 841-844.

We present a procedure for modeling the low-frequency 1/f noise properties of millimeter-wave InP HBT-based Schottky diodes. These noise properties, coupled with the device's small and large-signal characteristics, enable the generation of a comprehensive diode model. The model is particularly useful for analyzing mixer and detector MMIC's. Simulations using this model compare well with W-band mixer measurements.

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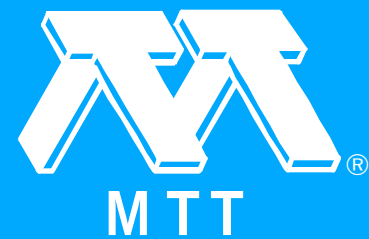


Abstracts

A theoretical and experimental study on low-voltage bias voltage controlled oscillators

Xiangdong Zhang, J. Kramer and B. Rizzi. "A theoretical and experimental study on low-voltage bias voltage controlled oscillators." 1997 MTT-S International Microwave Symposium Digest 2. (1997 Vol. II [MWSYM]): 845-848.

In this paper a theoretical and experimental study on phase noise and power performance of low-voltage Colpitts type voltage controlled oscillators (VCOs) is introduced. A phase noise analysis theory is developed to provide a clear understanding and a design approach for VCO circuits. VCOs at 2.4 GHz using 1.5 V bias have been developed to investigate the phase noise and power performance at low-voltages. The experimental results demonstrate a 10 dB improvement in phase noise, a 6 dB increase in output power, as well as a 10 dB reduction in frequency pushing in an optimum design using the theory.



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Fundamental limitations on output power and conversion loss of an even harmonic mixer in an up-conversion operation

K. Itoh, K. Tajima, K. Kawakami, O. Ishida and K. Mizuno. "Fundamental limitations on output power and conversion loss of an even harmonic mixer in an up-conversion operation." 1997 MTT-S International Microwave Symposium Digest 2. (1997 Vol. II [MWSYM]): 849-852.

An even harmonic mixer (EHM) with an antiparallel diode pair (APDP) is an effective technique for low spurious transmitters especially in millimeter-wave. The purpose of this study is to clarify general properties of the EHM in an up-conversion operation. For this purpose, fundamental formulas and universal charts are indicated in this paper. As results of the analysis, it becomes clear that output power can be increased and spurious emissions can be reduced in the case of higher LO level. Furthermore conversion loss limitation of 3.9 dB is indicated for the EHM with a resistive termination. Measured results indicate good agreements with presented formulas.

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On the performance of different HEMT cryogenic mixers

I. Angelov, M. Garcia and H. Zirath. "On the performance of different HEMT cryogenic mixers." 1997 MTT-S International Microwave Symposium Digest 2. (1997 Vol. II [MWSYM]): 853-856.

Performance of different HEMT mixers -i.e. gate, drain and resistive (microstrip and waveguide) has been studied experimentally at room and cryogenic temperatures. Conversion gain (loss for the resistive mixers) at cryogenic temperatures improves approximately 1/spl divide/1.5 dB. The noise figure improves too - all the mixers show 2-3 dB improvement in the noise figure performance.

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A simplified method to predict the conversion loss of FET resistive mixers

S. Peng. "A simplified method to predict the conversion loss of FET resistive mixers." 1997 MTT-S International Microwave Symposium Digest 2. (1997 Vol. II [MWSYM]): 857-860.

In FET resistive mixers, FET behaves like a switch when LO signal excites the gate terminal. By modeling the on-state conductance of the FET as a linear function of the gate voltage, we are able to analytically evaluate the conversion loss of the mixers by a simple Fourier transform. We have applied this method to calculate the conversion loss of an NE71000 MESFET and an NE32400 HFET resistive mixers at X-band, and compared with measured data. Excellent agreement was obtained in each case. The advantage of this method is apparent: good predictions of the conversion loss of FET resistive mixers can be quickly obtained without using sophisticated nonlinear device model and Harmonic-Balance circuit simulator.

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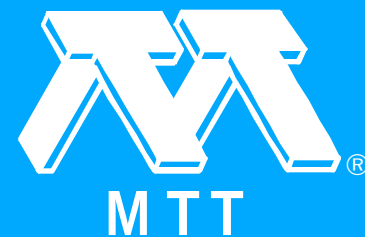


Abstracts

Transistor parameter extraction using DC, S-parameter and noise data simultaneously

Q. Cai, J. Gerber, T. Daniel and U.L. Rohde. "Transistor parameter extraction using DC, S-parameter and noise data simultaneously." 1997 MTT-S International Microwave Symposium Digest 2. (1997 Vol. II [MWSYM]): 861-864.

This paper presents, for the first time, an integrated method for transistor model parameter extraction by fitting the DC, multi-bias S-parameter and noise measurements simultaneously. The extracted model provides accurate small-signal, large-signal and noise characteristics. This technique is demonstrated for a Raytheon foundry HBT and excellent results are obtained. Self-heating effects are taken into consideration in the parameter extraction procedure.



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Improvements on a MOSFET model for non-linear RF simulations

C.E. Biber, M.L. Schmatz and T. Morf. "Improvements on a MOSFET model for non-linear RF simulations." 1997 MTT-S International Microwave Symposium Digest 2. (1997 Vol. II [MWSYM]): 865-868.

As the gate lengths of silicon MOSFETs become smaller and smaller, these devices are usable to frequencies in the GHz range. The non-linear MOSFET model presented in this paper is based on S-parameter measurements over a large bias range and has been implemented in a SPICE simulator. The improvements consist of new equations for the non-linear capacitances and output conductance of the MOS transistor. This new large signal model shows very good agreement between measurement and simulation up to 10 GHz.

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Abstracts

A distributed, measurement based, nonlinear model of FETs for high frequencies applications

B. Mallet-Guy, Z. Ouarch, M. Prigent, R. Quere and J. Obregon. "A distributed, measurement based, nonlinear model of FETs for high frequencies applications." 1997 MTT-S International Microwave Symposium Digest 2. (1997 Vol. II [MWSYM]): 869-872.

For the first time, a FET nonlinear model, distributed along the gate length and extracted from pulsed I(V) and pulsed S-parameters measurements is presented. This model has led to a better prediction of power saturation mechanism and offers promising perspectives for intermodulation and nonlinear noise modeling at high microwave frequencies.



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Novel method for determination of junction-FET access resistances

K. Osgood and A. Parker. "Novel method for determination of junction-FET access resistances." 1997 MTT-S International Microwave Symposium Digest 2. (1997 Vol. II [MWSYM]): 873-876.

A new method for extracting JFET access resistances, which does not need to consider the intrinsic channel resistance of the device, is presented. The method uses an impedance data set measured over a range of bias points. The data set is reduced to those points with reciprocal impedance matrices and appropriate bias conditions. The extraction procedure is ideal for automated device characterisation.

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Abstracts

Nonlinear modelling of SiGe HBTs up to 50 GHz

C. Rheinfelder, M. Rudolph, F. Beisswanger and W. Heinrich. "Nonlinear modelling of SiGe HBTs up to 50 GHz." 1997 MTT-S International Microwave Symposium Digest 2. (1997 Vol. II [MWSYM]): 877-880.

A new large-signal model for SiGe HBTs is presented that includes nonideal leakage currents, Kirk-effect, and thermal behavior. The parameters are extracted from measurements using a special procedure. The model yields excellent accuracy for DC and S parameters up to 50 GHz. It proved its usefulness in MMIC oscillator design.



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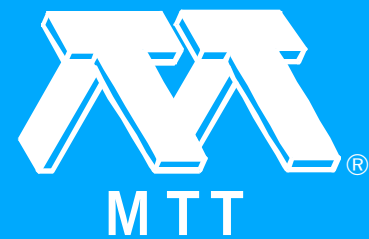
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A bias dependent HEMT noise model

L. Klapproth, A. Schaefer and G. Boeck. "A bias dependent HEMT noise model." 1997 MTT-S International Microwave Symposium Digest 2. (1997 Vol. II [MWSYM]): 881-884.

We present a model to describe the noise performance of HEMTs in dependence of the applied gate and drain voltages. The model is based on two uncorrelated noise sources at the intrinsic transistor. Temperatures related to resistors in the intrinsic transistor model are used to model the noise behavior of the device. By using the correlation matrix technique the parameters are extracted from noise parameter measurements in a straightforward manner.

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Design procedures for millimetre wave MMIC voltage controlled oscillators [using pHEMTs]

P.J. Garner, M.J. Howes and C.M. Snowden. "Design procedures for millimetre wave MMIC voltage controlled oscillators [using pHEMTs]." 1997 MTT-S International Microwave Symposium Digest 2. (1997 Vol. II [MWSYM]): 885-888.

A design procedure for millimetre wave MMIC VCOs is presented. The design uses a hierarchical breakdown of the sections of the oscillator and highlights components that should remain fixed and components which can be used to vary the oscillator performance. The method also demonstrates the use of contours of the simulated small signal conductance which are shown to be an excellent starting point for the design.

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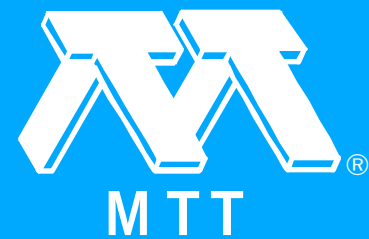


Abstracts

A flip-chip high efficiency X-band HPA

P. Cameron, W. Pan, C. Hanz, R. Nicklaus, P. Chu, D. Wong and T. Cisco. "A flip-chip high efficiency X-band HPA." 1997 MTT-S International Microwave Symposium Digest 2. (1997 Vol. II [MWSYM]): 889-892.

We have developed a broad band, high efficiency, X-band MMIC HPA implemented with our flip-chip technology. The amplifier utilizes PHEMT devices to achieve better than 35% PAE (40% peak) with an associated five watts of output power. The flip-chip technology reduces cost while at the same time increases performance. To our knowledge, this is the first reported flip-chip HPA that uses PHEMT devices.



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First demonstration of a 0.5 W, 2 to 8 GHz MMIC HBT distributed power amplifier based on a large signal design approach

J.P. Viaud, M. Lajugie, R. Quere and J. Obregon. "First demonstration of a 0.5 W, 2 to 8 GHz MMIC HBT distributed power amplifier based on a large signal design approach." 1997 MTT-S International Microwave Symposium Digest 2. (1997 Vol. II [MWSYM]): 893-896.

In this paper we report the results of the first demonstration of a 0.5 Watt, 2 to 8 GHz MMIC HBT distributed power amplifier optimised with a new design methodology. Initially developed for MESFET transistors, this new design methodology has been applied to HBT devices to obtain simultaneously both high power and high efficiency operation. Thus, a power density performance greater than 1 W/mm has been demonstrated compared to the MESFET where a typical value of 0.35 W/mm can be observed. Moreover, an average value of 20% power added efficiency between 2 and 8 GHz has been measured with a peak efficiency of 30% at 3 GHz.



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Robust cascode HBTs for efficient high power microwave applications

M. Salib and B. Bayraktaroglu. "Robust cascode HBTs for efficient high power microwave applications." 1997 MTT-S International Microwave Symposium Digest 2. (1997 Vol. II [MWSYM]): 897-900.

A new cascode HBT design was developed to overcome the thermal instability of high power HBTs without using ballast resistors. Thermally-stabilized cascode HBTs (TSC-HBTs) achieved unconditional thermal stability under dc bias as well as under high RF drive with large output mismatch conditions. Various cell sizes were developed for X/Ku-band applications to produce 0.25 W to 1.0 W output power with high power-added efficiency (70% at 8 GHz) and high power gain (>20 dB at 14 GHz).

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Transfer characteristic of IM/sub 3/ relative phase for a GaAs FET amplifier (1997 Vol. II [MWSYM])

N. Suematsu, T. Shigematsu, Y. Iyama and O. Ishida. "Transfer characteristic of IM/sub 3/ relative phase for a GaAs FET amplifier (1997 Vol. II [MWSYM])." 1997 MTT-S International Microwave Symposium Digest 2. (1997 Vol. II [MWSYM]): 901-904.

Measured transfer characteristic of relative phase of the third order intermodulation distortion (IM/sub 3/) of a GaAs FET amplifier is described. The measurement system and method are also described. For drives in the weakly nonlinear region, the measured relative phase of IM/sub 3/ is equal to that of carriers, and agrees with the analysis result based on Volterra-series representation. For drives in the saturation region, the measured relative phase of IM/sub 3/ versus the input power is larger than that of carrier's relative phase. The measured results and the measurement method are useful for the design and adjustment of predistortion type linearizer for GaAs FET high power amplifiers.

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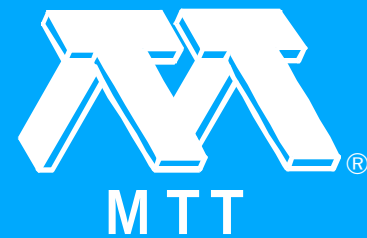


Abstracts

Pulsed internal-node waveform study of flip-chip MMIC power amplifiers

J.W. Bao, C.J. Wei, J.C.M. Hwang, R.F. Wang and C.P. Wen. "Pulsed internal-node waveform study of flip-chip MMIC power amplifiers." 1997 MTT-S International Microwave Symposium Digest 2. (1997 Vol. II [MWSYM]): 905-908.

A pulsed internal-node microwave waveform probing technique was developed and used to characterize flip-chip MMIC power amplifiers. Variations in load impedances were found across the band and different unit cells.



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Measurement of dynamic load lines of power heterojunction bipolar transistor

S. Ohara, Y. Nakasha, T. Iwai and K. Joshin. "Measurement of dynamic load lines of power heterojunction bipolar transistor." 1997 MTT-S International Microwave Symposium Digest 2. (1997 Vol. II [MWSYM]): 909-912.

Dynamic load lines of InGaP/GaAs Heterojunction Bipolar Transistors (HBTs) were experimentally measured with a load circuit tuned to maximum collector efficiency (η_{spl} and maximum gain. The phase relationship between the collector voltage and the collector current depended on the load circuit. The trajectory of the dynamic load line has a non-oval shape for the output power where gain compression heavily occurs.

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Abstracts

A theory of distributed amplifiers exploiting growing waves

M. Farina and T. Rozzi. "A theory of distributed amplifiers exploiting growing waves." 1997 MTT-S International Microwave Symposium Digest 2. (1997 Vol. II [MWSYM]): 913-918.

Providing a discussion of the basic mechanisms of mode coupling and positive feed-back along FET electrodes, we propose some possible applications of the growing waves phenomena to distributed (continuous and discrete) amplifier design.



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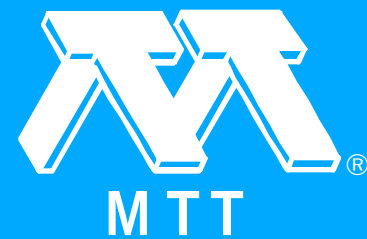


Abstracts

Low noise direct detector at submillimeter wavelength using SIS junction [Nb/AlO/sub x//Nb]

A. Karpov, J. Blondel, M. Voss and K.H. Gundlach. "Low noise direct detector at submillimeter wavelength using SIS junction [Nb/AlO/sub x//Nb]." 1997 MTT-S International Microwave Symposium Digest 2. (1997 Vol. II [MWSYM]): 919-920.

We have demonstrated the feasibility of a broad band SIS direct detector with a bandwidth up to 70 GHz around 330 GHz. The SIS detector responsivity approaches the quantum limit. The optical noise of 13 mK/spl radic/s measured with the new direct detector receiver is close to the noise of bolometer receiver developed for radioastronomy at the same wavelength. The SIS direct detector works at 4.5 K instead of 0.1-0.3 K required for bolometer receiver.



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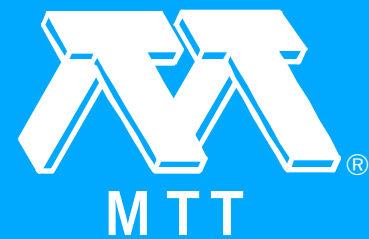
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A new hybrid technology for millimeter-wave integrated circuits

A.V. Chenakin, A.E. Martynyuk and V.I. Skachko. "A new hybrid technology for millimeter-wave integrated circuits." 1997 MTT-S International Microwave Symposium Digest 2. (1997 Vol. II [MWSYM]): 921-924.

This paper presents an original hybrid technology for the production of millimeter-wave integrated circuits which does not require the use of a dielectric substrate as a principal element of the integrated circuit. We propose using a relatively thick perforated plate as a substrate. Thin metal-dielectric structure is deposited on the substrate surface to form effective wide-band bias circuits. This approach permits the realization of the high parameters of the modern solid state devices due both to the extremely low-loss in the matching and bias circuits as well as to the effective heat removal from the solid state devices. The advantages and application of this technology are also described.

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Air bridge based planar hybrid technology for microwave and millimeterwave applications

E. Wasige, G. Kompa, F. vanRaay, I.W. Rangelow, W. Scholz, F. Shi, R. Kassing, R. Meyer and M.-C. Amann. "Air bridge based planar hybrid technology for microwave and millimeterwave applications." 1997 MTT-S International Microwave Symposium Digest 2. (1997 Vol. II [MWSYM]): 925-928.

A new silicon based, planar hybrid technology is being developed to address limitations associated with packaging and interconnections. The approach combines the advantages of both hybrid and monolithic technologies. Microwave transistor chips (GaAs FETs) are integrated in high resistivity silicon substrates with a vertical precision of better than 2 μm and lateral tolerances less than 10 μm . Air bridge technology and thin film techniques are then used to provide the necessary interconnections. The basic features of the proposed technology are presented here.

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Abstracts

Low power, tunable active inductor and its applications to monolithic VCO and BPF

Jin-Su Ko and Kwyro Lee. "Low power, tunable active inductor and its applications to monolithic VCO and BPF." 1997 MTT-S International Microwave Symposium Digest 2. (1997 Vol. II [MWSYM]): 929-932.

A novel tunable active inductor for low power operation is presented. The DC power consumption of the proposed scheme is about 1/3 of conventional one with wider range of tunability and higher Q. The new bias scheme using the parallel and the series bias resistors reduces the number of bias pins and stabilizes the bias, effectively. This novel low power tunable active inductor is applied to wideband (35% tuning ratio) monolithic VCO and wide tunable (14% tuning ratio) monolithic BPF.



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Abstracts

A low loss, 5.5 GHz-20 GHz monolithic balun

M.N. Tutt, H.Q. Tserng and A. Ketterson. "A low loss, 5.5 GHz-20 GHz monolithic balun." 1997 MTT-S International Microwave Symposium Digest 2. (1997 Vol. II [MWSYM]): 933-936.

A low-loss monolithic Marchand balun has been designed and fabricated using polyimide as the inter-metal dielectric. The measured return loss is less than -10 dB from 5.5 GHz to 28 GHz. The balun loss is less than 0.7 dB over the 6 GHz to 21 GHz operating band. This is the lowest loss ever reported for such a balun. The excellent loss is the result of using a relatively thick polyimide layer (10 /spl mu/m) as the inter-metal dielectric. This balun has been applied to HBT and pHEMT amplifiers with second harmonic components suppressed >40 dB, even in compression, demonstrating very good push-pull operation.



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InP MMICs for V-band FMCW radar

K. Sasaki, J. Utsu, K. Matsugatani, K. Hoshino, T. Taguchi and Y. Ueno. "InP MMICs for V-band FMCW radar." 1997 MTT-S International Microwave Symposium Digest 2. (1997 Vol. II [MWSYM]): 937-940.

We have developed InP based MMICs for V-band frequency modulated continuous wave (FMCW) radar. For the transistor of these MMICs, we used the InAlAs/InGaAs on InP pseudomorphic high electron mobility transistor (HEMT) with a 0.5 μm gate length. Because of the high electron mobility and the high sheet charge density, the HEMT performed with sufficient output power gain in the millimeter-wave frequency range. Millimeter-wave circuitry consists of four kinds of MMIC chips; 30 GHz voltage controlled oscillator (VCO), 30/60 GHz frequency doubler, 60 GHz amplifier and 60 GHz single-balanced mixer. We carried out a prototype experiment of radar transceiver utilizing these MMICs and confirmed FMCW radar operation.

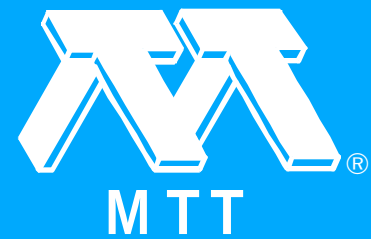


Abstracts

MMIC tunable bandpass filter using a ring resonator with loss compensation

D.K. Paul, M. Michael and K. Konstantinou. "MMIC tunable bandpass filter using a ring resonator with loss compensation." 1997 MTT-S International Microwave Symposium Digest 2. (1997 Vol. II [MWSYM]): 941-944.

Ring resonators incorporating negative resistance circuits for loss compensation are studied for use as high Q tunable MMIC resonators. The design of a 13 GHz MMIC bandpass filter together with a background theoretical analysis, are presented. Simulation results indicate unloaded Q-factors of 1000 over 1 GHz tuning bandwidth.



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CMOS layout and bias optimization for RF IC design applications

Cheon Soo Kim, Hyun Kyu Yu, Hanjin Cho, Seonghearn Lee and Kee Soo Nam. "CMOS layout and bias optimization for RF IC design applications." 1997 MTT-S International Microwave Symposium Digest 2. (1997 Vol. II [MWSYM]): 945-948.

High frequency and low noise performance of 0.8 μm polysilicon gate CMOS device has been analyzed intensively with the various multi-finger polysilicon gate layout and bias to find the optimal condition. From the analysis, the optimal width of unit gate finger and bias condition have been found to maximize $f_{\text{sub max}}$ and minimize $F_{\text{sub min}}$. At the conditions, $F_{\text{sub min}}$, gain and noise resistance characteristics of large width transistors are also analyzed.



Power performance of thermally-shunted heterojunction bipolar transistors

T. Jenkins, C. Bozada, C. Cerny, G. DeSalvo, R. Dettmer, J. Ebel, J. Gillespie, C. Havasy, L. Kehias, K. Nakano, C. Pettiford, T. Quach, J. Sewell, D. Via and R. Anholt. "Power performance of thermally-shunted heterojunction bipolar transistors." 1997 MTT-S International Microwave Symposium Digest 2. (1997 Vol. II [MWSYM]): 949-952.

The effects of layout and thermal shunt configuration on output power, efficiency, and gain of thermally-shunted AlGaAs/GaAs HBT's were investigated. A maximum power density of 16 mW/spl mu/m/sup 2/ at 10 GHz (CW) was observed. The power gain and power-added efficiency (PAE) at this power density were 7.8 dB and 65%, respectively.





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The development of planar Schottky diode waveguide mixers at submillimeter wavelengths

J.L. Hesler, T.W. Crowe, W.L. Bishop, R.M. Weikle, R.F. Bradley and Shing-Kuo Pan. "The development of planar Schottky diode waveguide mixers at submillimeter wavelengths." 1997 MTT-S International Microwave Symposium Digest 2. (1997 Vol. II [MWSYM]): 953-956.

This paper reports on progress towards state-of-the-art submillimeter wavelength waveguide mixers using planar Schottky barrier diodes. A double-sideband system noise temperature of 2380 K was measured at 585 GHz with 1.2 mW of local oscillator power using a fixed tuned mixer in which the diode is mounted in a microstrip channel. A system noise temperature of 2550 K was measured with 1.1 mW of LO power using a mixer in which the diode was mounted in a waveguide in front of a tunable backshort. These represent the best planar diode mixer results in this frequency range. Simulations indicate an IF bandwidth in excess of 100% and an RF bandwidth of 40% are achievable using the fixed tuned mixer block design.

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A high power 270 GHz frequency tripler featuring a Schottky diode parallel pair

J. Thornton, C.M. Mann and P. de Maagt. "A high power 270 GHz frequency tripler featuring a Schottky diode parallel pair." 1997 MTT-S International Microwave Symposium Digest 2. (1997 Vol. II [MWSYM]): 957-958.

A high output power millimetre wave frequency tripler is reported. Important features of the diode mount include a planar waveguide probe which facilitates the parallel combination of two Schottky varactor diodes and provides them with a more ideal embedding impedance. This approach allows for higher power production and handling ability than a similar device using a single diode. Maximum output power at 271 GHz is 15 mW with a flange to flange efficiency of /spl ap/5%.

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A mm-wave tapered slot antenna with improved radiation pattern

S. Sugawara, Y. Maita, K. Adachi, K. Mori and K. Mizuno. "A mm-wave tapered slot antenna with improved radiation pattern." 1997 MTT-S International Microwave Symposium Digest 2. (1997 Vol. II [MWSYM]): 959-962.

We have proposed a new configuration of Tapered Slot Antenna (TSA) with an improved radiation pattern. The new design has a tapered section expressed by the Fermi-Dirac distribution function. At 60 GHz, the H-plane side lobe level of the antenna is 5-dB lower than that of conventional TSA's such as Linearly Tapered Slot Antennas. We also present a new technique for reducing the width of a TSA without degradation of radiation pattern.

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Power generation of millimeter-wave SiC avalanche transit time oscillator at high temperature

C.C. Meng and G.Z. Liao. "Power generation of millimeter-wave SiC avalanche transit time oscillator at high temperature." 1997 MTT-S International Microwave Symposium Digest 2. (1997 Vol. II [MWSYM]): 963-966.

For the first time, millimeter-wave SiC (Silicon Carbide) IMPATT oscillator was analyzed at 500 K and 800 K with temperature dependent ionization rates and saturation velocity. The large signal simulations demonstrate the fact that SiC IMPATT devices have efficiency and power advantage over Si and GaAs IMPATT devices at millimeter-wave frequencies. The efficiencies (and d.c. power density) at 800 K for depletion widths of 0.25 μm (200 GHz), 0.5 μm (100 GHz) and 1 μm (50 GHz) are 12.4% (6.7 MW/cm²), 15% (4.5 MW/cm²) and 15.8% (3.3 MW/cm²), respectively, for p⁺/n single-drift flat-profile structures.

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Abstracts

30 GHz GaAs monolithic low noise amplifier-antennas

L. Roy. "30 GHz GaAs monolithic low noise amplifier-antennas." 1997 MTT-S International Microwave Symposium Digest 2. (1997 Vol. II [MWSYM]): 967-970.

This paper describes the design and performance of 30 GHz low noise amplifiers (LNAs) integrated with slot antennas on GaAs monolithic microwave integrated circuits (MMICs). Various designs are compared, showing the tradeoffs between achievable noise figure, gain and overall chip size. The smallest chip size, measuring 8.6 mm/sup 2/, would provide a 2.1 dB noise figure with 9.5 dB associated gain.



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Abstracts

A low cost W-band multi-beam Doppler radar for automotive applications

R.H. Rasshofer and E.M. Biebl. "A low cost W-band multi-beam Doppler radar for automotive applications." 1997 MTT-S International Microwave Symposium Digest 2. (1997 Vol. II [MWSYM]): 971-974.

For automotive millimeter wave applications, SIMMWIC technology provides a low cost alternative to conventional GaAs MMICs. In this paper, we present a 76 GHz radar system adopting the classic principle of multi-beam Doppler navigation systems for automotive applications. Exclusively low cost SIMMWIC components have been employed in the millimeter wave front-end.



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Abstracts

A three-dimensional active antenna for a high-speed wireless communication application

T. Seki, K. Uehara and K. Kagoshima. "A three-dimensional active antenna for a high-speed wireless communication application." 1997 MTT-S International Microwave Symposium Digest 2. (1997 Vol. II [MWSYM]): 975-978.

This paper proposes a three-dimensional active antenna configuration for a front-end module of a high-speed wireless communication system at millimeter and quasi-millimeter-wave frequencies. The active antenna is integrated with a microstrip antenna array on multilayer alumina-ceramic, individual MMIC chips including transmit/receive amplifiers, time division duplex switches, and a filter on multilayer polyimide. The three-dimensional structure achieves an unrestricted RF-circuit design on multilayer polyimide.



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Abstracts

Optimization of RF (MMIC)/optical subcarrier multiplexed communications system

S. Han, R. Gaudino, M. Shell, J. Laskar and D.J. Blumenthal. "Optimization of RF (MMIC)/optical subcarrier multiplexed communications system." 1997 MTT-S International Microwave Symposium Digest 2. (1997 Vol. II [MWSYM]): 979-982.

An accurate simulation model which provides an effective method of optimizing an optical subcarrier multiplexed (OSCM) communication network is developed and experimentally demonstrated. Effects of MMIC insertion and two types of header receiver schemes are studied, and the initial performance of MMIC components are presented.



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Printed microwave couplers with thermal isolation

R.A. Brown, P. Ensaf, T. Marshall, M. Piket-May, B. Popovic and Z. Popovic. "Printed microwave couplers with thermal isolation." 1997 MTT-S International Microwave Symposium Digest 2. (1997 Vol. II [MWSYM]): 983-986.

This paper discusses design principles and measurements for three printed microwave couplers designed for thermal isolation. These couplers are intended to minimize heat leakage when used as connectors to a cryostat, thereby maintaining the low temperature for a longer period of time. The first coupler is designed for L-band operation and exhibits a 10 dB return loss and 2 dB insertion loss. The second design operates in the cellular band with a maximum return loss of 28 dB and insertion loss less than 0.5 dB. Simple thermal modeling suggests significant improvements over standard coaxial connections. The third coupler is designed for X-band with a 15.6 dB return loss and a measured insertion loss of a few tenths of a dB at 10 GHz.

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Abstracts

Advantages of flip chip technology in millimeter-wave packaging

T. Krems, W.H. Haydl, H. Massler and J. Rudiger. "Advantages of flip chip technology in millimeter-wave packaging." 1997 MTT-S International Microwave Symposium Digest 2. (1997 Vol. II [MWSYM]): 987-990.

Power leakage into surface waves in monolithically integrated millimeter-wave circuits is to a great extent determined by the applied packaging technology. In this presentation it is shown that properly designed flip chip packages will not suffer from surface wave leakage. Coplanar waveguides on GaAs substrates are used to demonstrate the decisive differences in the leakage behavior of flip chip mounted MMICs and more conventional MMW packages, featuring surface mounted MMICs connected by wire bonds. All results are based on full wave spectral domain analysis and measurement data in the frequency range from 10 to 120 GHz.



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Integral microwave circulators for multi-chip module (MCM) applications

V. Krishnamurthy, B. Whitmore and K. Paik. "Integral microwave circulators for multi-chip module (MCM) applications." 1997 MTT-S International Microwave Symposium Digest 2. (1997 Vol. II [MWSYM]): 1829-1832.

The integration of passive components into multichip modules (MCM) provides a path for reducing the size and cost of microwave modules while minimizing interconnect parasitics. One passive component which is frequently used in transmit/receive modules of active phased array systems is the circulator. In this paper, an S-band Y-junction circulator was integrated into a MCM using High Density Interconnect (HDI) technology. HDI is a chips first approach where ICs are placed in cavities formed in a ceramic or plastic substrate. An interconnect layer is formed above the ICs, vias are used to make contact with the pads of the IC and Ti/Cu/Ti metalization is used to form the multi-layer interconnect. The S-band circulator fabricated in HDI displayed excellent electrical characteristics while minimizing losses incurred when a circulator is interconnected to a microwave module.

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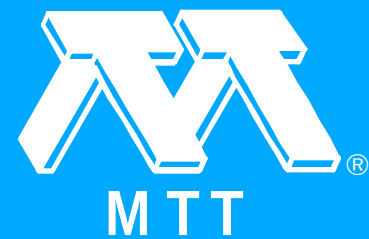
Microwave Si power transistor with monolithically fabricated impedance matching circuits

Ping Li, C. Luck, E. Soshea, R. Perko, T. Boles, P. Noonan and D. Haggis. "Microwave Si power transistor with monolithically fabricated impedance matching circuits." 1997 MTT-S International Microwave Symposium Digest 2. (1997 Vol. II [MWSYM]): 991-994.

A new technology is demonstrated for microwave Si power transistor manufacturing. Based on flip-chip technology and M/A-COM's glass based technology, impedance matching circuits in microwave Si power transistor can be fabricated monolithically using standard thin film processes. Thus, the high manufacturing cost for microwave Si power transistors, primarily associated with the package and assembly, can be substantially reduced. 1.88 GHz Si power transistors were fabricated using the new technology. In CW common emitter operation mode, 5 W of output power is obtained with 11 dB gain and 39% power added efficiency, at $V_{cc}=25$ V and $I_{cq}=25$ mA.

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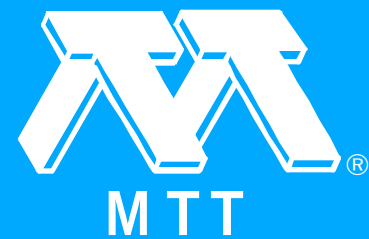
Surface mount microwave package characterization technique

A. Pham, C. Chun, J. Laskar and B. Hutchison. "Surface mount microwave package characterization technique." 1997 MTT-S International Microwave Symposium Digest 2. (1997 Vol. II [MWSYM]): 995-998.

We present a plastic package characterization technique using coplanar waveguide to package adapters (CPA) and line-reflect-match (LRM) calibrations. LRM calibrations on off-set CPA standards are employed to de-embed the response of CPA adapters in measured S-parameters. A variety of small shrink outline packages (SSOP) has been characterized to 26.5 GHz using this technique.

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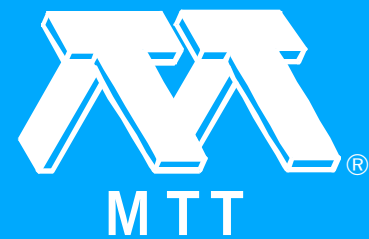
Miniature LTCC filters for digital receivers

A. Bailey, W. Foley, M. Hageman, C. Murray, A. Piloto, K. Sparks and K. Zaki. "Miniature LTCC filters for digital receivers." 1997 MTT-S International Microwave Symposium Digest 2. (1997 Vol. II [MWSYM]): 999-1002.

The integration of high quality narrow band pass filters into the low power RF system of advanced radar digital receivers is demonstrated by Low Temperature Cofired Ceramic (LTCC) technology. Using computer aided design, simulations, and yield analysis, strip line LTCC filters were designed with 100% yield to tolerances in materials and manufacturing processes. LTCC materials technology and processes used in the filter development is presented. Sample results of measured filter performances under extreme temperature cycling conditions are presented which demonstrate the excellent potential of the LTCC filter technology.

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Characteristics of finite ground coplanar waveguide lumped elements

G.E. Ponchak and L.P.B. Katehi. "Characteristics of finite ground coplanar waveguide lumped elements." 1997 MTT-S International Microwave Symposium Digest 2. (1997 Vol. II [MWSYM]): 1003-1007.

This paper presents the measured characteristics of lumped elements in coplanar waveguide with narrow width ground planes. It is shown for the first time that lumped elements may be placed in the ground planes of the Finite Ground Coplanar (FGC) waveguide to obtain enhanced electrical characteristics.

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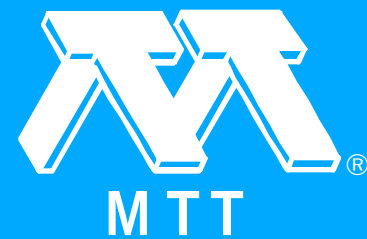


Abstracts

A fast and rigorous synthesis procedure for (monolithic) millimeterwave integrated circuit layout

M.O. Thieme and E.M. Biebl. "A fast and rigorous synthesis procedure for (monolithic) millimeterwave integrated circuit layout." 1997 MTT-S International Microwave Symposium Digest 2. (1997 Vol. II [MWSYM]): 1009-1012.

A new versatile and efficient procedure for designing (monolithic) millimeterwave integrated circuits is presented. It is based on a novel supergrid method (SGM). The advantage of this new method is the integration of a MoM simulation and a simplex optimization scheme, which saves 80% of computation time and up to 90% of computer memory. Thus, workstations and PCs instead of supercomputers can be used for the synthesis of complex millimeterwave integrated circuit and antenna layouts. To demonstrate the capability of the method, a novel circularly polarized (CP) integrated W-band detector antenna was designed and experimentally characterized.



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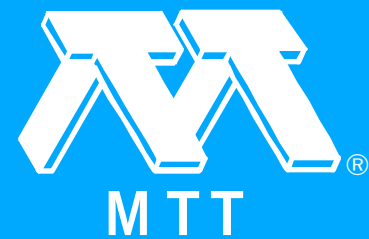


Abstracts

Rigorous and efficient fabrication-oriented CAD and optimization of complex waveguide networks (1997 Vol. II [MWSYM])

F. Alessandri, M. Dionigi, R. Sorrentino and L. Tarricone. "Rigorous and efficient fabrication-oriented CAD and optimization of complex waveguide networks (1997 Vol. II [MWSYM])." 1997 MTT-S International Microwave Symposium Digest 2. (1997 Vol. II [MWSYM]): 1013-1016.

A sophisticated CAD and optimization tool of complex microwave networks, incorporating fabrication and realizability constraints has been developed. Rigorous full wave models based on the mode matching technique are adopted along with specific algorithms to speed up both the analysis and optimization of the entire microwave structure. A beam-forming Butler matrix in waveguide technology characterized by 238 geometrical parameters has been designed and globally optimized. The full wave analysis required less than 1 second per frequency point, while the entire optimization was performed in less than one hour, using an IBM RS6000 250T.



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A unified approach for mixed EM and circuit simulation using model-reduction techniques

R. Achar, M.A. Kolbehdari and M. Nakhla. "A unified approach for mixed EM and circuit simulation using model-reduction techniques." 1997 MTT-S International Microwave Symposium Digest 2. (1997 Vol. II [MWSYM]): 1017-1020.

With the continually increasing operating speeds, the boundary between EM problems and general circuit designs is narrowing rapidly. There is a great demand for efficiently combining EM solutions with general purpose circuit simulators such as SPICE. In this paper we present a novel and a unified approach based on model-reduction techniques to combine EM formulations such as FEM, directly into general purpose circuit simulators. The method is two to three order faster than the previously published methods and is suitable for simulating large number of electromagnetic devices in a general circuit environment consisting of lumped/distributed circuit elements and nonlinear terminations.

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Abstracts

Coupled localized and distributed elements analysis applying an electromagnetic software in the frequency domain

D. Baillargeat, E. Larique, S. Verdeyme, M. Aubourg, R. Sommet and P. Guillon. "Coupled localized and distributed elements analysis applying an electromagnetic software in the frequency domain." 1997 MTT-S International Microwave Symposium Digest 2. (1997 Vol. II [MWSYM]): 1021-1024.

A coupled localized and distributed elements analysis applying the F.E.M. in the frequency domain is described. First, two studies concerning a two port network and a gunn diode amplifier, are performed to prove with success the efficiency of our method. Then the main objective of this paper is to present an electromagnetic analysis of the passive area of a transistor (FET) taking into account all its physical and geometrical characteristics. Theoretical and experimental results are compared and they show encouraging agreement.



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New formulae for the initial design in the optimization of T-junction manifold multiplexers

A. Morini, T. Rozzi and M. Morelli. "New formulae for the initial design in the optimization of T-junction manifold multiplexers." 1997 MTT-S International Microwave Symposium Digest 2. (1997 Vol. II [MWSYM]): 1025-1028.

We present an effective criterion for the choice of the starting point in the optimization of T-junction manifold multiplexers. Given N separately designed channel filters, the method provides the expressions for their locations with respect to the manifold as well as the spacings between the junctions forming the manifold itself. By inspection of the results it is seen that the proposed formulae perform considerably better than the standard ones based on stub models. In fact, in the non-contiguous case, the design is almost complete when the junctions forming the manifold have certain characteristics. In the contiguous case, a further optimization is required but the initial choice is very close to the final solution.

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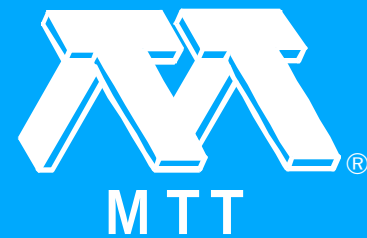


Abstracts

From layout to schematic using pattern recognition in microwave computer aided design

S. Tadjiky and R.H. Jansen. "From layout to schematic using pattern recognition in microwave computer aided design." 1997 MTT-S International Microwave Symposium Digest 2. (1997 Vol. II [MWSYM]): 1029-1033.

A novel pattern recognition tool has been developed to interpret a given MIC/MMIC layout in terms of even complex library components. This allows to go from layout to the data needed for a schematic. It opens the way to automate design flow between different simulators via schematic and netlist level.



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Wide-band SSB subharmonically pumped mixer MMIC (1997 Vol. II [MWSYM])

H. Okazaki and Y. Yamaguchi. "Wide-band SSB subharmonically pumped mixer MMIC (1997 Vol. II [MWSYM])." 1997 MTT-S International Microwave Symposium Digest 2. (1997 Vol. II [MWSYM]): 1035-1038.

To achieve low conversion-loss and high image-rejection performance in the wide band for up and down conversion, an SSB subharmonically pumped mixer using an in-phase RF divider/combiner is proposed. The SSB mixer MMIC is integrated in a small area of 1.8/spl times/1.3 mm/sup 2/ and shows good performance in the range 21.6 to 30.8 GHz.

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A planar circuit design for high order sub-harmonic mixers

T.J. Ellis and G.M. Rebeiz. "A planar circuit design for high order sub-harmonic mixers." 1997 MTT-S International Microwave Symposium Digest 2. (1997 Vol. II [MWSYM]): 1039-1042.

A planar circuit design technique is presented that results in relatively low conversion loss for sub-harmonic mixers using high-order LO harmonic frequencies. The design method results in conversion losses from 15 to 20 dB for LO frequencies ranging from the 3rd to the 9th sub-harmonic for signal frequencies up to W-Band. Measured data agrees closely to the simulated results for a 25 GHz, 3rd and 5th sub-harmonic prototype. The resulting conversion loss of these designs is not sensitive to the harmonic number used and provides a simple, commercially viable, planar approach to high frequency mixer design.

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Active, monolithically integrated coplanar V-band mixer

M. Schefer, U. Lott, H. Benedickter, H. Meier, W. Patrick and W. Bachtold. "Active, monolithically integrated coplanar V-band mixer." 1997 MTT-S International Microwave Symposium Digest 2. (1997 Vol. II [MWSYM]): 1043-1046.

An active V-band mixer is presented. The device used for mixing is an InP HEMT. The measured maximum mixer conversion gain is 5 dB. This is to the authors' knowledge the highest reported gain in the mm-wave range for a mixer that does not include a pre-amplifier or IF amplifier.

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High-performance W-band GaAs PIN diode single-pole triple-throw switch CPW MMIC

M. Case, M. Matloubian, Hsiang-Chih Sun, D. Choudhury and C. Ngo. "High-performance W-band GaAs PIN diode single-pole triple-throw switch CPW MMIC." 1997 MTT-S International Microwave Symposium Digest 2. (1997 Vol. II [MWSYM]): 1047-1051.

We present the device technology, design techniques, and circuit performance of a W-band single-pole triple-throw switch implemented in a coplanar waveguide (CPW) GaAs PIN diode MMIC technology. This switch provides more than 20 dB isolation and less than 1.5 dB insertion loss over the 75 to 85 GHz range, and more than 16 dB isolation and less than 1.6 dB insertion loss over the entire 75 to 110 GHz band. To our knowledge, this is the first report of a W-band CPW SP3T switch with state-of-the-art performance.

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Feedback optimization of grid oscillators

W.A. Shiroma and Z.B. Popovic. "Feedback optimization of grid oscillators." 1997 MTT-S International Microwave Symposium Digest 2. (1997 Vol. II [MWSYM]): 1053-1056.

We present a method for optimizing the feedback level in a transistor-grid oscillator. Based on the approximate large-signal S-parameters of the transistor, an equivalent circuit model for the grid is synthesized for maximum oscillator power. The resulting circuit serves as a convenient benchmark for determining the level of feedback for a given grid. Experimental results demonstrate how the substrate thickness and metallization pattern affect power performance. A grid with an asymmetric unit cell is shown to deliver almost 60% more effective radiated power than a grid with a symmetric unit cell.

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A 43-GHz AlInAs/GaInAs/InP HEMT grid oscillator

P. Preventza, M. Matloubian and D.B. Rutledge. "A 43-GHz AlInAs/GaInAs/InP HEMT grid oscillator." 1997 MTT-S International Microwave Symposium Digest 2. (1997 Vol. II [MWSYM]): 1057-1060.

A 36-element hybrid grid oscillator has been fabricated. The active devices are InP-based High Electron Mobility Transistors (HEMT's). The grid oscillates at 43 GHz with an effective radiated power of 200 mW. Measurements show the E and H-plane radiation patterns have side lobes 10 dB below the main beam. These results are a significant improvement over a previous millimeter-wave grid oscillator, which had a divided beam because of substrate modes.

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Phase noise in coupled oscillator arrays

Heng-Chia Chang, X. Cao, U.K. Mishra and R.A. York. "Phase noise in coupled oscillator arrays." 1997 MTT-S International Microwave Symposium Digest 2. (1997 Vol. II [MWSYM]): 1061-1064.

A simple method to evaluate the phase noise properties of the coupled oscillators for arbitrary coupling and injection-locking topologies is presented. The method is based on the phase dynamics equation and the concept of noise admittance to represent the noise source. The PM noise of the coupled oscillators can be easily analyzed by solving the coupling matrix related to the coupling topologies, after neglecting amplitude noise and AM-to-PM conversion. An 8.5 GHz prototype array was constructed to verify the phase noise reduction of the total PM noise and the array injection locked by the external low phase noise source.



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HBT active antenna as a self oscillating Doppler sensor

M.J. Kelly, J.A.C. Stewart and A.D. Patterson. "HBT active antenna as a self oscillating Doppler sensor." 1997 MTT-S International Microwave Symposium Digest 2. (1997 Vol. II [MWSYM]): 1065-1068.

This paper investigates the use of Heterojunction Bipolar Transistors (HBTs) as the working device in an active antenna for a self detection system. The devices used here are GaInP-GaAs HBT's from the GMMT F40 process. The design and performance of an active antenna based on this device is presented. A new large signal model is used to develop the active antenna described in this paper. The element oscillates at 11.40 GHz and produces approximately 5 mW of radiated power. A minimum detectable signal (MDS) of -99 dBm in a 10 Hz bandwidth has been measured.

[Click on title for a complete paper.](#)



Abstracts

The active phased array antennas coupled through slotlines

Cheol Mun, Chang Hoon Kang, Han Kyu Park and Young Joong Yoon. "The active phased array antennas coupled through slotlines." 1997 MTT-S International Microwave Symposium Digest 2. (1997 Vol. II [MWSYM]): 1069-1072.

In this paper, a 5-element active phased array antenna coupled through the slotline in the ground plane between oscillators is designed and fabricated. The proposed slotline coupling structure as a novel coupling structure has several advantages over the transmission line coupling such as the expansion capability in two dimensions and distortion free radiation pattern caused by the coupling network. In an experiment, 5-elements active phased array antenna system has 50/spl deg/ scanning range as the free-running frequencies of end elements are controlled.



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Abstracts

Computer aided engineering environment for spatial power combining systems

F. Nusseibeh, T.W. Nuteson, J. Patwardhan, M.A. Summers, C.E. Christoffersen, J. Kreskovsky and M.B. Steer. "Computer aided engineering environment for spatial power combining systems." 1997 MTT-S International Microwave Symposium Digest 2. (1997 Vol. II [MWSYM]): 1073-1077.

Development of a computer aided engineering environment that supports the design of spatial power combining systems is proposed. A complete integrated thermal/electromagnetic/circuit simulation capability using a mix of commercially available tools from various vendors will be compatible to the new tools being developed for spatial power combining systems. This paper focuses on and presents results for the electromagnetic field analysis, harmonic balance analysis, and rapid transient analysis part of the design environment. Also the integration of commercially available software is used to define the geometry layouts of the structures analyzed in this paper.



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Conductor loaded resonator filters with wide spurious free stop band

Chi Wang, K.A. Zaki, A.E. Atia and T. Dolan. "Conductor loaded resonator filters with wide spurious free stop band." 1997 MTT-S International Microwave Symposium Digest 2. (1997 Vol. II [MWSYM]): 1079-1082.

A new configuration of conductor loaded resonator filters using two different sized conductor loaded resonators is presented. The spurious performance of the conductor loaded resonator filters are significantly improved. A rigorous mode matching method is used to compute the resonant frequency, unloaded Q and the field of the resonant mode of the conductor (solid or ring) loaded resonators. The coupling coefficients between two resonators are computed using small aperture theory by Levy's approach. An 8-pole elliptic function filter is designed, constructed and tested. Experimental results verify the theory.

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Elliptical cavity resonators for dual-mode narrowband filters

L. Accatino, G. Bertin and M. Mongiardo. "Elliptical cavity resonators for dual-mode narrowband filters." 1997 MTT-S International Microwave Symposium Digest 2. (1997 Vol. II [MWSYM]): 1083-1086.

A novel cavity resonator with elliptical cross-section is proposed in order to realize dual-mode narrowband filters without tuning and coupling elements. No discontinuities are required inside the cavities hence significantly enhancing the unloaded Q, the ability to operate with higher power levels, and the ease of manufacturing. Dual-mode coupling is generated by the step discontinuity between the input rectangular waveguide and an inclined elliptical waveguide; a rigorous full-wave electromagnetic model for this discontinuity has been developed. Proper choice of the ellipticity and of the inclination angle allows us to obtain the desired coupling and tuning actions. Representative prototypes of elliptical cavities exhibiting various degrees of coupling have been carefully measured; the favorable comparison between experimental and theoretical results proves the accuracy of the model and its applicability for narrowband X/Ku band filters.

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Alternative designs for dual-mode filters

D.R. Jachowski. "Alternative designs for dual-mode filters." 1997 MTT-S International Microwave Symposium Digest 2. (1997 Vol. II [MWSYM]): 1087-1090.

Alternatives to conventional dual-mode filter designs are revealed by introducing an independent variable into a filter's coupling matrix through a sequence of plane rotation similarity transformations. A graphical means of evaluating the resulting alternatives is described. The procedure is demonstrated with the design of an improved six-resonance longitudinal dual-mode dielectric resonator filter without irises.

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Design and realization of a four pole elliptic microwave filter using low dielectric loaded cavities

S. Gendraud, S. Verdeyme, P. Guillon, M. Chaubet, J. Sombrin, S. Vigneron and B. Theron. "Design and realization of a four pole elliptic microwave filter using low dielectric loaded cavities." 1997 MTT-S International Microwave Symposium Digest 2. (1997 Vol. II [MWSYM]): 1091-1094.

The aim to increase the electrical properties of high power narrow band width filters required for space applications leads us to propose an alternative to classical circular metallic cavities. The introduction of dielectric media in metallic cavities permits to obtain high unloaded quality factor in devices of reduced sizes. An experimental four pole dual mode elliptic filter is constructed using these resonators. The test results are in excellent agreement with the filtering objective.

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Generalized cross-coupled filters using evanescent mode coupling elements

R.V. Synder. "Generalized cross-coupled filters using evanescent mode coupling elements." 1997 MTT-S International Microwave Symposium Digest 2. (1997 Vol. II [MWSYM]): 1095-1098.

Generalized cross-coupled filters require implementation of both positive and negative cross coupled elements. A positive element frequently uses inductive coupling, while a negative coupling element uses capacitive coupling. While the required negative couplings are readily achieved in most cases using inductive irises, the synthesized values for capacitive coupling frequently require larger coupling values than can be achieved with a simple iris. Traditional methods for realizing capacitive couplings have included the use of capacitive probes, which are difficult to adjust in practice. Further, the negative couplings can be large enough to again cause problems with simple inductive irises. In this paper, we present the use of resonated evanescent mode sections to realize both positive and negative couplings by employing the phase shift and impedance characteristics of the bandpass element represented by a short resonated section of evanescent mode waveguide. The structure is quite practical and flexible in packaging. Examples include the use of up to four cross couplings, two negative and two positive.

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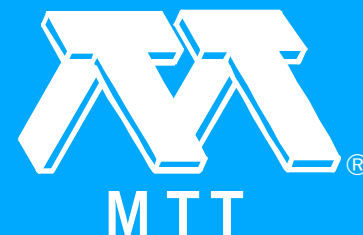


Abstracts

Improvement of spurious performance of combine filters

Hui-Wen Yao, K.A. Zaki, A.E. Atia and T. Dolan. "Improvement of spurious performance of combine filters." 1997 MTT-S International Microwave Symposium Digest 2. (1997 Vol. II [MWSYM]): 1099-1102.

Methods to improve the spurious performance of combine filters are investigated. The first spurious passband of a conventional combine filter with uniform rods can be pushed to a higher frequency by using stepped rod resonators or suppressed by a careful design of the coupling slots without a noticeable sacrifice of filter insertion loss. Experiments verify the theory.



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Abstracts

Dual mode combined dielectric and conductor loaded cavity filters

Chi Wang, K.A. Zaki and A.E. Atia. "Dual mode combined dielectric and conductor loaded cavity filters." 1997 MTT-S International Microwave Symposium Digest 2. (1997 Vol. II [MWSYM]): 1103-1107.

A new configuration of dual mode combined dielectric and conductor loaded cavity filter is presented. Using one or two conductor loaded cavities with dielectric loaded cavities, both low loss and excellent spurious performance are achieved. Resonant frequencies, unloaded Q and the fields of both resonators are rigorously computed by mode matching method. The coupling between two resonators is computed by small aperture approximation theory. Three different types of 4-pole elliptic function filters under same condition are constructed. Insertion loss and spurious performance of the filters are compared. Experimental results verify the theory.



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Abstracts

FEM analysis of nonreciprocity of a coplanar waveguide with a transversely magnetised ferrite layer

L. Zhou and L.E. Davis. "FEM analysis of nonreciprocity of a coplanar waveguide with a transversely magnetised ferrite layer." 1997 MTT-S International Microwave Symposium Digest 2. (1997 Vol. II [MWSYM]): 1109-1112.

In this paper a study of the phase shift and characteristic impedance of a coplanar waveguide with a dielectric substrate and a ferrite superstrate is carried out using a finite element method. The results show that selecting an appropriate ratio of the ferrite layer thickness to slot width and the width of the central strip to slot width can result in larger nonreciprocity and characteristic impedance values of 40-60/spl Omega/.



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Finite-Difference Time-Domain analysis of microwave ferrite devices

B.S. Yildirim and E.-B. El-Sharawy. "Finite-Difference Time-Domain analysis of microwave ferrite devices." 1997 MTT-S International Microwave Symposium Digest 2. (1997 Vol. II [MWSYM]): 1113-1116.

Finite-Difference Time-Domain Method is extended to gyromagnetic media using a time domain approach by solving Maxwell's curl equations and equation of motion of the magnetisation vector in consistency. New update equations are derived to include finite size ferrite material magnetized in a general direction. New code includes non-uniform magnetization due to demagnetization effects as well. In order to validate our formulation, a full wave analysis of a thin film isolator is performed in 3D. Numerical results are then compared with measurements and a good agreement has been achieved. The method presented in this paper can be applied for other microwave ferrite devices such as circulators and phase shifters.

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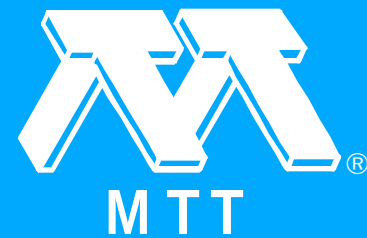


Abstracts

Modeling a stripline ferrite phase shifter

S.N. Stitzer. "Modeling a stripline ferrite phase shifter." 1997 MTT-S International Microwave Symposium Digest 2. (1997 Vol. II [MWSYM]): 1117-1120.

A model is proposed for the behavior of transmission lines on ferrite substrates. This may be the first time a model has correctly described the absorption below the gyromagnetic resonant frequency corresponding to the magnetization at saturation, or $\gamma/4\pi M_s$. This new model should allow accurate prediction of impedances and propagation constants for frequencies operating close to this cutoff frequency, permitting more accurate transmission lines and transformers to be designed. Comparison with measured data from a low-temperature co-fired (LTCC) ferrite stripline phase shifter is given.



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Microwave phase shift using ferrite-filled waveguide below cutoff (1997 Vol. II [MWSYM])

C.R. Boyd. "Microwave phase shift using ferrite-filled waveguide below cutoff (1997 Vol. II [MWSYM])." 1997 MTT-S International Microwave Symposium Digest 2. (1997 Vol. II [MWSYM]): 1121-1124.

Unlike conventional waveguides, lossless ferrite-filled guides may exhibit a complex propagation factor below cutoff of the dominant TE mode when a transverse magnetic bias field is applied. In that case, the field in a very long waveguide has the character of a travelling wave whose amplitude decays exponentially with distance from the driven end. The wavelength and the magnitude of the applied bias field are inversely related, and at zero field as the gyromagnetic effects vanish in the ferrite the wavelength becomes infinite. For a bias field of one polarity, the travelling wave will be a forward wave, and for the opposite polarity a backward wave. This peculiar behavior allows phase shift to be produced in a band pass filter-like structure in which small cross-section, below-cutoff ferrite waveguide sections alternate with sections of high dielectric constant material.

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Abstracts

C band ferrite microstrip limiter

J.J. Green. "C band ferrite microstrip limiter." 1997 MTT-S International Microwave Symposium Digest 2. (1997 Vol. II [MWSYM]): 1125-1126.

A microstrip line on a polycrystalline yttrium iron garnet substrate was measured as a function of incident microwave power level to determine power limiting. Properties acceptable to system designers were found for the low level insertion loss, recovery time, temperature performance and response to a frequency modulated pulse.



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Effective-field theory for ferrite thin-film junction circulator

H. How, S.W. McKnight and C. Vittoria. "Effective-field theory for ferrite thin-film junction circulator." 1997 MTT-S International Microwave Symposium Digest 2. (1997 Vol. II [MWSYM]): 1127-1130.

We have calculated the S-parameters and losses in ferrite-film junction circulators using a new effective-field theory assuming TEM-like propagation. Conductivity losses dominate the dielectric and magnetic losses in Y-junction circulators fabricated on ferrite films with thicknesses less than 200 /spl mu/m.

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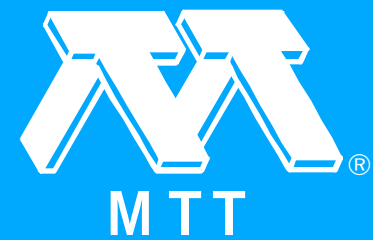
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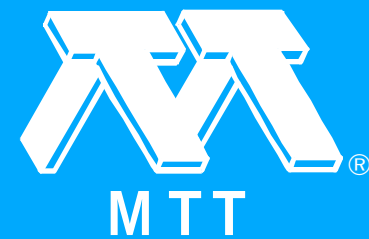
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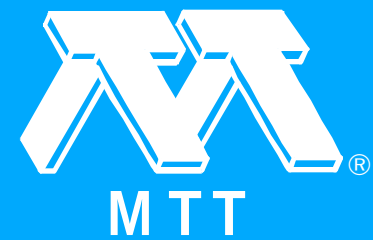
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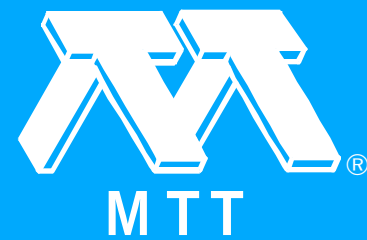
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Technical Program Contents (1997 Vol. III [MWSYM])

"Technical Program Contents (1997 Vol. III [MWSYM])." 1997 MTT-S International Microwave Symposium Digest 3. (1997 Vol. III [MWSYM]).



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Abstracts

An ultra-wideband exciter for ground-penetration radar systems

Phuong Phu, E. Adler, J. Speulstra, J. Clark, M. Bartlett and J. Fisher. "An ultra-wideband exciter for ground-penetration radar systems." 1997 MTT-S International Microwave Symposium Digest 3. (1997 Vol. III [MWSYM]): 1135-1138.

Waveform requirements for a ground penetration ultra-wideband exciter (UWBE) include generating a frequency spectrum over a wide bandwidth, with a low-start frequency. A scripted linear-frequency-modulated waveform is used for the frequency coverage, with the added ability of arbitrarily notching-out portions of the transmitting spectrum in which radio frequency interference (RFI) exists. This exciter uses an arbitrary waveform generator (AWG), which scripts waveform packets with notches in the spectrum. The AWG is coupled to a frequency synthesizing architecture (FSA) device for waveform packet placement to create a phase-continuous broad-band response.



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Broadband waveguide-based spatial combiners

A. Alexanian and R.A. York. "Broadband waveguide-based spatial combiners." 1997 MTT-S International Microwave Symposium Digest 3. (1997 Vol. III [MWSYM]): 1139-1142.

An array of tapered slotlines is inserted between rectangular waveguides. Results for a 2/spl times/4 active array at X-band are presented, indicating good combining efficiency and thermal properties as well as excellent bandwidth. To increase the device packing density and remove the lower cutoff frequency of the rectangular waveguide a coaxial combiner is also proposed. A radial arrangement of tapered slotlines is placed between two flared coaxial lines. 64 elements are combined with low combining loss over the 5 to 20 GHz band.

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Abstracts

60-GHz-band ultracompact transmitter for HDTV

H. Nakakita, F. Suginoshita and N. Yazawa. "60-GHz-band ultracompact transmitter for HDTV." 1997 MTT-S International Microwave Symposium Digest 3. (1997 Vol. III [MWSYM]): 1143-1146.

We have developed a 60-GHz-band ultracompact transmitter for short-range transmission of High Definition TV (HDTV) program material. This transmitter utilizes microwave direct-frequency modulators with simplified temperature-compensation circuits and millimeter-wave modules involving MMIC multipliers and power amplifiers incorporated with integrated planar antennas. This structure has enabled the development of a pocket-sized transmitter (120/spl times/90/spl times/30 mm/sup 3/) with a low power consumption of 2.2 W. With this transmitter, HDTV signals have been successfully transmitted on an experimental video link with this transmitter.



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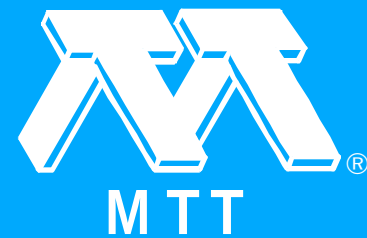
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Abstracts

A 28GHz LMDS transceiver for subscriber applications (Paper Withdrawn)

D. Vik, D. Donoghue, A. Borghetti and Z. Bogan. "A 28GHz LMDS transceiver for subscriber applications (Paper Withdrawn)." 1997 MTT-S International Microwave Symposium Digest 3. (1997 Vol. III [MWSYM]).



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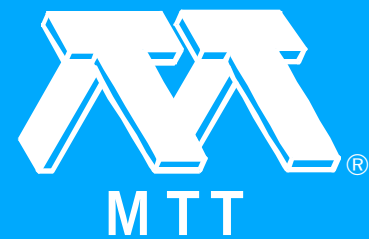
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Channel loading effects on power limited wireless transmitters utilizing discrete multitone modulation

A. Leke and J.S. Kenney. "Channel loading effects on power limited wireless transmitters utilizing discrete multitone modulation." 1997 MTT-S International Microwave Symposium Digest 3. (1997 Vol. III [MWSYM]): 1147-1150.

A method is presented for optimizing the throughput of a radio channel limited by intermodulation distortion induced in transmission of discrete multitone (DMT) signals. The DMT concept is presented, and the carrier-to-interference ratios as a function of the amount of channel loading are computed for different power levels. These values, obtained using 2 different methods-the NPR approach and the MMSE Gain method-are shown to be in good agreement. The degradation in C/I for a fully loaded channel with respect to the two-tone case is also computed.

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Abstracts

A novel RF to baseband monolithic microwave receiver with on-chip tuning

L.A. Geis, M.A. Wyatt and D. Starratt. "A novel RF to baseband monolithic microwave receiver with on-chip tuning." 1997 MTT-S International Microwave Symposium Digest 3. (1997 Vol. III [MWSYM]): 1151-1154.

A novel single-chip monolithic microwave receiver on silicon with integrated high Q inductors and laser-trimmable capacitors and resistors is presented. All functions, including some elementary mixed signal circuitry, necessary to demodulate a 1.5 GHz signal and convert it to baseband digital data are described.



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A high performance transceiver hybrid IC for PHS hand-set operating with single positive voltage supply

M. Nishijima, J. Itoh, T. Kuniyama, T. Yokoyama, S. Yamamoto, K. Miyatsuji, M. Nishitsuji and O. Ishikawa. "A high performance transceiver hybrid IC for PHS hand-set operating with single positive voltage supply." 1997 MTT-S International Microwave Symposium Digest 3. (1997 Vol. III [MWSYM]): 1155-1158.

A high performance transceiver hybrid IC (HIC) operating with single positive voltage supply has been developed for PHS hand-set. The HIC integrates a power amplifier (PA), a front-end (F/E) IC, a T/R SPDT switch (SW) and their peripheral circuits, which are mounted on the HIC circuit board with thick Cu metal heat-sink. In the transmitter block, the PA with a SW exhibits a low dissipation current of 190 mA, a high power gain of 39.4 dB and a low adjacent channel leakage power of -56.4 dBc at an output power of 20.5 dBm. In the receiver block, the F/E with a SW exhibits a low noise figure of 3.7 dB, a low dissipation current of 4.8 mA and a high conversion gain of 25.4 dB. The HIC needs only single positive voltage supply of 3.5 V. The HIC size is only 10 mm/spl times/13 mm/spl times/1.9 mm.

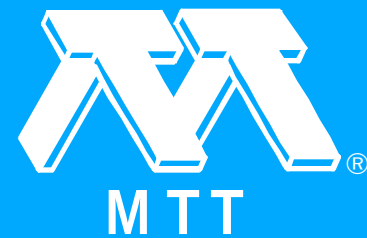


Abstracts

Cesium beam frequency standards

W.D. Lee and D.B. Sullivan. "Cesium beam frequency standards." 1997 MTT-S International Microwave Symposium Digest 3. (1997 Vol. III [MWSYM]): 1161-1163.

This historical review of the development of cesium beam frequency standards covers the period from the announcement of the first atomic frequency standard in 1949 to the present. It describes the concepts as well as the key factors affecting the development of the various cesium standards.



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The waveguide below-cutoff attenuation standard (1997 Vol. III [MWSYM])

D.H. Russell. "The waveguide below-cutoff attenuation standard (1997 Vol. III [MWSYM])." 1997 MTT-S International Microwave Symposium Digest 3. (1997 Vol. III [MWSYM]): 1165-1169.

A semi-tutorial review of the history, development and application of waveguide below-cutoff attenuation standards is presented. A brief summary of the EM theory is followed by descriptions of the various designs implemented over a span of 60 years. Designs range from simplistic to elaborate electro-mechanical creations stretching the toolmaker's art yet ultimately dependent upon the primary standard of length.



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Abstracts

A review of the six-port measurement technique

G.F. Engen. "A review of the six-port measurement technique." 1997 MTT-S International Microwave Symposium Digest 3. (1997 Vol. III [MWSYM]): 1171-1172.

The six-port measurement technique has found wide acceptance, and played a major role in microwave metrology, particularly within the community of national standards laboratories. This paper reviews this development and technology.



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A 94 GHz monolithic high output power amplifier

P. Huang, E. Lin, R. Lai, M. Biedenbender, T.W. Huang, H. Wang, C. Geiger, T. Block and P.H. Liu. "A 94 GHz monolithic high output power amplifier." 1997 MTT-S International Microwave Symposium Digest 3. (1997 Vol. III [MWSYM]): 1175-1178.

A two-stage monolithic W-band power amplifier using 0.1- μm pseudomorphic AlGaAs/InGaAs/GaAs T-gate power HEMT process has been designed, fabricated, and tested. This MMIC PA exhibits 8 dB linear gain and a maximum output power of 300 mW with 10.5% peak power-added efficiency at 94 GHz. The substrate thickness is 2 mil to take advantage of lower thermal resistance as well as smaller via holes and a more compact chip layout. To our knowledge, the 300-mW output power represents the highest output power for a single W-band power amplifier chip at this frequency.

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Abstracts

60 GHz high-efficiency HEMT MMIC chip set development for high-power solid state power amplifier

Y. Hwang, J. Lester, G. Schreyer, G. Zell, S. Schrier, D. Yamauchi, G. Onak, B. Kasody, R. Kono, Y.C. Chen and R. Lai. "60 GHz high-efficiency HEMT MMIC chip set development for high-power solid state power amplifier." 1997 MTT-S International Microwave Symposium Digest 3. (1997 Vol. III [MWSYM]): 1179-1182.

A 60 GHz high-efficiency HEMT MMIC chip set was developed including two fully-matched HEMT MMIC chips. A 2-mil thick MMIC with 300 mW output power and 22% efficiency and a 4-mil thick gain stage MMIC are described. They were used as building blocks of high power (1 to 50 watts) SSPA.



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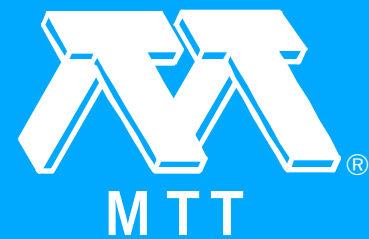
A 6 watt Ka-band MMIC power module using MMIC power amplifiers (1997 Vol. III [MWSYM])

D.L. Ingram, D.I. Stones, T.W. Huang, M. Nishimoto, H. Wang, M. Siddiqui, D. Tamura, J. Elliott, R. Lai, M. Biedenbender, H.C. Yen and B. Allen. "A 6 watt Ka-band MMIC power module using MMIC power amplifiers (1997 Vol. III [MWSYM])." 1997 MTT-S International Microwave Symposium Digest 3. (1997 Vol. III [MWSYM]): 1183-1186.

In this paper we present the development of a 6 Watt 24% PAE Ka-band power module with an associated power gain of 21.5 dB. The power module consists of a driver amplifier and two power amplifier chips. These MMIC amplifiers were fabricated with a 2-mil thick substrate using 0.15- μm InGaAs/AlGaAs/GaAs HEMT technology. The driver amplifier is a fully matched single-ended design with an output power of 27.5 dBm, a 10.7 dB power gain and 27% PAE. We use a hybrid approach for the output power amplifier which consists of two partially-matched MMIC chips and a 8-way Wilkinson combiner fabricated on alumina substrate. The MMIC power amplifiers delivered a record power of 35.4 dBm (3.5 W) with a PAE of 28% and an associated power gain of 11.5 dB. The 8-way combiner has an insertion loss of 0.6 dB. We believe this is a new benchmark for power module using monolithic approach at this frequency range.

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High gain and high efficiency K-band power HEMT with WSi/Au T-shaped gate

T. Kunii, N. Yoshida, S. Miyakuni, T. Shiga, T. Oku, T. Kitano, J. Udomoto, M. Komaru, A. Inoue, S. Tsuji, N. Tanino, T. Ishikawa and Y. Mitsui. "High gain and high efficiency K-band power HEMT with WSi/Au T-shaped gate." 1997 MTT-S International Microwave Symposium Digest 3. (1997 Vol. III [MWSYM]): 1187-1190.

We have developed WSi/Au T-shaped buried gate pseudomorphic HEMT with the good uniformity of recess current by using a selective etching process and with a high off-state break down voltage of over 19 V. A 1.4 W output power has been obtained with a power-added efficiency of 55.6% and an associated gain of 9.2 dB under high voltage operation of $V_d=10$ V at 18 GHz. This is the highest gain and efficiency achieved by a single FET chip with over a watt output power at this frequency.

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Novel InGaP/AlGaAs/InGaAs heterojunction FET for X-Ku band power applications

Y. Okamoto, K. Matsunaga, M. Kuzuhara and M. Kanamori. "Novel InGaP/AlGaAs/InGaAs heterojunction FET for X-Ku band power applications." 1997 MTT-S International Microwave Symposium Digest 3. (1997 Vol. III [MWSYM]): 1191-1194.

We have successfully fabricated a novel heterojunction FET (HJFET) with an InGaP surface layer for high yield X-Ku band power applications. Standard deviation in the threshold voltage of 60 mV was achieved by using a highly-selective wet recess etching technique. The fabricated HJFET (Wg=16.8 mm) delivered an output power of 9.5 W and a power-added efficiency of 35% with a low carrier-to-third-order intermodulation distortion ratio of -29.5 dBc at 12 GHz. Moreover, the 25.2 mm HJFET delivered an output power of 12.2 W.

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Abstracts

Development of a compact, broadband FET linearizer for satellite use

S. Ogura, K. Seino, T. Ono, A. Kamikokura and H. Hirose. "Development of a compact, broadband FET linearizer for satellite use." 1997 MTT-S International Microwave Symposium Digest 3. (1997 Vol. III [MWSYM]): 1195-1198.

A small sized, high performance linearizer has been developed. This linearizer consists of only one FET and simple matching circuits and is useful in a very broadband from 2 to 12 GHz. The linearizer has been adopted into an SSPA for the GLOBALSTAR program, and a 2 dB NPR improvement has been achieved at the 3 dB output backoff point.



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A microwave miniaturized linearizer using a parallel diode

K. Yamauchi, K. Mori, M. Nakayama, Y. Mitsui and T. Takagi. "A microwave miniaturized linearizer using a parallel diode." 1997 MTT-S International Microwave Symposium Digest 3. (1997 Vol. III [MWSYM]): 1199-1202.

A miniaturized linearizer using a parallel diode has been developed. It is composed of a parallel diode and a resistance for d.c. bias feed. The linearizer utilizes a nonlinear resistive element of the diode. In this paper, the operation principle of the linearizer is described. The parallel diode provides a high temperature stability and readiness of bias voltage adjustment. BY applying this linearizer to an S-band power amplifier, an improvement of ACP of 5 dB and power added efficiency of 8.5% has been achieved for the $\pi/4$ -shift QPSK modulated signal.

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Abstracts

High efficiency planar oscillator with RF power of 100 mW near 140 GHz

M. Wollitzer, J. Buechler and J.-F. Luy. "High efficiency planar oscillator with RF power of 100 mW near 140 GHz." 1997 MTT-S International Microwave Symposium Digest 3. (1997 Vol. III [MWSYM]): 1205-1208.

An integrated planar oscillator on a high resistivity silicon substrate generates an RF-power of 100 mW in D-band with a peak efficiency of 4.5%. The single sideband S/N ratio of the oscillator is -75 dBc/Hz@100 kHz off carrier. The investigated disc resonator with capacitive coupling to a microstrip line is manufactured by application of micromachining techniques.



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Abstracts

A low-power X-band frequency synthesizer module

T. Nakagawa, H. Okazaki and Y. Yamaguchi. "A low-power X-band frequency synthesizer module." 1997 MTT-S International Microwave Symposium Digest 3. (1997 Vol. III [MWSYM]): 1209-1212.

This paper describes an X-band frequency synthesizer that features low power consumption. To save power and reduce cost, new MMIC's were developed and combined with commercially available components. With +10 dBm output, the power consumption is 270 mW, the lowest ever reported for X-band synthesizers.



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A DC to X-band frequency doubler using GaAs HBT MMIC

Xiangdong Zhang and Yong-Hoon Yun. "A DC to X-band frequency doubler using GaAs HBT MMIC." 1997 MTT-S International Microwave Symposium Digest 3. (1997 Vol. III [MWSYM]): 1213-1216.

An analog frequency doubler is developed using GaAs HBT MMIC technology. In this doubler circuit, a novel push-push circuit configuration is used to provide the efficient frequency conversion and the fundamental frequency rejection over a broad bandwidth. The measurement results of the MMIC demonstrate an average 0 to 3 dB conversion gain and a 10 dB rejection on fundamental frequency up to 14 GHz. Thus, this MMIC can be used as a low-cost insertion block to achieve any stable local-oscillation signals up to X-band by multiplying the high quality VCOs at low frequencies, especially the inexpensive Si BJT based VCOs at wireless frequencies.





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A 5 to 10 GHz low spurious triple tuned type PLL synthesizer driven by frequency converted DDS unit

K. Tajima, Y. Imai, Y. Kanagawa and K. Itoh. "A 5 to 10 GHz low spurious triple tuned type PLL synthesizer driven by frequency converted DDS unit." 1997 MTT-S International Microwave Symposium Digest 3. (1997 Vol. III [MWSYM]): 1217-1220.

This paper presents a 5 to 10 GHz low spurious triple tuned type PLL synthesizer with narrow channel steps for wide-band reception in RF measurement systems. The synthesizer is driven by a DDS to achieve such characteristics with a single PLL configuration. It corrects DDS's output frequency and division ratios of two variable frequency dividers in the PLL. With the proposed topology, high level spurious components by the DDS do not fall in from the PLL's loop bandwidth. An added frequency converter placed between the DDS and PLL also suppresses spurious level by reducing a transfer gain from the DDS to the PLL output. Furthermore, a voltage controlled oscillator (VCO) with inverted tuning circuits is presented for low phase noise characteristics. A developed PLL synthesizer with channel step 625 kHz achieved low spurious level below -46 dBc, phase noise of -105 dBc/Hz@1 MHz offset and switching speed of 90 /spl mu/s.

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A very wide-tuning range 5-GHz-band Si bipolar VCO using three-dimensional MMIC technology

K. Kamogawa, K. Nishikawa, C. Yamaguchi, M. Hirano, I. Toyoda and T. Tokumitsu. "A very wide-tuning range 5-GHz-band Si bipolar VCO using three-dimensional MMIC technology." 1997 MTT-S International Microwave Symposium Digest 3. (1997 Vol. III [MWSYM]): 1221-1224.

The first completely integrated, wide-tuning range 5-GHz-band 0.5- μm Si bipolar transistor voltage-controlled oscillator (VCO), based on three-dimensional MMIC technology, is presented. A 33% frequency tuning range from 4.02 to 5.35 GHz is obtained at the collector voltage of 3 V because the base-emitter resistance of the active transistor works like a varistor with a large ratio. Furthermore, the oscillation frequency is remarkably linear against the controlled base bias. The achieved phase noise is -108 dBc/Hz at 1 MHz offset from the carrier.

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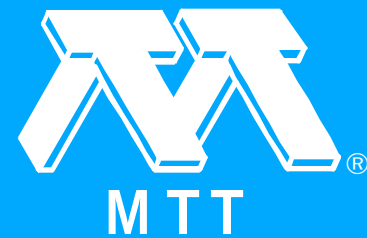


Abstracts

W band monolithic multipliers

F. Brauchler, J. Papapolymerou, J. East and L. Katehi. "W band monolithic multipliers." 1997 MTT-S International Microwave Symposium Digest 3. (1997 Vol. III [MWSYM]): 1225-1228.

This paper describes the realization of a W band planar monolithic multiplier using finite ground coplanar lines. These lines provide near TEM low loss propagation to W band and enhance multiplier performance. The developed MMIC multipliers have demonstrated 93 mW output power, 26% efficiency and output bandwidth from 70 to 80 GHz.



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Abstracts

Application of the TLM-method for the analysis of longitudinally periodic structures

M. Walter, U. Muller and A. Beyer. "Application of the TLM-method for the analysis of longitudinally periodic structures." 1997 MTT-S International Microwave Symposium Digest 3. (1997 Vol. III [MWSYM]): 1231-1234.

The paper delivers new aspects to the TLM-method applied to longitudinally periodic structures. This contribution explains the main features of the method like the parameter estimation and the phase walls derived from the Floquet's theorem as well as examples and compares the obtained results to analytical solutions and measurements.



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Modal block-LU-decomposition technique for the efficient CAD of ridged waveguide filters

R. Beyer, F. Arndt and W. Hauth. "Modal block-LU-decomposition technique for the efficient CAD of ridged waveguide filters." 1997 MTT-S International Microwave Symposium Digest 3. (1997 Vol. III [MWSYM]): 1235-1238.

A mode-matching/block-LU-decomposition (MMLU) technique is presented for the fast calculation of the modal S-parameters of and the fields in waveguide components composed of step discontinuities and homogeneous sections. The MMLU approach leads to a numerically efficient block-tridiagonal matrix structure. Arbitrary cross-sections are included by the combination with the fast and flexible 2D FE method. The efficiency of the method is demonstrated at the CAD of advanced broadband higher-order mode suppression ridged waveguide filters. Excellent agreement with measurements verifies the theory.

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Abstracts

A new global time domain electromagnetic simulator of microwave circuits including lumped elements based on finite element method

K. Guillouard, M.F. Wong, V.F. Hanna and J. Citerne. "A new global time domain electromagnetic simulator of microwave circuits including lumped elements based on finite element method." 1997 MTT-S International Microwave Symposium Digest 3. (1997 Vol. III [MWSYM]): 1239-1242.

This paper proposes an extension of the Finite Element Time Domain (FETD) method for the global electromagnetic (EM) analysis of complex inhomogeneous microwave distributed circuits, containing linear or non linear lumped elements. This technique combines Maxwell's equations and circuit equations, using directly SPICE software. Results are given for a capacitor, a resistor as well as a Schottky diode.



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Abstracts

Variational analysis of arbitrarily oriented thick iris coupling a rectangular and an elliptical waveguide

A. Morini, T. Rozzi, M. Pistolesi and F. Spinsanti. "Variational analysis of arbitrarily oriented thick iris coupling a rectangular and an elliptical waveguide." 1997 MTT-S International Microwave Symposium Digest 3. (1997 Vol. III [MWSYM]): 1243-1246.

Elliptical waveguide is receiving growing interest for likely application to tuningless dual mode filters. Its coupling to a rectangular waveguide takes often place via a thick rectangular iris that can be rotated with respect to the axes of both guides. In this contribution we develop an accurate fullwave multimode variational approach of the coupling iris including the complete Green's functions of both guides and accounting for the 90/spl deg/-edge condition in the field expansions on the iris apertures.



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Field theory analysis of conically shaped coupling elements in dual mode filters and polarizers

U. Balaji and R. Vahldieck. "Field theory analysis of conically shaped coupling elements in dual mode filters and polarizers." 1997 MTT-S International Microwave Symposium Digest 3. (1997 Vol. III [MWSYM]): 1247-1250.

The S-parameters of conically shaped coupling elements in dual mode filters and polarizers in circular waveguides have been derived using the mode matching method. The coupling elements are single or double ridges of uniform angular thickness placed at any arbitrary angle to the excitation in order to couple the orthogonal polarizations. Using ridges of this shape enables the analysis entirely in cylindrical coordinates and the evaluation of some of the coupling integrals analytically. A 90/spl deg/ differential phase shift between the orthogonal modes for a polarizer application has also been realized using a double ridged circular waveguide.

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Radar requirements and architecture trades for automotive applications

R. Dixit and L. Rafaelli. "Radar requirements and architecture trades for automotive applications." 1997 MTT-S International Microwave Symposium Digest 3. (1997 Vol. III [MWSYM]): 1253-1256.

There continues to be significant interest in the field of autonomous intelligent cruise control (ACC) and collision warning (CW)/collision reduction (CR) radar systems for in-vehicle applications. With some products already deployed on truck and bus platforms, and the imminent application of such systems in some highend automobiles, this paper provides an overview of the system requirements and architecture trades. The main body of emphasis is on various designs of forward looking millimeterwave radars, and how their capabilities meet the requirements for wide field-of-view sensors. Additionally, there are updates on costs targets and application rate projections.

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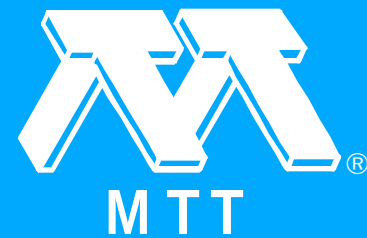


Abstracts

Millimeter wave radar sensor for automotive intelligent cruise control (ICC)

M.E. Russell, A. Crain, A. Curran, R.A. Campbell, C.A. Drubin and W.F. Miccioli. "Millimeter wave radar sensor for automotive intelligent cruise control (ICC)." 1997 MTT-S International Microwave Symposium Digest 3. (1997 Vol. III [MWSYM]): 1257-1260.

An all-weather automotive MMW radar sensor is described that uses an FMCW radar design capable of acquiring and tracking all obstacles in its field of view. Design tradeoffs are discussed and radar sensor test results are presented along with the applicability of the radar to collision warning systems.



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Millimeter-wave dual mode radar for headway control in IVHS

K. Konno and S. Koshikawa. "Millimeter-wave dual mode radar for headway control in IVHS." 1997 MTT-S International Microwave Symposium Digest 3. (1997 Vol. III [MWSYM]): 1261-1264.

In intelligent vehicle and highway systems (IVHS), lateral and headway vehicle control is used to maintain stable driving. Headway control keeps the controlled vehicle an appropriate distance from vehicles directly ahead. Each vehicle needs to have an obstacle detection system installed to monitor distances to the preceding vehicle and its relative speed. In the future, headway control systems for consumer use must be cheap and capable of operating in all environmental conditions. To enable such equipment to be built, a dual mode millimeter-wave radar has been proposed. It would be able to operate in both radar mode, in which it would measure the distance to the leading vehicle, and in communication mode, in which it would exchange data with a vehicle ahead of it. By operating in two modes alternately, the dual mode radar can provide the headway control system with all the data needed to control the distances to the leading vehicles, their speeds, acceleration conditions, and the leading vehicle's steering angle and brake signal. The data can then be used for stable control of the vehicles. This paper describes the concept of the dual mode radar system and the results of the experiments undertaken.

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Active SIMMWIC-antenna for automotive applications

M. Singer, K.M. Strohm, J.-F. Luy and E.M. Biebl. "Active SIMMWIC-antenna for automotive applications." 1997 MTT-S International Microwave Symposium Digest 3. (1997 Vol. III [MWSYM]): 1265-1268.

An active SIMMWIC-Antenna (Silicon Monolithic Millimeterwave Integrated Circuit) for vehicular technology in the frequency range around 76.5 GHz is presented. This active antenna acts as a transceiver and is well suited for low-cost integrated sensor systems for automotive applications. The monolithic active antenna embedded in a synchronization network requires only 3.2/spl times/2.6 mm/sup 2/ chip size. Using subharmonic injection locking frequency tuning and stabilization is realized. With an injection power of 0 dBm we measured a tuning range of 300 MHz. To our knowledge, this is the first synchronizable monolithic integrated active antenna suited for automotive applications in the frequency band around 76.5 GHz.



Abstracts

A novel circularly polarized W-band direct detection receiver for six-port polarimetric radar systems

M.O. Thieme, R.H. Rasshofer, A. Stiller and E.M. Biebl. "A novel circularly polarized W-band direct detection receiver for six-port polarimetric radar systems." 1997 MTT-S International Microwave Symposium Digest 3. (1997 Vol. III [MWSYM]): 1269-1272.

A circularly polarized silicon integrated W-band direct detection receiver (DDR) for use in six-port polarimetric radar systems has been designed, numerically optimized and fabricated. The major advantage of the receiver is a novel low-loss, purely planar dual patch antenna (DPA) layout, which allows the receiver to be manufactured using monolithic integration. The measurement results for the receiver demonstrate a good cross polarization discrimination (XPD)>14 dB@76 GHz over a wide range of the scan angle (12 dB@/spl plusmn/20/spl deg/).



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A 155-GHz monolithic InP-based HEMT amplifier

H. Wang, R. Lai, Y.C. Chen, Y.L. Kok, T.W. Huang, T. Block, D. Streit, P.H. Liu, P. Siegel and B. Allen. "A 155-GHz monolithic InP-based HEMT amplifier." 1997 MTT-S International Microwave Symposium Digest 3. (1997 Vol. III [MWSYM]): 1275-1278.

This paper presents the development, of a three-stage 155-GHz monolithic low noise amplifier (LNA) using 0.1- μm pseudomorphic (PM) InAlAs/InGaAs/InP HEMT technology. This amplifier exhibits a measured small signal gain of 12 dB at 153-155 GHz, and more than 10-dB gain from 151 to 156 GHz. This is the highest frequency amplifier ever reported using three terminal devices.

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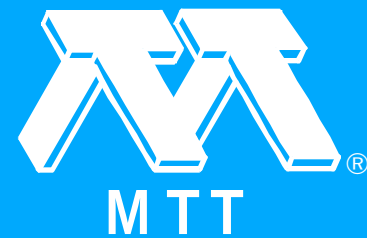


Abstracts

Full-waveguide band, 90 to 140 GHz, MMIC amplifier module

S. Weinreb, P.C. Chao and W. Copp. "Full-waveguide band, 90 to 140 GHz, MMIC amplifier module." 1997 MTT-S International Microwave Symposium Digest 3. (1997 Vol. III [MWSYM]): 1279-1280.

A six-stage, indium phosphide, monolithic integrated circuit amplifier has been fabricated and tested in a WR-8 waveguide mount. The amplifier has a gain of 15+/-3 dB in the frequency range of 90 to 140 GHz and a noise figure of 7.0 dB at 110 GHz.



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Compact monolithic coplanar 94 GHz front ends

W.H. Haydl, L. Verweyen, T. Jakobus, M. Neumann, A. Tessmann, T. Krems, M. Schlechtweg, W. Reinert, H. Massler, J. Rudiger, W. Bronner, A. Hulsmann and T. Fink. "Compact monolithic coplanar 94 GHz front ends." 1997 MTT-S International Microwave Symposium Digest 3. (1997 Vol. III [MWSYM]): 1281-1284.

Fully integrated W-band 94 GHz heterodyne receivers in coplanar 0.15 μm AlGaAs/InGaAs/GaAs PM-HEMT technology are described. The MMICs consist of a multistage low noise RF amplifier, a mixer, and an LO buffer amplifier. Balanced diode and single ended resistive HEMT mixers were investigated. A conversion gain of 13 dB and a DSB noise figure of 6.5 dB were obtained with a very compact 1/spl times/4 mm/sup 2/ front end MMIC, employing cascode amplifiers and balanced rat race diode mixer. The chip size is substantially less than that of any receiver chip published to date.

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Millimeter-wave waveguide-bandwidth cryogenically-coolable InP HEMT amplifiers

M.W. Pospieszalski, W.J. Lakatosh, E. Wollack, L.D. Nguyen, Minh Le, M. Lui and Takyiu Liu. "Millimeter-wave waveguide-bandwidth cryogenically-coolable InP HEMT amplifiers." 1997 MTT-S International Microwave Symposium Digest 3. (1997 Vol. III [MWSYM]): 1285-1288.

The design, construction and performance of 65-90 GHz and 75-110 GHz low-noise cryogenically-coolable amplifiers are presented. A comparison between modeled and measured performance is shown. A laboratory receiver exhibiting an average noise of 50 K across 65-90 GHz and 70 K across 75-110 GHz is described. These are the widest band and lowest noise HEMT receivers ever reported at these frequencies.

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Abstracts

Efficient modeling of microscopic and macroscopic noise behavior of submicron-highly-doped semiconductor devices at millimeter-wave frequencies

A. Abou-Elnour, D. Liebig and K. Schunemann. "Efficient modeling of microscopic and macroscopic noise behavior of submicron-highly-doped semiconductor devices at millimeter-wave frequencies." 1997 MTT-S International Microwave Symposium Digest 3. (1997 Vol. III [MWSYM]): 1289-1292.

An efficient rigorous physical simulator is developed to determine both microscopic and macroscopic noise behavior of submicron and highly doped semiconductor devices at millimeter-wave frequencies. The model is applied to determine the internally generated microscopic noise in the different device regions and their correlation with the externally measured noise fluctuations at the device terminals. Finally, both bias and frequency dependence of important noise parameters are extracted.



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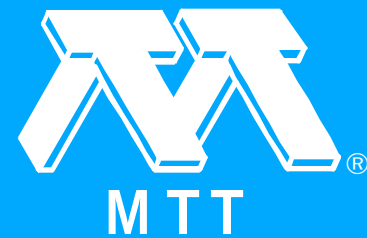


Abstracts

Design and characterization of FET based cold/hot noise sources

L.P. Dunleavy, M.C. Smith, S.M. Lardizabal, A. Fejzuli and R.S. Roeder. "Design and characterization of FET based cold/hot noise sources." 1997 MTT-S International Microwave Symposium Digest 3. (1997 Vol. III [MWSYM]): 1293-1296.

Innovative design, modeling, and characterization methods are described for FET cold noise sources. A developed InP HEMT cold/hot noise source demonstrates 105 K in the 18-22 GHz range; the highest reported frequency for a FET cold noise source. Measurements confirm variable source temperature from 105 K to over 1000 K.



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SiGe bipolar junction transistors for microwave power applications

*G.N. Henderson, M.F. O'Keefe, T.E. Boles, P. Noonan, J.M. Sledziewski and B.M. Brown.
"SiGe bipolar junction transistors for microwave power applications." 1997 MTT-S International Microwave Symposium Digest 3. (1997 Vol. III [MWSYM]): 1299-1302.*

High-efficiency silicon germanium (SiGe) bipolar junction transistors have been developed for 5-10 V, 1.88 GHz power amplifier applications. Class A-B biased common base parts have demonstrated a power gain $G_{\text{sub } p}=16$ dB, one-dB compression point $P_{\text{sub } 1\text{dB}}=25$ dBm and power-added-efficiency $\text{PAE}(P_{\text{sub } 1\text{dB}})=53\%$ at $V_{\text{sub } c}=5$ V and >1 W output power with >15 dB gain and $>50\%$ PAE at $V_{\text{sub } c}=10$ V. Common-emitter measurements ($V_{\text{sub } c}=7$ V) have demonstrated an output power of 28 dBm with greater than 60% collector efficiency. Under two-tone operation, the devices have achieved an output power of 23 dBm with 37% PAE at a third-order-intermodulation distortion of $\text{IM3}=30$ dBc. These results represent a significant improvement over conventional Si BJT's.

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High efficiency submicron gate LDMOS power FET for low voltage wireless communications

G. Ma, W. Burger, Xiaowei Ren, J. Gibson and M. Shields. "High efficiency submicron gate LDMOS power FET for low voltage wireless communications." 1997 MTT-S International Microwave Symposium Digest 3. (1997 Vol. III [MWSYM]): 1303-1306.

A low cost, high efficiency silicon MOSFET using 0.6 μm LDMOS (LV3) technology was developed in Motorola for high frequency (1-2 GHz) and low voltage (3.4-12.5 V) wireless applications. The LV3 devices can deliver 77% power added efficiency (PAE) with 12 dB gain, 28.7 dBm output power at 3.4 V and 850 MHz. The LV3 devices also can provide 70% PAE, 11 dB gain, 36 dBm Pout at 6 V, 850 MHz and 50% PAE, 9 dB gain, 33 dBm Pout at 5.8 V, 1.9 GHz. This is the best known RF performance for silicon devices at 3.4 V and 6 V.

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High-efficiency, small-chip AlGaAs/GaAs power HBTs for low-voltage digital cellular phones

N. Hayama, C.-W. Kim, H. Takahashi, N. Goto and K. Honjo. "High-efficiency, small-chip AlGaAs/GaAs power HBTs for low-voltage digital cellular phones." 1997 MTT-S International Microwave Symposium Digest 3. (1997 Vol. III [MWSYM]): 1307-1310.

A 61% power added efficiency (PAE), high linearity AlGaAs/GaAs power HBT with a very small chip size of 0.58/spl times/0.77 mm for use in personal digital cellular phones (PDC) is described. The device layout is optimized to reduce thermal resistance while maintaining a compact chip size. This power HBT, which has 60 fingers of 2/spl times/30 /spl mu/m emitter, exhibited 31.4 dBm output power and 61% power added efficiency with -51.7 dBc adjacent channel leakage power at a 50 kHz offset frequency under 1.5 GHz /spl pi//4-shifted QPSK modulation when operated at a low collector-emitter voltage of 3.4 V. These results satisfy Japan's PDC standard in a chip area that is less than 20% of that needed for a conventional GaAs power MESFET.



Abstracts

A 1.9 GHz variable gain linear power amplifier MMIC for PHS using novel cascaded MESFETs

M. Kimishima, K. Hayashi and M. Takahashi. "A 1.9 GHz variable gain linear power amplifier MMIC for PHS using novel cascaded MESFETs." 1997 MTT-S International Microwave Symposium Digest 3. (1997 Vol. III [MWSYM]): 1311-1314.

A GaAs power amplifier MMIC for 1.9 GHz Japanese digital cordless phone has been developed using novel cascaded MESFETs. The MMIC exhibits a gain of 32 dB, a power added efficiency of 37% at P-1 dB of 23.6 dBm, -64 dBc adjacent channel leakage power (ACP) at 600 kHz offset with 21 dBm output, and an operating voltage of 3 V. In addition, the ACP of less than -57 dBc is obtained at gain control of 0 dB to -14 dB remaining an output power of 21 dBm.



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An E-mode GaAs FET power amplifier MMIC for GSM phones

W. Abey, T. Kawai, I. Okamoto, M. Suzuki, C. Khandavalli, W. Kennan, Y. Tateno, M. Nagahara and M. Takikawa. "An E-mode GaAs FET power amplifier MMIC for GSM phones." 1997 MTT-S International Microwave Symposium Digest 3. (1997 Vol. III [MWSYM]): 1315-1318.

An enhancement-mode three stage GaAs FET power MMIC has been developed for single supply portable applications. The MMIC operates from a 4.8 V power supply and provides over 35 dBm output power from 890-915 MHz with more than 35 dB gain and 47% power added efficiency. Power control range is greater than 70 dB. Leakage current is 2 uA.

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A 2 W, 65% PAE single-supply enhancement-mode power PHEMT for 3 V PCS applications

Der-woei Wu, R. Parkhurst, Shyh-Liang Fu, J. Wei, Chung-Yi Su, Shih-Shun Chang, D. Moy, W. Fields, P. Chye and R. Levitsky. "A 2 W, 65% PAE single-supply enhancement-mode power PHEMT for 3 V PCS applications." 1997 MTT-S International Microwave Symposium Digest 3. (1997 Vol. III [MWSYM]): 1319-1322.

An enhancement-mode power PHEMT process has been developed for low-voltage wireless subscriber power amplifier applications. Employing a highly selective reactive ion etching process to define the vertical position of the Schottky gate, this device only requires a positive voltage. A 12-mm gate periphery device demonstrated 33 dBm output power (167 mW/mm), 14.7 dB power gain (16.7 dB linear gain), and 65.4% PAE at 3 V and 1.8 GHz.

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High efficiency, low adjacent channel leakage 2-V operation GaAs power MESFET amplifier for 1.9-GHz digital cordless phone system

M. Nagaoka, H. Wakimoto, K. Kawakyu, K. Nishihori, Y. Kitaura, T. Sasaki, A. Kameyama and N. Uchitomi. "High efficiency, low adjacent channel leakage 2-V operation GaAs power MESFET amplifier for 1.9-GHz digital cordless phone system." 1997 MTT-S International Microwave Symposium Digest 3. (1997 Vol. III [MWSYM]): 1323-1326.

A low-voltage GaAs power amplifier for 1.9-GHz digital mobile communication applications such as PHS handsets has been developed, using refractory WN_x/W self-aligned gate MESFETs with p-pocket layers. This power amplifier operates with a single low 2-V supply, and an output power of 21.0 dBm, a power gain of 22.3 dB, a low dissipated current of 162.9 mA and a high power-added efficiency of 38.5% were attained with a low 600-kHz adjacent channel leakage power of -58.0 dBc for 1.9-GHz /spl pi//4-shifted QPSK modulated input.





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Wavelength optimized electro-optic scanning of MMICs with Fabry-Perot enhancement

P.O. Muller, D. Erasme and B. Huyart. "Wavelength optimized electro-optic scanning of MMICs with Fabry-Perot enhancement." 1997 MTT-S International Microwave Symposium Digest 3. (1997 Vol. III [MWSYM]): 1329-1332.

We present a direct, internal electro-optic probing technique using a CW DFB laser diode. Optical Fabry-Perot resonance offers an immediate AM electro-optic signal. No polarization treatment of the probe beam is needed and a simplified fiber reinjection set-up is realized. During the scanning of MMICs, active wavelength control provides optimum measurement sensitivity.

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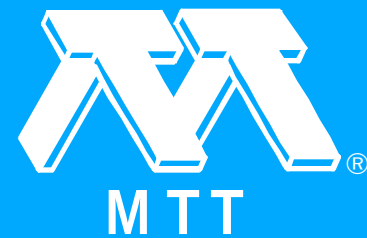


Abstracts

MM-wave near-field scanning resistivity microscope

M. Golosovsky and D. Davidov. "MM-wave near-field scanning resistivity microscope." 1997 MTT-S International Microwave Symposium Digest 3. (1997 Vol. III [MWSYM]): 1333-1334.

We have used a near field mm-wave scanning probe to image resistivity of different materials. We compare the near-field to the far-field imaging and find an optimal distance range for the near-field imaging.



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Abstracts

An SOLR calibration for accurate measurement of orthogonal on-wafer DUTs

S. Basu and L. Hayden. "An SOLR calibration for accurate measurement of orthogonal on-wafer DUTs." 1997 MTT-S International Microwave Symposium Digest 3. (1997 Vol. III [MWSYM]): 1335-1338.

Orthogonal CPW thru are notorious for generating undesired modes due to the bend discontinuity. These undesired modes are not accounted for in conventional calibration methods such as SOLT, LRM, and TRL, since they require, by definition, well-behaved thru standards. In this paper, we will demonstrate through experimental results how the Short-Open-Load-Reciprocal thru (SOLR) approach, which avoids imposing any dependency on the nature of the thru standard itself, provides a superior calibration.



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Abstracts

Coplanar waveguide technique for measurement of dielectric constant or thickness of dielectric films

M.K. Waldo, I. Kaufman and S. El-Ghazaly. "Coplanar waveguide technique for measurement of dielectric constant or thickness of dielectric films." 1997 MTT-S International Microwave Symposium Digest 3. (1997 Vol. III [MWSYM]): 1339-1342.

This paper presents results of an investigation aimed at using a coplanar waveguide resonator for virtually instantaneous measurement of the thickness or dielectric constant of insulating films on an open structure. Among possible applications are process monitoring, measurement of liquid films, and the detection of thin ice deposits on aircraft surfaces.



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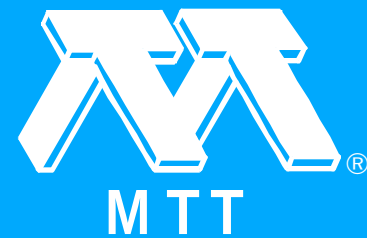


Abstracts

Permittivity characterization from transmission-line measurement

M.D. Janezic and D.F. Williams. "Permittivity characterization from transmission-line measurement." 1997 MTT-S International Microwave Symposium Digest 3. (1997 Vol. III [MWSYM]): 1343-1346.

We analyze three accurate broadband techniques for measuring the complex permittivity of dielectric substrates using coplanar waveguide transmission-line measurements and demonstrate good agreement with single-frequency cavity measurements.



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Abstracts

Complex permittivity measurements of extremely low loss dielectric materials using whispering gallery modes

J. Krupka, K. Derzakowski, A. Abramowicz, M. Tobar and R.G. Geyer. "Complex permittivity measurements of extremely low loss dielectric materials using whispering gallery modes." 1997 MTT-S International Microwave Symposium Digest 3. (1997 Vol. III [MWSYM]): 1347-1350.

Whispering-gallery modes are used for very accurate complex permittivity measurements of both isotropic and uniaxially anisotropic dielectric materials. A mode-matching technique is used to find the relationship between the complex permittivity, resonant frequency, and the dimensions of a resonant structure. The total uncertainty in permittivity is smaller than 0.05 percent and is limited principally by uncertainty in sample dimensions.



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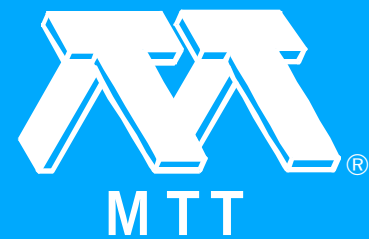
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Precision free-space measurements of complex permittivity of polymers in the W-band

G.L. Friedsam and E.M. Biebl. "Precision free-space measurements of complex permittivity of polymers in the W-band." 1997 MTT-S International Microwave Symposium Digest 3. (1997 Vol. III [MWSYM]): 1351-1354.

The complex permittivity of polymers used in millimeter wave systems has been determined by means of a broad-band free-space measurement system operating in the 75 GHz to 95 GHz frequency range. The technique is based on measurements of the complex transmission coefficient through planar samples for different angles of incidence and polarization states. Accurate estimates of the relative permittivity and loss tangent are obtained by employing an optimized measurement set-up and an enhanced processing of the measured data. The uncertainties of relative permittivity and loss tangent are as low as 0.1% and 2/spl times/10/sup -4/, respectively. Results are reported for nonpolar polymers (polypropylene, polyethylene, teflon, rexolite) and for polar polymers (nylon, plexiglas, PVC).

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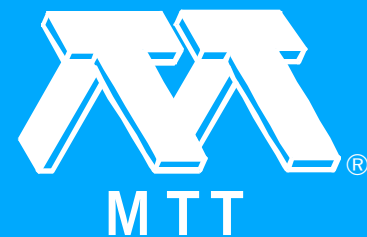


Abstracts

Measurement of transmittance and scattering of radome membranes from 30 to 1000 GHz (1997 Vol. III [MWSYM])

M.N. Afsar, I. Tkachov and T. Wells. "Measurement of transmittance and scattering of radome membranes from 30 to 1000 GHz (1997 Vol. III [MWSYM])." 1997 MTT-S International Microwave Symposium Digest 3. (1997 Vol. III [MWSYM]): 1355-1358.

Transmittance of a number of woven and non-woven radome membranes with various diameter of threads of the fabric and thickness of the laminate has been studied as a continuous function of frequency over the range 30-1000 GHz by utilizing Fourier Transform Spectroscopy. These woven and non-woven radome membranes were manufactured by W.L. Gore and Associates and known as "Gore-Tex". It is for the first time the transmittance has been measured with various angles of incidence of the incident wave. Strong diffractive scattering has been found above the frequency with wavelength comparable with period of the fabrics (240 GHz for the standard Gore-Tex product). Gore-Tex woven membrane materials are suitable for radome applications up to 1000 GHz.



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Finite-difference vector potential time-domain approach to the analysis of planar structures

N. Georgieva and E. Yamashita. "Finite-difference vector potential time-domain approach to the analysis of planar structures." 1997 MTT-S International Microwave Symposium Digest 3. (1997 Vol. III [MWSYM]): 1361-1364.

A time-domain finite-difference approach based on the expression of the field vectors by the vector potential functions is proposed for the analysis of planar structures. The algorithm is theoretically equivalent to the time-domain integral equations (TDIE) approach but is much faster because the calculation of the vector potentials is carried out by the finite-difference wave equation instead of integration. Still, integration can be involved when electrically remote objects are present. Only four tangential to the planar interfaces components of the vector potentials are calculated which makes this algorithm advantageous to the FDTD one in respect of storage requirements.

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Abstracts

Investigation of various H-shaped antennas with an ATLM field-solver

S. Lindenmeier, B. Bader and P. Russer. "Investigation of various H-shaped antennas with an ATLM field-solver." 1997 MTT-S International Microwave Symposium Digest 3. (1997 Vol. III [MWSYM]): 1365-1368.

In this contribution we investigate two variations of H-shaped planar antennas by using an ATLM field solver. The antennas are coupled in a different way to a microstrip feedline. The coupling is done alternatively by an aperture slot and a viahole. Using the ATLM method for antenna design, structures with finite metalization thickness and viaholes are modeled as easily as strictly planar structures. The calculated S-parameters of the antenna structures are compared to measured results.



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Unified analysis of quasi-TEM and higher order modes in planar transmission lines

C. Rieckmann, A.S. Omar and A. Jostingmeier. "Unified analysis of quasi-TEM and higher order modes in planar transmission lines." 1997 MTT-S International Microwave Symposium Digest 3. (1997 Vol. III [MWSYM]): 1369-1372.

TEM modes are shown to be derivable from a scalar magnetic potential $/\text{spl psi/}$ if the supporting transmission line can be considered a slot coupled waveguide with more than one coupling slot. The magnetic potential must jump at the coupling slots in order to give rise to the axial electric current on the strips separating these slots. The advantage of this formulation is its compatibility to the numerically efficient generalized spectral domain (GSD) technique which has already been used for the calculation of TE and TM modes in slot-coupled waveguides. Substrates are taken into account by applying the eigenmode transformation technique. Numerical results are presented for TEM modes in multi-slot lines and for quasi-TEM and higher order modes in coplanar waveguides. Excellent agreement with the results obtained by other methods have been achieved with moderate cpu time and storage requirements.

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Global edge-conditioned basis functions from local solutions of Maxwell's equations

S. Amari, A. Motamedi, J. Bornemann and R. Vahldieck. "Global edge-conditioned basis functions from local solutions of Maxwell's equations." 1997 MTT-S International Microwave Symposium Digest 3. (1997 Vol. III [MWSYM]): 1373-1376.

A new set of edge-conditioned basis functions for the moment method solutions of electromagnetic problems is introduced. The basis functions are themselves solutions to the differential forms of Maxwell's equations and satisfy the local boundary conditions at metallic wedges. Numerical results using this new set are presented and compared with available data for a ridged rectangular waveguide to demonstrate its adequacy. An efficient technique to compute integrals of rapidly oscillating and singular integrands is also presented.

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Abstracts

Circuit based model for coupling between MMICs in multi-chip assemblies

R.W. Jackson and Zhaoyang Wang. "Circuit based model for coupling between MMICs in multi-chip assemblies." 1997 MTT-S International Microwave Symposium Digest 3. (1997 Vol. III [MWSYM]): 1377-1380.

This paper describes a circuit model for the approximate determination of the coupling between MMICs in a multichip module. The model is developed from basic electromagnetics and relies on averages of the currents on the various MMICs. The technique is suitable for use in layout based circuit simulators and uses no numerical electromagnetics.



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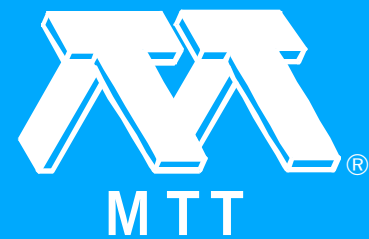
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Nonlinear PML for absorption of nonlinear electromagnetic waves

Jian-Guo Ma, Jian Xu and Zhizhang Chen. "Nonlinear PML for absorption of nonlinear electromagnetic waves." 1997 MTT-S International Microwave Symposium Digest 3. (1997 Vol. III [MWSYM]): 1381-1384.

Nonlinear time-domain numerical modeling requires the development of absorbing boundary conditions to effectively absorb the nonlinear electromagnetic waves. In this paper, based on Berenger's PML (1994), the nonlinear perfectly matched layer (nPML) absorbing condition is developed and implemented in the recently proposed TLM-based FDTD method. Numerical results show the effectiveness of the nPML. The proposed nPML scheme can also be implemented in other FDTD schemes.

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Radio architecture of a wideband DS-CDMA testbed for future cellular systems

W. Anzill and T. Melander. "Radio architecture of a wideband DS-CDMA testbed for future cellular systems." 1997 MTT-S International Microwave Symposium Digest 3. (1997 Vol. III [MWSYM]): 1387-1390.

The radio implementation of a wideband test system which has been developed by Ericsson is described. With the testbed, wireless multimedia service investigations for UMTS/FPLMTS can be done under field conditions. The system architecture provides a flexible air interface where new services can easily be introduced. Already implemented services are high quality speech with fixed or variable data rates as well as high data rate transmissions for video, Internet or other TCP/IP data applications. The high data rates and the flexibility of applications result in new demands for the radio architecture and for key components, like digital-to-analog and analog-to-digital converters and power amplifiers. This paper provides a system overview describing some applications and a more detailed description of the radio architecture of the wideband testbed. Finally measurements of the data throughput and of the radio channel are shown.

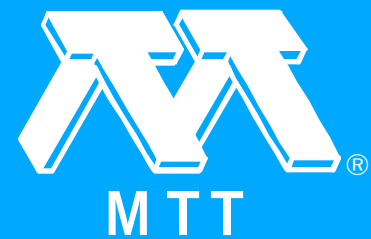


Abstracts

Mobitex PC card wireless modem

*S. Moghe, J. Stone, S. Stratmoen, S. Consolazio, K. Rausch, S. Geske and M. Patel.
"Mobitex PC card wireless modem." 1997 MTT-S International Microwave Symposium Digest
3. (1997 Vol. III [MWSYM]): 1391-1394.*

Northrop Grumman Corporation has developed a Type II extended PC card wireless modem that operates at 900 MHz over the nationwide Mobitex wireless data network and incorporates a conventional 14.4 kbps wireline modem, as well as cellular network access capability. The modem enables notebook computer and PDA users to send and receive electronic mail and data wirelessly. Gallium Arsenide (GaAs) monolithic microwave integrated circuit (MMIC) and Silicon application specific integrated circuit (ASIC) technology made it possible to implement complex high performance functions in a small size. A second generation modem using low temperature cofired ceramic (LTCC) and Ball Grid Array (BGA) packaging technologies is under development.



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A low cost 16.2 GHz phase locked oscillator for wireless LAN

T.A. Bos, F. Bayer and U. Lott. "A low cost 16.2 GHz phase locked oscillator for wireless LAN." 1997 MTT-S International Microwave Symposium Digest 3. (1997 Vol. III [MWSYM]): 1395-1398.

For wireless LAN applications and the wireless ATM network demonstrator system "Magic WAND", a phase locked oscillator was built with standard, low cost components. Although a simple architecture is chosen, the oscillator has a phase noise of -87 dBc/Hz at 10 kHz frequency offset and an output power of 0 dBm at 16.2 GHz. By changing the reference frequency, the output frequency can be tuned from 15.61 GHz to 16.34 GHz without degradation of the phase noise.



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A true enhancement mode single supply power HFET for portable applications

E. Glass, J.-H. Huang, J. Abrokwa, B. Bernhardt, M. Majerus, E. Spears, R. Droopad and B. Ooms. "A true enhancement mode single supply power HFET for portable applications." 1997 MTT-S International Microwave Symposium Digest 3. (1997 Vol. III [MWSYM]): 1399-1402.

A true enhancement mode heterojunction FET has been developed for low voltage, high efficiency power amplifier applications. A 12 mm wide/spl times/1.0 /spl mu/m gate length device-with no additional circuitry-and only a single voltage supply of 3.5 V exhibited a power output of +31.5 dBm with 75% power-added efficiency at a power gain of 11.6 dB at 850 MHz.



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3.4 V operation 1 W MMIC power amplifier with SrTiO/sub 3/ capacitors for digital cellular phones

K. Yamaguchi, T.B. Nishimura, N. Iwata, K. Takemura, M. Kuzuhara and Y. Miyasaka. "3.4 V operation 1 W MMIC power amplifier with SrTiO/sub 3/ capacitors for digital cellular phones." 1997 MTT-S International Microwave Symposium Digest 3. (1997 Vol. III [MWSYM]): 1403-1406.

This paper describes 950 MHz power performance of a two-stage MMIC amplifier utilizing n-AlGaAs/InGaAs/n-AlGaAs FETs and SiTiO/sub 3/ capacitors. Under 3.4 V drain bias operation, the MMIC with 2.0/spl times/2.4 mm/sup 2/ area delivered a /spl pi//4-shifted QPSK output signal of 0.8 W (29.0 dBm), a power-added efficiency (PAE) of 30% and an associated gain of 26.4 dB with an adjacent channel leakage power at 50 kHz off-center frequency of -50.5 dBc. It also achieved a saturated output power of 1.1 W with PAE of 39%.



Abstracts

A S-band push-pull 60-watt GaAs MESFET for MMDS applications

G. Sarkissian, R. Basset, Z. Shingu and F. Ono. "A S-band push-pull 60-watt GaAs MESFET for MMDS applications." 1997 MTT-S International Microwave Symposium Digest 3. (1997 Vol. III [MWSYM]): 1409-1412.

A new 2.5-2.7 GHz High-Power GaAs FET for the MMDS application is presented. It uses two pairs of pre-matched chips mounted on the same carrier and combined in push-pull configuration with a microstrip balun. This device exhibits 60 W of output power with 11.0 dB of gain. This is the highest power reported for such a device.



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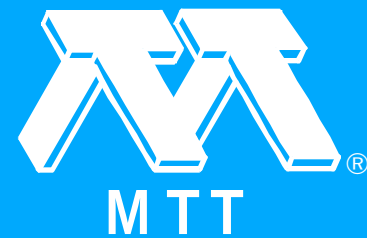


Abstracts

60W L-band power AlGaAs/GaAs heterostructure FETs

J. Morikawa, K. Asano, K. Ishikura, H. Oikawa, M. Kanamori and M. Kuzuhara. "60W L-band power AlGaAs/GaAs heterostructure FETs." 1997 MTT-S International Microwave Symposium Digest 3. (1997 Vol. III [MWSYM]): 1413-1416.

This paper describes DC and RF power performance of a newly-developed high-power AlGaAs/GaAs heterostructure FET (HFET) designed for L-band SSPA applications. A push-pull power amplifier, composed of two HFET chips, demonstrated state-of-the-art power performance of 60 W output-power with a power-added efficiency (PAE) of 54% at 1.5 GHz.



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High efficiency S-band 30 W power GaAs FETs

I. Takenaka, H. Takahashi, K. Asano, J. Morikawa, K. Ishikura, M. Kanamori, M. Kuzuhara and H. Tsutsui. "High efficiency S-band 30 W power GaAs FETs." 1997 MTT-S International Microwave Symposium Digest 3. (1997 Vol. III [MWSYM]): 1417-1420.

An S-band high-efficiency power GaAs MESFET has been developed by employing the second-harmonic terminating technique in both the input and output matching circuits. This internally matched power FET demonstrates state-of-the-art performance of 30.9 W (44.9 dBm) output power with more than 60% power-added efficiency and a 15.0 dB linear gain at 2.5 GHz. Successful termination of the second-harmonic was confirmed by measuring gate and drain voltage waveforms using EOS (Electro-Optic Sampling). This amplifier can be assembled in conventional ceramic package, and thus is suitable for satellite communication system applications.

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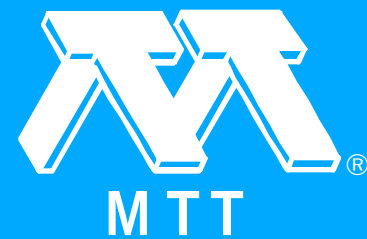


Abstracts

High efficiency 11 watt octave S/C-band PHEMT MMIC power amplifier

J.J. Komiak, S.C. Wang and T.J. Rogers. "High efficiency 11 watt octave S/C-band PHEMT MMIC power amplifier." 1997 MTT-S International Microwave Symposium Digest 3. (1997 Vol. III [MWSYM]): 1421-1424.

Design and performance of 0.25 μm double fully selective recess PHEMT power amplifiers that have established new benchmarks for octave band power and efficiency are reported. The amplifiers tested from two lots, ten wafers total, average 11 Watts at 42% PAE with 17 dB power gain from 3 to 6 GHz, with peak performance of 17 Watts at 54.5% PAE and yields of 49.9%.



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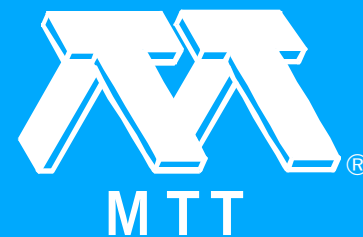


Abstracts

A 15-watt dual band HBT MMIC power amplifier

M.R. DeHaan, M. Jones, G. Wilcox, J. McLeod and S.C. Miller. "A 15-watt dual band HBT MMIC power amplifier." 1997 MTT-S International Microwave Symposium Digest 3. (1997 Vol. III [MWSYM]): 1425-1427.

A monolithic HBT power amplifier is presented for S and C band applications. The amplifier provides greater than 15 watts of peak output power at S and C bands with approximately 18 dB of gain. The amplifier also provides a minimum of 10 watts output power across the entire frequency range that encloses both bands.



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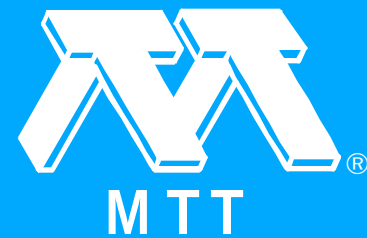


Abstracts

A 6-18 GHz broadband high power MMIC for EW applications

A.R. Barnes, M.T. Moore and M.B. Allenson. "A 6-18 GHz broadband high power MMIC for EW applications." 1997 MTT-S International Microwave Symposium Digest 3. (1997 Vol. III [MWSYM]): 1429-1432.

A three stage, 6-18 GHz, dual channel MMIC power amplifier has been designed and tested. The design has been fabricated using a 0.25 μm T-gate, MBE grown GaAs-InGaAs-AlGaAs, power PHEMT process at Texas Instruments. The measured single channel small signal gain is 24.1/spl plusmn/3.4 dB over 6-18 GHz with an input return loss of >12 dB. The single channel output power at 2 dB gain compression, over 6-18 GHz is 3.4/spl plusmn/1.1 Watts pulsed and 2.4/spl plusmn/1.1 Watts CW. Using off chip combiners the dual channel amplifier gives 5.1/spl plusmn/1.3 Watts pulsed, 4.3/spl plusmn/1.3 Watts CW with a small signal gain of 24 dB/spl plusmn/3.5 dB over 6-18 GHz.



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Push-pull power amplifiers in the X band

S. Toyoda. "Push-pull power amplifiers in the X band." 1997 MTT-S International Microwave Symposium Digest 3. (1997 Vol. III [MWSYM]): 1433-1436.

Two types of class C push-pull power amplifiers for the X band are newly devised. In these amplifiers, tuning type amplifiers are constructed using TE/sub 01/spl delta// mode dielectric resonators, and phase inverting circuits which are necessary at the input and output sides of the push-pull power amplifiers are also constructed using the TE/sub 01/spl delta// mode dielectric resonators. The experiment was performed for the two amplifiers. The operating frequency of the first amplifier was 12.4 GHz, the output power was 37.2 dBm, and the power added efficiency was 75%. For the second amplifier, the operating frequency was 11.2 GHz, the output power was 46 dBm, and the power added efficiency of 77% was attained.

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W-band measurements of 100 /spl mu/m height micro-machined air-filled rectangular waveguides

C.E. Collins, J.W. Digby, R.D. Pollard, R.E. Miles, G.M. Parkhurst, J.M. Chamberlain, D.P. Steenson, N.J. Cronin, L.S. Karatzas and J.W. Bowen. "W-band measurements of 100 /spl mu/m height micro-machined air-filled rectangular waveguides." 1997 MTT-S International Microwave Symposium Digest 3. (1997 Vol. III [MWSYM]): 1439-1442.

The first S-parameter measurements of micro-machined 100 /spl mu/m high air-filled rectangular waveguides are reported, which have been performed at W-band using a specially designed test fixture connected to a standard vector network analyser. The results obtained show low loss and demonstrate propagation in TE/sub 10/ mode.

Click on title for a complete paper.



Abstracts

Broadband noise parameter and S-parameter measurement technique

M.L. Schmatz and W. Baechtold. "Broadband noise parameter and S-parameter measurement technique." 1997 MTT-S International Microwave Symposium Digest 3. (1997 Vol. III [MWSYM]): 1443-1446.

An accurate noise parameter measurement technique is presented that uses an amplifier/attenuator noise source, a multi-octave tuner and a directional coupler for noise injection at all tuner states. The presented concept allows measurements with more than 30 different ENR steps and the ability to calibrate the ENR during system calibration. A system that demonstrates the concept was built for the frequency range from 0.5-6.0 GHz.



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Abstracts

Determination of wave noise sources using spectral parametric modeling (1997 Vol. III [MWSYM])

T. Werling, E. Bourdel, D. Pasquet and A. Boudiaf. "Determination of wave noise sources using spectral parametric modeling (1997 Vol. III [MWSYM])." 1997 MTT-S International Microwave Symposium Digest 3. (1997 Vol. III [MWSYM]): 1447-1450.

We measure transistor noise power density and compute the Fourier's transform. Finally, spectral parametric modeling is used to extract noise waves correlation matrix. Results obtained by this new method has been experimentally compared with a conventional method.



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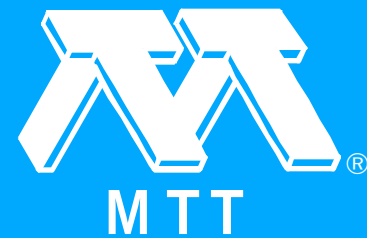


Abstracts

High speed noise power ratio measurement techniques on rf power amplifiers

W.G. Vaillancourt and S.E. Yates. "High speed noise power ratio measurement techniques on rf power amplifiers." 1997 MTT-S International Microwave Symposium Digest 3. (1997 Vol. III [MWSYM]): 1451-1454.

The Noise Power Ratio (NPR) measurement is a growing requirement for power amplifiers used in the wireless and satellite industries. This measurement is time consuming and difficult to implement in a high volume production environment. A high speed NPR measurement technique is presented and compared to traditional manual NPR measurements.



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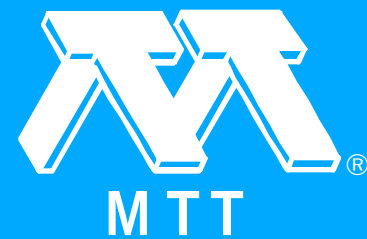


Abstracts

A dynamic AM/AM and AM/PM measurement technique

A.A. Moulthrop, C.J. Clark, C.P. Silva and M.S. Muha. "A dynamic AM/AM and AM/PM measurement technique." 1997 MTT-S International Microwave Symposium Digest 3. (1997 Vol. III [MWSYM]): 1455-1458.

The AM/AM and AM/PM characteristics of a power amplifier are typically measured in a static manner using a CW signal. For communications signals, the amplitude envelope is varying so the distortion is actually occurring dynamically. This paper presents a technique to measure dynamic AM/AM and AM/PM. Results are presented for two examples of power amplification: a traveling-wave tube amplifier and a solid-state amplifier.



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Abstracts

A broadband heterodyne measurement setup for active millimeter wave integrated antennas

R.H. Rasshofer, A. Stiller, M.O. Thieme, H. Schulz and E.M. Biebl. "A broadband heterodyne measurement setup for active millimeter wave integrated antennas." 1997 MTT-S International Microwave Symposium Digest 3. (1997 Vol. III [MWSYM]): 1459-1462.

A novel heterodyne measurement setup for the characterization of circularly or elliptically polarized active millimeter wave antennas is presented. The major advantages of this setup are a very broad bandwidth from 75 to 110 GHz, a dynamic range of more than 50 dB and a cross-polarization purity of about 30 dB. This setup has been applied to characterize a circularly polarized active patch antenna. Numerically calculated and measured results of the antenna performance are compared.



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GaAs HBT profile optimization using the Taguchi method

G.N. Henderson and Der-woei Wu. "GaAs HBT profile optimization using the Taguchi method." 1997 MTT-S International Microwave Symposium Digest 3. (1997 Vol. III [MWSYM]): 1465-1468.

A method is presented for quantitatively optimizing HBT performance using a combination of physical and equivalent circuit models in the design-of-experiments framework. An optimized profile was designed which demonstrated over 4 dB improvement in G_{max} at 10 GHz (over the M/A-COM baseline process) without resorting to reduced device dimensions and/or a thin base layer.





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Bias and temperature dependent noise modeling of HBTs

T. Daniel. "Bias and temperature dependent noise modeling of HBTs." 1997 MTT-S International Microwave Symposium Digest 3. (1997 Vol. III [MWSYM]): 1469-1472.

This paper presents a detailed model which accurately predicts the bias and temperature dependent noise characteristics of AlGaAs/GaAs heterojunction bipolar transistors (HBTs). The features introduced to the intrinsic noise model are the following: (i) correlation of the noise sources and (ii) the frequency dependency of the noise sources. Compared to the present noise models, this study provides significant improvement in predicting small signal and large signal noise for HBT based circuits. These models can be implemented easily into any SPICE or harmonic balance simulators. The results of this study are validated using devices from different foundries.

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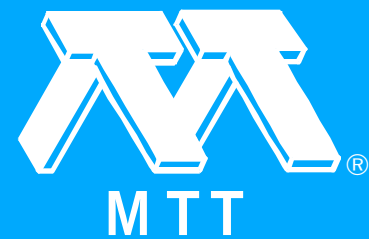


Abstracts

Transmission line model of the distributed heterojunction bipolar transistor

L.L. Liou. "Transmission line model of the distributed heterojunction bipolar transistor." 1997 MTT-S International Microwave Symposium Digest 3. (1997 Vol. III [MWSYM]): 1473-1476.

The distributed nature of heterojunction bipolar transistor was modeled using the transmission line method. Admittances due to the bipolar junction, base metal Schottky contact, base and emitter contact resistances, were taken into account. Coupled differential equations describing the distributed nature of the junction potentials were derived. A numerical scheme was developed to solve the equations, and microwave parameters were calculated. The model can be applied to design HBT layouts for high microwave performance.



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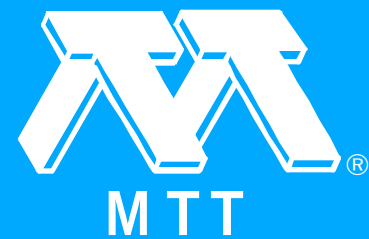


Capacitance topology for high frequency modeling of bipolar transistors

A.A. Ciubotaru and R.L. Carter. "Capacitance topology for high frequency modeling of bipolar transistors." 1997 MTT-S International Microwave Symposium Digest 3. (1997 Vol. III [MWSYM]): 1477-1480.

The standard SPICE Gummel-Poon model for bipolar transistors in the case of current crowding is inaccurate at high frequencies primarily due to the position of the capacitances. An improved distributed bipolar transistor model is developed, with fractions of both the depletion and the diffusion capacitances placed outside the base spreading resistance and the transistor junctions. The model is contrasted with the standard model by comparing the high frequency characteristics for an HBT.





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Electrothermal simulation of HBT by TLM method with quasi two dimensional model

Jinjin Shen, Kangsheng Chen and Zhikun Xie. "Electrothermal simulation of HBT by TLM method with quasi two dimensional model." 1997 MTT-S International Microwave Symposium Digest 3. (1997 Vol. III [MWSYM]): 1481-1484.

Presents an improved quasi two dimensional model incorporating depletion-layer approximation to simulate electrothermal properties of HBT. In the model the temperature profile and minority carrier distributions are numerically simulated by transmission line matrix (TLM) method. The results show that this model can conveniently simulate the electrothermal effects under the efficient reduction both in CPU time and memory space.

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A physics-based electro-thermal model for microwave and millimetre wave HEMTs

R.G. Johnson, C.M. Snowden and R.D. Pollard. "A physics-based electro-thermal model for microwave and millimetre wave HEMTs." 1997 MTT-S International Microwave Symposium Digest 3. (1997 Vol. III [MWSYM]): 1485-1488.

An electro-thermal physical model is described for HEMT microwave and millimetre wave simulations which includes temperature effects due to self-heating within the device. Comparisons of the results from the model with measured data are made and it is found that good agreement is obtained without fitting of any of the parameters. The model is compatible with CAD requirements and is particularly suited to large-signal applications.

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Magnetically tunable superconducting microstrip resonators using yttrium iron garnet single crystals

M. Tsutsumi and T. Fukusako. "Magnetically tunable superconducting microstrip resonators using yttrium iron garnet single crystals." 1997 MTT-S International Microwave Symposium Digest 3. (1997 Vol. III [MWSYM]): 1491-1494.

A magnetically tunable microstrip superconducting resonator using an yttrium iron garnet (YIG) single crystal was demonstrated experimentally. Tunability of 200 MHz at a center frequency of 5.3 GHz was observed, and a quality factor of 965 with minimum insertion loss of 19.5 dB was measured for a half-wavelength microstrip line consisting of a YIG-YBCO-MgO composite structure. The dispersion relation of the resonator was analyzed using the spectral domain method and discussed with experimental results on the mixed states of TEM and magnetostatic wave modes.

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Abstracts

Analytic design of high efficiency harmonic loading oscillator using harmonic two signal method

Moon-Que Lee, Sangwook Nam, Youngwoo Kwon and Kyung-Whan Yeom. "Analytic design of high efficiency harmonic loading oscillator using harmonic two signal method." 1997 MTT-S International Microwave Symposium Digest 3. (1997 Vol. III [MWSYM]): 1495-1498.

A 61% DC-to-RF conversion efficiency oscillator with very low bias of 2.0 V is designed in 1.86 GHz. To obtain maximum DC-to-RF conversion efficiency, DC operating point is chosen in class AB with the second harmonic loading. The maximum efficiency and output power are analyzed and predicted very fast through a novel HTSM (Harmonic Two Signal Method) under class AB or B bias condition. Harmonic components effects on the oscillators, self-oscillating condition, and DC current change as the RF drive level are also analyzed through HTSM.



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Simplified nonquasi-static FET modelling approach experimentally validated up to 118.5 GHz

M. Fernandez-Barciela, P.J. Tasker, M. Demmler, Y. Campos-Roca, H. Messler, E. Sanchez, C. Curras-Francos and M. Schlechtweg. "Simplified nonquasi-static FET modelling approach experimentally validated up to 118.5 GHz." 1997 MTT-S International Microwave Symposium Digest 3. (1997 Vol. III [MWSYM]): 1499-1502.

In this paper two similar simplified nonquasi-static approaches are applied for high-frequency large-signal FET prediction. Both account for low-frequency dispersion and use a simplified extraction process through the use of linear delays. Excellent results are obtained from dc up to the device $f_{\text{sub T}}$ frequencies, even when $f_{\text{sub T}}$ is 120 GHz. For low-frequency prediction a simple quasi-static extrinsic approach can produce excellent results thus further simplifying modelling. The influence of including the low-frequency dispersion modelling is also taken into account.

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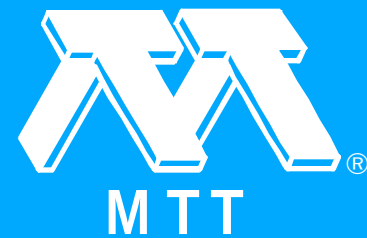


Abstracts

A charge model of step recovery diode for CAD

K. Opalska and J. Baranowski. "A charge model of step recovery diode for CAD." 1997 MTT-S International Microwave Symposium Digest 3. (1997 Vol. III [MWSYM]): 1503-1506.

A physics-based, numerically efficient model of Step Recovery Diode (SRD) is presented. The model, based on partitioning of charge in the diode base into sections, has been implemented in generic circuit simulators and tested in simulations of variety of pulse circuits. It has been also verified by comparison of measurement data and model analysis results. The verification confirmed the model ability to represent accurately SRD pulse behaviour for a wide range of diode operating conditions.



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Abstracts

Iterative solution of linear systems in harmonic balance analysis

M.M. Gourary, S.G. Rusakov, S.L. Ulyanov, M.M. Zharov, K.K. Gullapalli and B.J. Mulvaney. "Iterative solution of linear systems in harmonic balance analysis." 1997 MTT-S International Microwave Symposium Digest 3. (1997 Vol. III [MWSYM]): 1507-1510.

Harmonic balance (HB) is a steady-state simulation technique of primary interest for RF and microwave circuits. Krylov subspace methods promise efficient solution of the large linear systems that arise in HB simulators. This paper deals with an experimental investigation of GMRES and QMR, two leading Krylov subspace methods as applied to the HB problem. The problem of coordinating the linear solver's accuracy with the error at the nonlinear level is also discussed.



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Nonlinear dynamic modeling of micromachined microwave switches

E.K. Chan, E.C. Kan, R.W. Dutton and P.M. Pinsky. "Nonlinear dynamic modeling of micromachined microwave switches." 1997 MTT-S International Microwave Symposium Digest 3. (1997 Vol. III [MWSYM]): 1511-1514.

Nonlinear dynamic lumped models of micromachined microwave switches have been formulated and successfully applied to analyses of transient characteristics and geometrical scaling. Parameter extraction through electrical measurements is summarized. The results are compared to transient quasi-2D simulations.

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Abstracts

A pulsed-measurement based electrothermal model of HBT with thermal stability prediction capabilities

T. Peyretailade, M. Perez, S. Mons, R. Sommet, P. Auxemery, J.C. Lalaurie and R. Quere. "A pulsed-measurement based electrothermal model of HBT with thermal stability prediction capabilities." 1997 MTT-S International Microwave Symposium Digest 3. (1997 Vol. III [MWSYM]): 1515-1518.

In this paper, a new electrothermal non linear model of HBT suitable for CAD purposes is presented. This model is fully determined by pulsed measurement techniques and for the first time, it is shown that the prediction of thermal instabilities (collapse of current gain) is obtained from the CAD model. The model has been validated both by DC and RF load-pull measurements.



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Analysis and design of feedforward power amplifier

Sang-Gee Kang, Il-Kyoo Lee and Ki-Suk Yoo. "Analysis and design of feedforward power amplifier." 1997 MTT-S International Microwave Symposium Digest 3. (1997 Vol. III [MWSYM]): 1519-1522.

A linear power amplifier is particularly emphasized on the system using a linear modulation scheme, because intermodulation distortion which causes adjacent channel interference and co-channel interference is mostly generated in a nonlinear power amplifier. In this paper, parameters of a linearization loop, such as an amplitude imbalance, a phase imbalance and a delay mismatch, are fully analyzed to get a specific cancellation performance and linearization bandwidth. Experimental results are presented for Korea PCS frequency band. The center frequency of the feedforward amplifier is 1.855 GHz with 30 MHz bandwidth. The cancellation performance of the first linearization loop is more than 40 dB and intermodulation cancellation performance of feedforward amplifier is more than 35 dB.





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Mode computation in long tapered multi-cell linear accelerator structures using the GSM method

M. Dohlus, A. Jostingmeier, A.S. Omar and C. Rieckmann. "Mode computation in long tapered multi-cell linear accelerator structures using the GSM method." 1997 MTT-S International Microwave Symposium Digest 3. (1997 Vol. III [MWSYM]): 1523-1526.

For a proper design of linear colliders it is important to know the resonant modes corresponding to higher order dipole passbands of long tapered multi-cell structures. Grid-oriented codes, as, for example, the MAFIA program package, cannot be used for the analysis of such structures. In this contribution, the accurate and numerical efficient generalized scattering matrix method is applied to the computation of these modes. The sixth dipole passband of the 180-cell accelerating structure used for the S-band linear collider at DESY is extensively being investigated with the proposed method. The calculations predict that this passband is especially dangerous for a stable operation of the collider which will lead to a change of the current structure design. The validity of the developed code is confirmed by comparing the results which have been obtained from the MAFIA program package for a 36-cell structure with those of our method. Furthermore a special numerical technique is suggested allowing a reliable computation of the so-called trapped modes which often occur in tapered multi-cell structures.

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Hybrid FEM analysis of thick CPW discontinuities with nonrectangular cross section

Fang-Lih Lin and Ruey-Beei Wu. "Hybrid FEM analysis of thick CPW discontinuities with nonrectangular cross section." 1997 MTT-S International Microwave Symposium Digest 3. (1997 Vol. III [MWSYM]): 1527-1530.

In this paper, a hybrid finite element method is proposed to analyze the coplanar waveguide discontinuities with finite metallization thickness and nonrectangular cross section. It has been shown that not only the metallization thickness but also the conductor edge profile can produce noticeable effects on circuit performance and should be taken into account for accurately modeling the coplanar waveguide discontinuities.





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Practical metal loss implementation for a microstrip line structure using SIBC in FDTD simulation

E. Takagi, B. Houshmand and T. Itoh. "Practical metal loss implementation for a microstrip line structure using SIBC in FDTD simulation." 1997 MTT-S International Microwave Symposium Digest 3. (1997 Vol. III [MWSYM]): 1531-1534.

Metal transmission loss of a microstrip line was calculated by FDTD simulation using surface impedance boundary condition (SIBC) technique. Calculated results were compared to measurement results. Proper SIBC implementation in FDTD simulation produced good results, even if coarse grids were used for a microstrip line structure.

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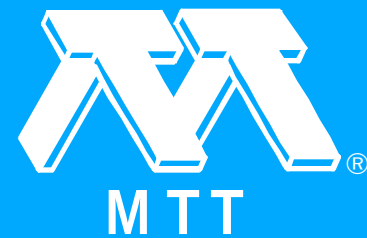


Abstracts

MICs in a multilayer dielectric media in a rectangular waveguide

O.M.C. Pereira Filho and T.K. Sarkar. "MICs in a multilayer dielectric media in a rectangular waveguide." 1997 MTT-S International Microwave Symposium Digest 3. (1997 Vol. III [MWSYM]): 1535-1538.

This paper describes a full-wave analysis of MICs in a multilayer dielectric media in a rectangular waveguide. The analysis combines the Spectral Domain approach with residue theory and the contour integration method to accurately evaluate the impedance matrix of the method of moments.



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Second order nonuniform grid spacing in the FDTD technique

M. Falconer and V. Tripathi. "Second order nonuniform grid spacing in the FDTD technique." 1997 MTT-S International Microwave Symposium Digest 3. (1997 Vol. III [MWSYM]): 1539-1542.

A second order accurate nonuniform technique for FDTD simulations which does not depend on supraconvergence is presented. The technique is useful for FDTD simulations with nonuniform grid spacings for systems which require finer details in small regions of the simulation space.

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FDTD method with a conformal polygonal mesh and perfectly matched layer absorbing boundary condition

K. Naishadham and Zhian Lin. "FDTD method with a conformal polygonal mesh and perfectly matched layer absorbing boundary condition." 1997 MTT-S International Microwave Symposium Digest 3. (1997 Vol. III [MWSYM]): 1543-1546.

The accuracy of the finite-difference time-domain (FDTD) method in microwave circuit simulation depends significantly on the accuracy with which the computational grid resolves the structure's geometry, especially when it has curved boundaries (e.g., dielectric resonator filters). Body-conformal grids allow for accurate resolution of the object, but complicate the implementation of absorbing boundary conditions (ABC). In order to address this conflict, we propose a new FDTD implementation in which triangular grids are used near the scatterer boundary, while rectangular grids are employed away from the scatterer to facilitate simple ABC. The improvement in accuracy by the new method is illustrated by its application to the scattering from a circular dielectric cylinder.

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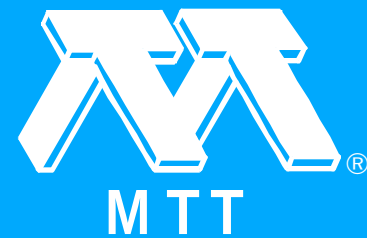


Abstracts

A S/V potential method for Maxwell's equations near corners using nodal elements

W.E. Boyse and K.D. Paulsen. "A S/V potential method for Maxwell's equations near corners using nodal elements." 1997 MTT-S International Microwave Symposium Digest 3. (1997 Vol. III [MWSYM]): 1547-1550.

A new method is presented for obtaining accurate solutions to time harmonic Maxwell's equations when sharp corners are present. It uses a new formulation of the impedance boundary condition which includes the scalar potential in such a way that boundary conditions are satisfied exactly.



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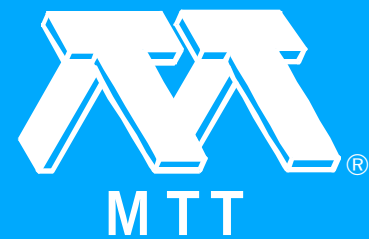


Abstracts

New 3D low loss, wide band microwave interconnection

P. Monfraix, A. Coello Vera, O. Llopis, P. Ulian, S. George, C. Drevon, C. Tronche and J. Graffeuil. "New 3D low loss, wide band microwave interconnection." 1997 MTT-S International Microwave Symposium Digest 3. (1997 Vol. III [MWSYM]): 1551-1554.

This paper describes a new wide band [0; 40 GHz] vertical interconnection approach between two RF homogeneously grounded coplanar lines. It can be considered as two 90/spl deg/ vertical bends transition. Both electromagnetic simulation and measurement demonstrate very good results on the whole frequency range.



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Time-domain (transient) analysis of capacitive Jaumann absorbers

A. Cheldavi and M. Kamarei. "Time-domain (transient) analysis of capacitive Jaumann absorbers." 1997 MTT-S International Microwave Symposium Digest 3. (1997 Vol. III [MWSYM]): 1555-1558.

Capacitive Jaumann Absorbers (C.J.A.) are widely used as electromagnetic wave absorbers in several applications, because in addition to bandwidth expanding, they reduce the spacing between sheets for specified bandwidth. Time-domain analysis of N-sheet C.J.A. and an optimum design for N (arbitrary)-sheet capacitive Jaumann electromagnetic (EM) absorber, using genetic algorithm will be presented. This algorithm is a random optimization method based on the genetic relation in the human being. We show that by using this algorithm and without imposing the double-notch design criteria the bandwidth of one or two-sheet C.J.A. can be expanded even more than 108% shown by Knott (1995). We also show that our results approaches Knott's results when we restrict the characteristic impedances and lengths of the lines to vary within a very short range. One, two and three-sheet C.J.A. are designed. The only restriction used is about the meaningful range for the design variables. The goal of this algorithm is to impose arbitrary restriction on the range of the variation of the variables. Finally, we obtain a 20-dB attenuation bandwidth more than 145% for one-sheet, 173% for two-sheet (compare with 108% obtained by Knott) and 193% for three-sheet capacitive Jaumann EM absorbers, with some acceptable short range for the variables. We design the one-sheet and two-sheet capacitive Jaumann absorbers at low frequency and the three-sheet at high frequency. The 20-db attenuation bandwidth obtained for the one-sheet and two-sheet capacitive Jaumann absorbers are respectively, from 10 to 77 MHz and from 4 to 61 MHz. For the three-sheet capacitive Jaumann absorber the 20-db attenuation bandwidth obtained is from 0.8 GHz to 280 GHz.

Abstracts

Modal analysis of parallel and crossed rectangular waveguide broadwall couplers with apertures of arbitrary shape

T. Sieverding, A.H. Motamedi, J. Reiter and F. Arndt. "Modal analysis of parallel and crossed rectangular waveguide broadwall couplers with apertures of arbitrary shape." 1997 MTT-S International Microwave Symposium Digest 3. (1997 Vol. III [MWSYM]): 1559-1562.

Parallel and crossed rectangular waveguide broadwall couplers with apertures of arbitrary shape and number are analyzed rigorously by the efficient and flexible boundary-contour/mode-matching (BCMM) method. The modal S-matrix combination technique takes adequately into account both the finite wall thickness and the higher order mode interaction between the discontinuities. Examples with circular, elliptical, and cross apertures demonstrate the flexibility of the design method. The theory is verified with measurements.



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A generalized 3D subgrid technique for the finite-difference time domain method

J. Ritter and F. Arndt. "A generalized 3D subgrid technique for the finite-difference time domain method." 1997 MTT-S International Microwave Symposium Digest 3. (1997 Vol. III [MWSYM]): 1563-1566.

A new subgridding technique for finite difference (FD) methods is presented. The method is based on the integral form of Maxwell's equations combined with a simple yet efficient orthogonalization technique for the discretization geometry at subgrid interfaces. No additional correction factors or interpolations are required. This leads to spurious-mode free solutions when applied to FD approximations of eigenvalue problems and to stable difference formulations when applied to the finite difference time-domain (FD-TD) method. The high efficiency of the subgridding technique is demonstrated by the FD-TD analysis of an interdigital filter with circular posts.

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An efficient inversion technique for banded linear systems

V.E. Boria, G. Gerini and M. Guglielmi. "An efficient inversion technique for banded linear systems." 1997 MTT-S International Microwave Symposium Digest 3. (1997 Vol. III [MWSYM]): 1567-1570.

Using the admittance matrix representation for the description of microwave devices can lead to systems with a banded coefficient matrix. In this paper we describe an efficient procedure for the solution of banded linear systems. A comparative study between the procedure proposed and two other commonly used techniques is performed indicating that the technique presented in this paper is indeed very effective.

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Abstracts

General full-wave Green's functions in spectral domain for arbitrarily multilayered dielectric media

K. Li. "General full-wave Green's functions in spectral domain for arbitrarily multilayered dielectric media." 1997 MTT-S International Microwave Symposium Digest 3. (1997 Vol. III [MWSYM]): 1571-1574.

In this paper, we present general analytical formulas of the full-wave spectral domain Green's functions for arbitrarily multilayered dielectric media. The Green's functions are two scalar potentials created by a horizontal dipole, corresponding two electromagnetic modes, transverse magnetic and transverse electric modes to the normal direction of the layer plane. The analytical formulas in spectral domain have simple form and are applicable to arbitrary number of the dielectric layers. The derivation of the formulas employs a technique developed for the derivation of the electrostatic Green's function in multilayered media. The Green's functions used in the spectral domain approach are also presented.



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Abstracts

Accurate CAD for dual mode filters in circular waveguide including tuning elements

V. Boria, M. Guglielmi and P. Arcioni. "Accurate CAD for dual mode filters in circular waveguide including tuning elements." 1997 MTT-S International Microwave Symposium Digest 3. (1997 Vol. III [MWSYM]): 1575-1578.

Dual mode filters in circular waveguide are very extensively used in multiplexers for modern communication satellites. Their industrial manufacture requires the use of tuning screws to be manually adjusted as well as significant experimental effort. In this paper we present an accurate CAD tool for dual mode filters in circular waveguide that can take into account the effect of tuning elements. The CAD tool is based on a multimode admittance matrix formulation and can effectively be used to reduce the filter development effort. In addition to theoretical results, measured results are also presented thus fully validating the CAD tool discussed.



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Input noise current spectral density estimation for a distributed based optical receiver

A. Borjak, L. Moura, J.J. O'Reilly and I. Darwazeh. "Input noise current spectral density estimation for a distributed based optical receiver." 1997 MTT-S International Microwave Symposium Digest 3. (1997 Vol. III [MWSYM]): 1579-1582.

Modelling of the input noise current spectral density of the distributed amplifier (DA) based optical receiver is carried out and an expression of the input noise current spectral density is presented, showing the effect of the photodiode impedance. Derived analytical expressions show the contribution of the different noisy elements to the overall noise.





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Wide band CAD model for coplanar waveguide using FDTD technique

E. Lan, S.M. El-Ghazaly, V. Nair, K. Eisenbeiser and B. Ooms. "Wide band CAD model for coplanar waveguide using FDTD technique." 1997 MTT-S International Microwave Symposium Digest 3. (1997 Vol. III [MWSYM]): 1583-1586.

The coplanar waveguide (CPW) is one of the most suitable transmission lines for millimeter-wave circuits. This paper presents the development of a very wide band CAD model for the CPW and its discontinuities. The propagation characteristics of CPW and its discontinuities on semiconductor substrates are modeled using the FDTD technique. Empirical equations suitable for implementation in commercial software packages are developed. Several CPW structures were fabricated on GaAs substrates and tested. Very good agreement between the measurement and the model is observed over a wide frequency band, from 1 to 110 GHz.

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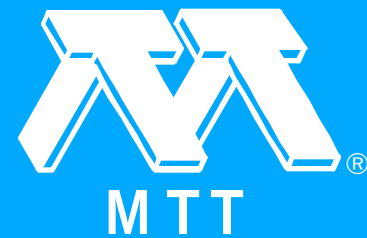


Abstracts

Application of the harmonic-balance method to the stability analysis of oscillators

J. Gerber and Chao-Ren Chang. "Application of the harmonic-balance method to the stability analysis of oscillators." 1997 MTT-S International Microwave Symposium Digest 3. (1997 Vol. III [MWSYM]): 1587-1590.

This paper outlines the application of harmonic-balance stability analysis to the design of oscillator circuits. Small-signal stability criteria and large-signal operation are considered. An improved picture of the stable regions of circuit operation and determination of physically stable operating points is demonstrated.



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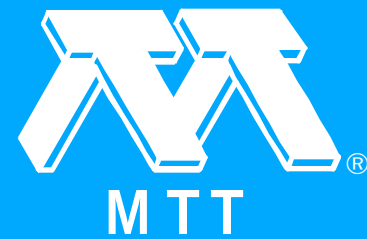


Abstracts

Accurate and efficient CAD-oriented modeling of circular waveguide bends

A. Weisshaar, M. Mongiardo and V.K. Tripathi. "Accurate and efficient CAD-oriented modeling of circular waveguide bends." 1997 MTT-S International Microwave Symposium Digest 3. (1997 Vol. III [MWSYM]): 1591-1594.

An extended local modes approach suitable for computer-aided design of curved waveguide bends is presented. This together with a new equivalent network representation of the circular bend consisting of uncoupled modes and coupling networks are found to provide accurate and efficient computer-aided design and simulation tools for circular bends.



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CAD and electrical performance of new compact power divider suitable for use in M(H)MICs

J. Benbrahim, H. Kobeissi and K. Wu. "CAD and electrical performance of new compact power divider suitable for use in M(H)MICs." 1997 MTT-S International Microwave Symposium Digest 3. (1997 Vol. III [MWSYM]): 1595-1598.

This paper presents a class of new compact power dividers suitable for use in microwave and millimeter-wave integrated circuits (ICs). Compared to the classical structure, the new topology of the power divider is made with a sinusoidally tapered circuit shape attached with multiple output ports that are co-linearly located along one plane. The phase and magnitude balance of a signal for the output ports are achieved with diffractive hole(s) etched in the middle of the circuit contour. An efficient field-theoretical CAD procedure is applied to accurate design of this irregularly shaped circuit with a mixed waveguide model and boundary integral method.

Electrical performance of the power divider shows a good agreement with theoretical prediction.

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Parasitic resistance extraction errors with implications for FET model accuracy around $V_{ds}=0$

V.I. Cojocaru and T.J. Brazil. "Parasitic resistance extraction errors with implications for FET model accuracy around $V_{ds}=0$." 1997 MTT-S International Microwave Symposium Digest 3. (1997 Vol. III [MWSYM]): 1599-1602.

The accuracy of non-linear FET models around the origin in the V_{gs} - V_{ds} bias plane, may be seriously affected by errors in the extracted values of the source and drain parasitic resistances. In this paper we present test results that prove how relatively small errors of this kind, which can be easily encountered when using conventional extraction techniques, can lead to large errors in the values extracted for some intrinsic parameters, and in particular for the two gate capacitances. The source of these errors is investigated and, as a solution, an improved extraction methodology is offered, which substantially reduces the risk of such errors.

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EM-ANN modelling and optimal chamfering of 90/spl deg/ CPW bends with air-bridges

P.M. Watson and K.C. Gupta. "EM-ANN modelling and optimal chamfering of 90/spl deg/ CPW bends with air-bridges." 1997 MTT-S International Microwave Symposium Digest 3. (1997 Vol. III [MWSYM]): 1603-1606.

Electromagnetically-trained artificial neural network (EM-ANN) models for coplanar waveguide (CPW) 90/spl deg/ bends with air-bridges are presented. The optimal chamfer is determined for a conventional CPW bend where both the slot and strip are chamfered. Also, a novel compensated CPW bend is introduced where only the strip is chamfered. Optimum value of this chamfer is found to be the maximum chamfer allowed by air-bridge placement. This novel compensated CPW bend is shown to reduce the return loss from that in the conventional optimally chamfered CPW bend by 3 to 7 dB.

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On the generalized scattering matrix of a lossless multiport

A. Morini and T. Rozzi. "On the generalized scattering matrix of a lossless multiport." 1997 MTT-S International Microwave Symposium Digest 3. (1997 Vol. III [MWSYM]): 1607-1610.

In characterizing interacting discontinuities in a waveguide increasing use is made of the so called generalized scattering matrix (GSM) formalism in order to describe 'accessible modes' below cutoff. This is motivated by the intrinsic numerical stability of the scattering matrix with respect to the transmission matrix, for instance. Unfortunately, we found that in many recent works and textbooks the GSM of a length of waveguide involving a mode above cutoff and several ones below cutoff is defined so that unitarity of the matrix and hence power conservation is not preserved. Still, numerical values of the fundamental mode scattering parameters reported as examples by the same references appear to be correct. In solving this apparent paradox, we address the problem of correctly defining the GSM for lossless modes below cutoff and alert the reader to the drawbacks of using a definition that does not maintain unitarity.

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Abstracts

Efficient numerical method for the design of microwave active circuits

E. Kerherve and P. Jarry. "Efficient numerical method for the design of microwave active circuits." 1997 MTT-S International Microwave Symposium Digest 3. (1997 Vol. III [MWSYM]): 1611-1614.

The real frequency technique with the Marquardt-More optimization algorithm is probably one of the best microwave active circuit synthesis methods available for the design of amplifiers and active filters. This numerical approach was introduced to overcome the limitations of the analytical methods, when applied to the single or double matching problem.



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Abstracts

Analysis and design of microwave structures using broad frequency band and shape driven edge finite element models

F. Thevenon, M.F. Wong, P. Guillaume, M. Masmoudi, M. Rochette and V. Fouad Hanna. "Analysis and design of microwave structures using broad frequency band and shape driven edge finite element models." 1997 MTT-S International Microwave Symposium Digest 3. (1997 Vol. III [MWSYM]): 1615-1618.

The use of high order derivatives is applied to obtain parametrized solutions in terms of frequency and shape for the analysis of microwave structures using 3D edge finite elements. These solutions are derived from the derivatives with respect to the frequency and/or geometric parameters of single frequency and/or geometric finite element solutions. These techniques allows the broad frequency band extrapolation as well as the shape optimization.



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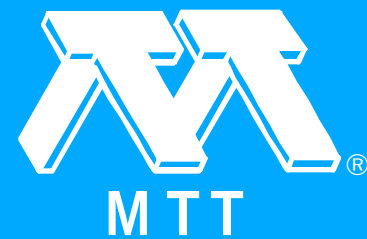


Abstracts

Synthesis of impedance matching circuits using arbitrary nonuniform transmission lines

A.H. Hamade, A.B. Kouki and F.M. Ghannouchi. "Synthesis of impedance matching circuits using arbitrary nonuniform transmission lines." 1997 MTT-S International Microwave Symposium Digest 3. (1997 Vol. III [MWSYM]): 1619-1622.

An efficient approach for the synthesis of impedance matching circuits using arbitrary nonuniform transmission lines is proposed. The proposed technique is first summarized and its merits are discussed. Several practical examples are then considered and different matching circuits are synthesized covering wide impedance and frequency ranges. The results obtained by the proposed approach are compared to measured data as well as to those obtained by a commercial simulator using a full wave analysis.



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Characterization and minimization of mutual coupling between NLC-FED slot antennas

Yongxi Qian and T. Itoh. "Characterization and minimization of mutual coupling between NLC-FED slot antennas." 1997 MTT-S International Microwave Symposium Digest 3. (1997 Vol. III [MWSYM]): 1623-1626.

Mutual coupling between both single and twin slot antennas fed by non-leaky coplanar (NLC) waveguides with conductor backing is characterized rigorously for the first time. While there is pronounced mutual coupling (about -12 dB) between two single slots separated by $\lambda/2$, we show that by employing an optimized twin-slot configuration, it is possible to reduce significantly the coupling level to below -30 dB over a 15% bandwidth, making this unidirectional radiator an attractive candidate for millimeter-wave imaging arrays.

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Abstracts

A new broadband coplanar waveguide to slotline transition

Kuang-Ping Ma and T. Itoh. "A new broadband coplanar waveguide to slotline transition." 1997 MTT-S International Microwave Symposium Digest 3. (1997 Vol. III [MWSYM]): 1627-1630.

A new broadband CPW to slotline transition is proposed and analyzed in this paper. This new transition utilizes CPW-slotline mode conversion phenomenon to convert CPW mode to slotline mode, and the transition bandwidth is broadened by the use of air-bridges. The Finite-Difference Time-Domain (FDTD) method is employed to analyze the transition and a very wide transition bandwidth is observed. A relatively good comparison is made with experiment results further verifies the concept.



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FDTD investigation of higher order mode leakage from three dimensional microstrip line structures

Zhewang Ma and E. Yamashita. "FDTD investigation of higher order mode leakage from three dimensional microstrip line structures." 1997 MTT-S International Microwave Symposium Digest 3. (1997 Vol. III [MWSYM]): 1631-1634.

Electromagnetic field leakage phenomena associated with the first higher order mode of an asymmetrically fed microstrip line structure is investigated by using the FDTD method. From the obtained scattering parameters and loss factor of the three-dimensional microstrip line structure, leakage properties of the first higher order mode at different frequencies are made clear, and they confirm the predictions of the two-dimensional transmission line analysis. Experimental measurements are implemented and the measured data are in favorable agreement with the simulated results.



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Scattering parameters of interdigital microstrip gap under laser spot illumination

Y. Horii and M. Tsutsumi. "Scattering parameters of interdigital microstrip gap under laser spot illumination." 1997 MTT-S International Microwave Symposium Digest 3. (1997 Vol. III [MWSYM]): 1635-1638.

This paper studies scattering characteristics of an optically controlled interdigital gap fabricated on the semiconductor microstrip line, and proposes the potential application of this gap to the microwave phase shifter with small variation in amplitude. Experiments have been carried out by making interdigital gap on the silicon chip and using the semiconductor laser diode.

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Abstracts

Measurements of unloaded Q-factor of transmission mode dielectric resonators

K. Leong, J. Mazierska and J. Krupka. "Measurements of unloaded Q-factor of transmission mode dielectric resonators." 1997 MTT-S International Microwave Symposium Digest 3. (1997 Vol. III [MWSYM]): 1639-1642.

A procedure to determine accurately the unloaded Q-factor, resonant frequency and coupling coefficients of a dielectric resonator in the transmission mode has been developed. The technique is based on a derived equation relating S_{21} and Q_L , measurements of S_{21} , S_{11} and S_{22} and accounts for crosstalk, coupling and cable losses.



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Image observation of pico second electrical pulse by scanning force optoelectronic microscope

K. Takeuchi and A. Mizuhara. "Image observation of pico second electrical pulse by scanning force optoelectronic microscope." 1997 MTT-S International Microwave Symposium Digest 3. (1997 Vol. III [MWSYM]): 1643-1646.

We succeeded for the first time in visualizing instantaneous voltage distribution of 2ps electrical pulse propagating on coplanar strips (CPS). This result was obtained using a scanning force optoelectronic microscope (SFOEM) which we have developed by coupling a scanning force microscope (SFM) and an ultrafast optical sampling technique. The observed voltage distribution shows a single peak deviating outward. The result seems not consistent with a simple theoretical prediction. There is a possibility that simple theoretical treatments usually used are no more useful for calculating ultrafast pulse distribution.

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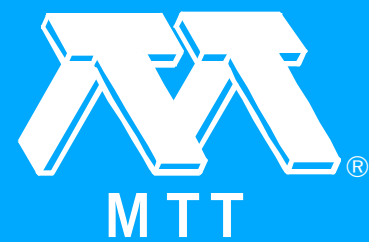


Vizualisation of portable phone-user interactions via near field mapping on mannequins and volunteers

L. Ahlonsou, D. Picard and J.C. Bolomey. "Vizualisation of portable phone-user interactions via near field mapping on mannequins and volunteers." 1997 MTT-S International Microwave Symposium Digest 3. (1997 Vol. III [MWSYM]): 1825-1828.

The characterization of the interaction between portable telephone and user is one of the key of a better power budget predictions in cellular links. A lot of works consider the problem under numerical modelling and only a few have a complete experimental approach. This paper describes a near field (NF) technique which allows, from measurements, to visualize the field distribution almost anywhere outside a cylinder enclosing the system made up by a full scale user (volunteers or mannequin phantoms) and a portable telephone. Tests are conducted in the 800-1050 MHz operating frequency range, which corresponds to actual GSM equipment. A mapping of the field provides a unique assistance in identifying the effective part of the user contributing to the radiation and can help in developing an equivalent antenna model for validating computer codes base only on head-hand modelling.





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Microscopic observation of the temperature coefficient distribution of dielectric material for microwave application using scanning photothermal dielectric microscope

Y. Cho, T. Kasahara and K. Fukuda. "Microscopic observation of the temperature coefficient distribution of dielectric material for microwave application using scanning photothermal dielectric microscope." 1997 MTT-S International Microwave Symposium Digest 3. (1997 Vol. III [MWSYM]): 1647-1650.

Two dimensional images of the temperature coefficient of the distribution of the dielectric constant of a two phases composite ceramics composed of $\text{TiO}/\text{sub } 2/$ and $\text{Bi}/\text{sub } 2/\text{Ti}/\text{sub } 4/\text{O}/\text{sub } 11/$ are observed using scanning photothermal dielectric microscope. The obtained images clearly show that the each grain of $\text{TiO}/\text{sub } 2/$ and $\text{Bi}/\text{sub } 2/\text{Ti}/\text{sub } 4/\text{O}/\text{sub } 11/$ in the ceramics has a negative and a positive temperature coefficient, respectively and that the macroscopic averaged temperature coefficient of the ceramics is relatively low due to the cancellation of the coefficients with the opposite signs.

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Novel methods of measuring impurity levels in liquid tanks

M. Weiss and R. Knochel. "Novel methods of measuring impurity levels in liquid tanks." 1997 MTT-S International Microwave Symposium Digest 3. (1997 Vol. III [MWSYM]): 1651-1654.

A microwave multi level gauging system employing a FSCW radar measurement technique is described. Conventional FMCW radar technique is normally employed to find only the level of the liquid surface in storage tanks. The system described here also detects a second level, caused for example by an impurity such as water in a petrol tank. For estimating the time delay and amplitude of each reflection from each scatterer an optimal signal processing algorithm is derived, based on a reference model. To determine the physical height of the impurity level, in for example petrol tanks, the dielectric constant of the petrol must be known. A novel algorithm is derived for estimating this from the same measurement. Measurement uncertainties of ± 0.2 mm have been achieved for the multi level range detection, performed in the frequency range from 1.5 to 3.5 GHz. From this measured data the error of the calculated dielectric constants was about to 1%. This yields an accuracy for the petrol height of 0.5%.



Abstracts

Network-analyzer self-calibration with four or five standards for the 15-term error-model

A. Gronefeld and B. Schiek. "Network-analyzer self-calibration with four or five standards for the 15-term error-model." 1997 MTT-S International Microwave Symposium Digest 3. (1997 Vol. III [MWSYM]): 1655-1658.

Novel self-calibration equations for the 15-term error-model are presented that form an analogon to the well known similarity-transforms of the 7-term error-model. These equations permit construction of a multitude of self-calibration procedures, one of which, the Tmrg-procedure, is introduced.



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Comparison of air coplanar microprobes for on-wafer measurements at W-band

A. Pham, J. Laskar, S. Basu and J. Pence. "Comparison of air coplanar microprobes for on-wafer measurements at W-band." 1997 MTT-S International Microwave Symposium Digest 3. (1997 Vol. III [MWSYM]): 1659-1662.

We apply the on-wafer thru-reflect-line (TRL) and thru-reflect-match calibrations and measurements to evaluate and compare the performance of waveguide and coax fed microprobes at W-band. The results compare the repeatability, isolation, and performance of these probes.

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A calibration procedure for W-band on-wafer testing

Yon-Lin Kok, M. Dufault, Tian-Wei Huang and Huei Wang. "A calibration procedure for W-band on-wafer testing." 1997 MTT-S International Microwave Symposium Digest 3. (1997 Vol. III [MWSYM]): 1663-1666.

This paper describes a W-band (75/spl sim/110 GHz) on-wafer probing calibration procedure based on the microstrip SOLT calibration technique. Two on-wafer offset-open microstrips are used together with SOLT standards to generate high frequency calibration kits. For microstrip-line calibration on 2-mil thick GaAs substrate, measurements of some passive elements are presented and compared with those measured by a multiline TRL calibration. Electromagnetic simulations of these calibration and test standards are also generated. Close agreement between measurements and computer simulation provides verification in high frequency range (75/spl sim/110 GHz). Measurements using this calibration kit from 1 to 65 GHz are also checked against previously reported data. It is found that this SOLT calibration standard set is valid from 1 to 110 GHz.

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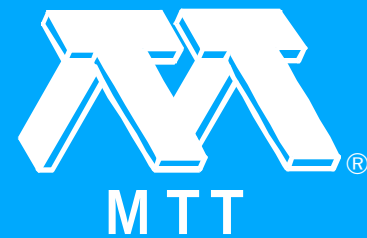


Abstracts

A new field-probing technique for millimeter-wave components

A. Basu and T. Itoh. "A new field-probing technique for millimeter-wave components." 1997 MTT-S International Microwave Symposium Digest 3. (1997 Vol. III [MWSYM]): 1667-1670.

A new technique for probing the fields in the vicinity of a millimeter-wave circuit or antenna, using a dielectric waveguide is described. This technique is expected to be particularly useful for frequencies greater than 100 GHz, where effects of manufacturing inaccuracies, and minute material defects may lead to hard-to-trace faults.



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A membrane quadrant probe for R&D applications

S. Basu and R. Gleason. "A membrane quadrant probe for R&D applications." 1997 MTT-S International Microwave Symposium Digest 3. (1997 Vol. III [MWSYM]): 1671-1673.

Membrane probes are known for their applications to production probing and their ability to integrate RF lines, matching networks and good power supply bypassing for known good die testing on-wafer. Nonetheless, they require die-specific design and are not reconfigurable. In this paper, we discuss a quadrant probe based on membrane technology which offers this alternative with lower loss than membrane probes and better DC bypassing capability than any other quadrant probe.



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Known good die testing of wide S/C band power MMICs

S. Basu, R. Finke and E. Strid. "Known good die testing of wide S/C band power MMICs." 1997 MTT-S International Microwave Symposium Digest 3. (1997 Vol. III [MWSYM]): 1675-1677.

The testing process for power MMICs today is expensive and slow because it is done in a fixtured environment. The chip is usually diced up from a wafer, mounted on a carrier, and wire-bonded to an off-chip matching network (OCMN) before being tested. In this paper we demonstrate an integrated known-good-die testing solution at the wafer level, for a high-power S/C-band power amplifier. Fixtured and on-wafer results are compared.



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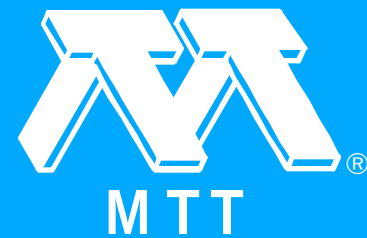


Abstracts

Microstrip ring resonator as a moisture sensor for wheat grains

K.K. Joshi, M. Abegaonkar, R.N. Karekar and R.C. Aiyer. "Microstrip ring resonator as a moisture sensor for wheat grains." 1997 MTT-S International Microwave Symposium Digest 3. (1997 Vol. III [MWSYM]): 1679-1682.

Microwave resonant frequency and quality factor of a ring resonator are measured with a single wheat grain as an overlay on the ring and are found to vary with the moisture content independent of the weight of the kernel.



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Measurement of temperature dependence of relative permittivity by the cavity perturbation method

T. Takahashi, Y. Iijima and T. Miura. "Measurement of temperature dependence of relative permittivity by the cavity perturbation method." 1997 MTT-S International Microwave Symposium Digest 3. (1997 Vol. III [MWSYM]): 1683-1686.

A new cavity perturbation method has been proposed as a technique for evaluating the temperature dependence of relative permittivity, ϵ_r , in the pseudo-microwave range. In order to increase the accuracy of this method, an automatic measuring apparatus, satisfying the perturbation principle, was constructed and improvements in data processing were employed, such as the periodic least square method. Results for some microwave dielectrics demonstrated that measured ϵ_r values for this method conform to those of the dielectric rod resonator method.

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A novel time domain characterization technique of intermodulation in microwave transistors: application to the visualization of the distortion of high efficiency power amplifiers

D. Barataud, A. Mallet, J.P. Frayse, F. Blache, M. Campovecchio, J.M. Nebus, J.P. Villotte and J. Verspecht. "A novel time domain characterization technique of intermodulation in microwave transistors: application to the visualization of the distortion of high efficiency power amplifiers." 1997 MTT-S International Microwave Symposium Digest 3. (1997 Vol. III [MWSYM]): 1687-1690.

Along with the increasing necessity of improving the large signal characterization of microwave transistors and the validation of nonlinear models, a novel characterization has emerged based on a time domain approach. As explained and illustrated in this paper, this method allows the visualization and the accurate determination of amplifier distortions at low, medium and large RF power levels. The extraction of single tone and multitone voltage/current waveforms from a dedicated measurement system enhances the novel characterization technique proposed and the validation of non linear electrothermal model for CAD. Examples of measured and simulated results of GaAs FETs and GaInP/GaAs HBTs are given to demonstrate the great possibilities offered by the characterization procedure. Its use to optimize trade-offs between efficiency and linearity of power amplifiers is clearly demonstrated by the display and the visualization of the envelop and carrier distortions of the signals at both ports of power FETs and HBTs.

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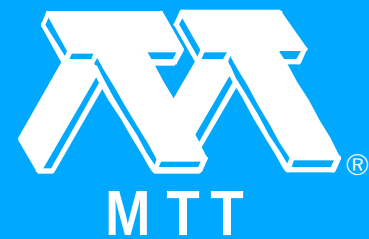
Improvement of digital mapping predistorters for linearising transmitters

Qiming Ren and I. Wolff. "Improvement of digital mapping predistorters for linearising transmitters." 1997 MTT-S International Microwave Symposium Digest 3. (1997 Vol. III [MWSYM]): 1691-1694.

In this paper we present a new kind of 2-dimensional mapping predistorter for linearising transmitters. This method applies self-tuning adaptive control to eliminate iteration processes and therefore to reduce adaptation time. All errors due to modulator imperfections (e.g. RF carrier leakage from local oscillator, differential gain and phase imbalance between I and Q paths) can be corrected by this method. The simulation shows that adaptation time and memory size of look-up-tables are reduced.

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Sensitivity of distortion cancellation in feedforward amplifiers to loop imbalances

Y.K.G. Hau, V. Postoyalko and J.R. Richardson. "Sensitivity of distortion cancellation in feedforward amplifiers to loop imbalances." 1997 MTT-S International Microwave Symposium Digest 3. (1997 Vol. III [MWSYM]): 1695-1698.

The sensitivity of distortion cancellation in feedforward amplifiers to amplitude and phase imbalance is investigated. Some workers have suggested that the amplifier is more sensitive to imbalance in signal cancellation loop. It is shown here that this is not true in general. It can become more sensitive to imbalance in either cancellation loop depending on their level of cancellation. Results of a feedforward amplifier simulation are presented to confirm this finding.

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Abstracts

FFT windows for intermodulation analysis of microwave circuits from transient simulation

K. Gard. "FFT windows for intermodulation analysis of microwave circuits from transient simulation." 1997 MTT-S International Microwave Symposium Digest 3. (1997 Vol. III [MWSYM]): 1699-1702.

The use of time-domain window functions is investigated for intermodulation analysis of two-tone transient simulations. Window selection is dependent on whether fast Fourier transform (FFT) dynamic range is noise limited by interpolation noise or by window roll-off characteristics. Two tone transient and harmonic balance simulations of a MESFET amplifier show excellent agreement over a wide dynamic range.



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Phase compensation in an optically controlled microwave attenuator

H. Shimasaki, S. Matsuda and M. Tsutsumi. "Phase compensation in an optically controlled microwave attenuator." 1997 MTT-S International Microwave Symposium Digest 3. (1997 Vol. III [MWSYM]): 1703-1706.

A microwave attenuator has been developed whose attenuation can be controlled by illuminating the silicon substrate. The phase shift which appeared together with the attenuation can be compensated by a ferrite phase shifter under dc magnetic field to the line. The attenuation characteristics without phase shift are shown by experiments in X band and confirmed theoretically by the spectral domain approach.





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Millimetre wave generation by filtering the FM-IM spectra of a directly modulated DFB laser

K.E. Razavi and P.A. Davies. "Millimetre wave generation by filtering the FM-IM spectra of a directly modulated DFB laser." 1997 MTT-S International Microwave Symposium Digest 3. (1997 Vol. III [MWSYM]): 1707-1708.

The nonlinear characteristics of semiconductor lasers have been exploited in order to generate low phase noise microwave and millimetre-wave frequencies for radio-over-fibre applications. This is achieved using the modulation characteristics of a MQW-DFB semiconductor laser. A high FM index MQW-DFB laser is directly modulated at the resonant frequency of its FM characteristic response in order to generate high order harmonics. By optimising the rf modulation frequency drive power, high order sideband components can be generated, selected and mixed on a photodetector to generate microwave and millimetre-wave frequencies. This paper presents results utilising the direct modulation technique, which demonstrate the generation of beat frequencies up to 25 GHz. Optimization of the optical filtering process and of the phase-noise dependence of the generated beat frequency on the modulation drive source are also discussed.

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40 GHz-narrow band photoreceiver for clock recovery in 40 Gbit/s optical transmission systems

A. Miras, E. Legros, S. Vuye, G. Wanlin and L. Giraudet. "40 GHz-narrow band photoreceiver for clock recovery in 40 Gbit/s optical transmission systems." 1997 MTT-S International Microwave Symposium Digest 3. (1997 Vol. III [MWSYM]): 1709-1712.

Tunable microwave narrow band amplifiers have been realized on a 38-45 GHz band, for clock recovery in 40 Gbit/s optical transmission systems. These amplifiers are also useful for radio applications on the fiber, by adjusting the center frequency on the 38-42.5 GHz band allocated for communication networks in Europe. Based on a fully stabilised GaAs PHEMT 0.2 μm gate length technology, the amplifiers are designed to match the impedance of a side illuminated AlGaInAs/InP PIN photodiode at their input, and 50 Ω at their output. The center frequency is tunable by 2 GHz steps, the bandwidth is typically 3 GHz and the maximum gain is 29 dB on a 50 Ω load. A photoreceiver module has been assembled by cascading such amplifiers tuned for 39.8 GHz. The photoreceiver transimpedance is 78.5 dB/ Ω , and the average equivalent input noise is 37 pA/ Ω .

10 Gb/s clock extraction and data regeneration circuit implemented with phase-locked loop

Tae-Whan Yoo and Moon-Soo Park. "10 Gb/s clock extraction and data regeneration circuit implemented with phase-locked loop." 1997 MTT-S International Microwave Symposium Digest 3. (1997 Vol. III [MWSYM]): 1713-1716.

A PLL clock-extraction and data-regeneration circuit (CEDAR) for 10 Gb/s optical transmission system was realized in a hybrid IC form. The jitter characteristics satisfied the recommendations of ITU-T. The CEDAR compensated against the temperature was tested for the temperature from -10/spl deg/C to 60/spl deg/C and showed no increase of error.



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Synthesis of amplitude response of optical directional coupler modulators

S.W. Lovseth, C. Laliew and A. Gopinath. "Synthesis of amplitude response of optical directional coupler modulators." 1997 MTT-S International Microwave Symposium Digest 3. (1997 Vol. III [MWSYM]): 1717-1720.

Optical directional coupler modulator amplitude response may be synthesized using the Gelfand-Levitan-Marchenko inverse scattering technique. The technique determines the coupling function required to obtain the specified response, and for this summary we illustrate it with the response function of a third order Butterworth function. The technique provides the possibility of designing coupler modulators with small switching voltages, and better linearity.

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Abstracts

A new approach for optical millimeter wave generation utilizing locking techniques

T. Berceli. "A new approach for optical millimeter wave generation utilizing locking techniques." 1997 MTT-S International Microwave Symposium Digest 3. (1997 Vol. III [MWSYM]): 1721-1724.

A new approach is presented for the optical generation of millimeter waves. Instead of the millimeter wave signal, one of its subharmonics is optically transmitted and the millimeter wave signal is generated utilizing the subharmonic signal as a reference. This way the optical components become much simpler and cheaper. In this procedure a crucial point is the frequency division at millimeter wave frequencies. For this purpose a new method is introduced: the superharmonic injection locking of oscillators. The main advantage of the new approach is that it is applicable even for frequencies at shorter millimeter waves.



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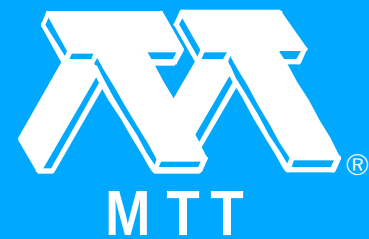
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Dual mode patch superconductor cavity filters

Xiaoying Zhang, Chi Wang, K.A. Zaki and K.S. Harshavardhan. "Dual mode patch superconductor cavity filters." 1997 MTT-S International Microwave Symposium Digest 3. (1997 Vol. III [MWSYM]): 1725-1728.

A new kind of dual mode filter consisting of high temperature superconductor (HTS) patch loaded circular cavity resonators is presented. The resonator is analyzed using full wave mode matching method. The generalized scattering matrices of the HTS patch loaded circular cavity are obtained. After performing cascading procedure and applying boundary conditions, resonant frequencies, field distribution, unloaded Q of the resonator and the coupling between two cavities through irises are obtained. Two 4-pole dual mode elliptic function patch conductor loaded cavity filters are designed, constructed and tested. Excellent measured frequency responses of the filter are obtained.

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Large-signal design of MMIC Ka-band power amplifiers based on physical models

A.D. Plews, C.M. Snowden and M.J. Howes. "Large-signal design of MMIC Ka-band power amplifiers based on physical models." 1997 MTT-S International Microwave Symposium Digest 3. (1997 Vol. III [MWSYM]): 1729-1732.

A quasi-two-dimensional physical model is used to predict the effects of process variations on the DC, small-, and large-signal behaviour of a pHEMT. A large-signal equivalent circuit model of the mm-wave pHEMT extracted from the physical model is used to predict the non-linear behaviour of an amplifier. A two-tone on-wafer source- and load-pull measurement system has been constructed to allow verification of the modelling procedure.

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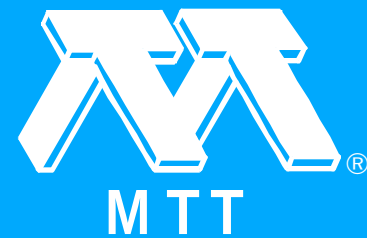


Abstracts

Modeling and characterization of interconnects and IC packages by FDTD 3D simulation

M. Falconer and V. Tripathi. "Modeling and characterization of interconnects and IC packages by FDTD 3D simulation." 1997 MTT-S International Microwave Symposium Digest 3. (1997 Vol. III [MWSYM]): 1733-1736.

Time domain electromagnetic simulation of 3-D lossy interconnect coupling and ground bounce in a typical IC package is presented. The FDTD simulation tool is also proposed and used as a Virtual TDR (V-TDR) to extract the circuit models associated with complex 3D structures.



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Abstracts

Full-wave investigation on the curved bonding wire interconnection by using a suitable FDTD code

F. Alimenti, P. Mezzanotte and L. Roselli. "Full-wave investigation on the curved bonding wire interconnection by using a suitable FDTD code." 1997 MTT-S International Microwave Symposium Digest 3. (1997 Vol. III [MWSYM]): 1737-1740.

The scattering parameters of the curved bonding wire interconnection, accounting for its curvature, have been computed by using a proper discretization technique along with the Finite Difference Time Domain (FDTD) method. The curvature has been modeled assuming a polygonal approximation. The obtained results have been compared against vector network analyzer measurements showing a satisfactory agreement. In order to investigate the curvature effect, the proposed approach has been compared with a rectangular approximation of the bonding wire demonstrating that this approximation provides a useful modeling of the interconnection.



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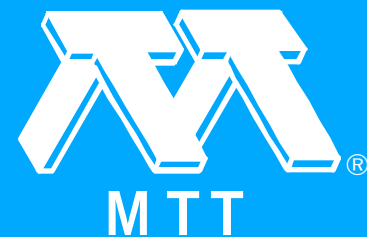


Abstracts

Measurements of field distributions and scattering parameters in multiconductor structures using an electric field probe

Yingjie Gao and I. Wolff. "Measurements of field distributions and scattering parameters in multiconductor structures using an electric field probe." 1997 MTT-S International Microwave Symposium Digest 3. (1997 Vol. III [MWSYM]): 1741-1744.

A simple electric coaxial field probe for application in the 0.05-20 GHz band has been developed, which can measure not only the magnitude and the phase of the microwave field distribution inside multiconductor RF and microwave circuits, but also the scattering parameters at arbitrary reference planes inside the structures can be measured using this technique.



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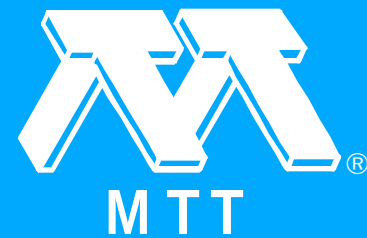


Abstracts

An adaptive antenna integrated with automatic gain control for receiver front end

J.L. Dawson and Jenshan Lin. "An adaptive antenna integrated with automatic gain control for receiver front end." 1997 MTT-S International Microwave Symposium Digest 3. (1997 Vol. III [MWSYM]): 1747-1750.

In this paper a new type of adaptive antenna is presented, which is intended for use in mobile receivers. A nonlinear, adaptive, analog feedback controller has been developed to control the phase relationship between the two receiving elements. Both the controller and a complete RF prototype are described in this paper.



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Finite-difference time-domain analysis of a dual resonance and shielded cellular antenna

B.S. Yildirim and E.-B. El-Sharawy. "Finite-difference time-domain analysis of a dual resonance and shielded cellular antenna." 1997 MTT-S International Microwave Symposium Digest 3. (1997 Vol. III [MWSYM]): 1751-1754.

This paper presents a dual-resonance shielded antenna suitable for cellular phone applications. The antenna is shielded with a metallic wall to reduce possible health hazards towards user. Unlike other cellular antennas, new antenna's operating bandwidth spans between the first two resonances of the antenna and an almost 50 ohms flat input resistance can be obtained within a bandwidth of 824-896 MHz, using proper antenna dimensions. A proto-type of the dual resonance shielded antenna has been built and input impedance, near and far field measurements have been performed. Near field measurements showed that excessive electromagnetic radiation towards user is blocked by 90% without significantly sacrificing the omnidirectional characteristics required for cellular phone devices. Input impedance measurements are compared with the numerical results and a good agreement has been achieved. The new antenna uses all copper wires and shield which makes it easy and inexpensive to build.

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Microstrip-fed cylindrical slot antennas for GPS avionics applications

C.H. Ho, P.K. Shumaker, K.B. Smith, D.W. Huang, J.W. Liao and Y.H. Wang. "Microstrip-fed cylindrical slot antennas for GPS avionics applications." 1997 MTT-S International Microwave Symposium Digest 3. (1997 Vol. III [MWSYM]): 1755-1758.

The commercial GPS user antenna for aircraft networks requires a right-hand circular polarization and a uniform pattern coverage over approximately the entire upper hemisphere. It also demands a mechanical configuration that has no appreciable drag and needs no elaborate structural modification to the aircraft. The printed cylindrical slot antennas presented in this paper are useful in this application where low-profile installation is required on a high dynamic aircraft. These new printed GPS antennas provide compact size, low cost, ease of mass production.

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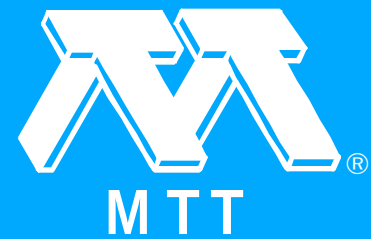


Abstracts

Performance of PCS handset antennas in mobile environments

M.G. Douglas, M. Okoniewski and M.A. Stuchly. "Performance of PCS handset antennas in mobile environments." 1997 MTT-S International Microwave Symposium Digest 3. (1997 Vol. III [MWSYM]): 1759-1762.

FDTD modeling of two handset-mounted antennas in the proximity of the user was performed to investigate the effects of some aspects of the communications environment on antenna performance. We have shown that: (i) the antenna mean effective gain (MEG) is strongly influenced by the type of the environment; (ii) much less power is absorbed in the user's head when the polarization diversity antenna is used instead of the monopole antenna; and (iii) antenna performance is underestimated if ground reflections are not taken into account.



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Abstracts

The implication of nonlinear effect on DS/CDMA with imperfect power control in optical transmission

S. Geslin, A. Borjak, L. Moura and J.J. O'Reilly. "The implication of nonlinear effect on DS/CDMA with imperfect power control in optical transmission." 1997 MTT-S International Microwave Symposium Digest 3. (1997 Vol. III [MWSYM]): 1763-1766.

The impact of imperfect power control on an asynchronous direct sequence code division multiple access (DS/CDMA) system in optical transmission is discussed. The performance of the system is evaluated using the derived bit-error-rate (BER) by taking into account the intermodulation distortion due to the laser diode nonlinearity.



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Abstracts

An accurate determination of the characteristic impedance matrix of coupled symmetrical lines on chips based on high frequency S-parameter measurements

T.-M. Winkel, L.S. Dutta and H. Grabinski. "An accurate determination of the characteristic impedance matrix of coupled symmetrical lines on chips based on high frequency S-parameter measurements." 1997 MTT-S International Microwave Symposium Digest 3. (1997 Vol. III [MWSYM]): 1769-1772.

A new method has been developed to determine the characteristic impedance matrix of a symmetric coupled lossy two line system on chips. The presented results are based on high frequency measurements of the scattering parameters. A comparison between the measured and analytical calculated results is given and shows excellent agreement.



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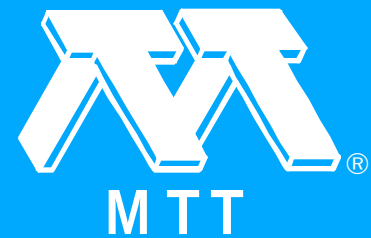


Abstracts

Embedded multiconductor transmission line characterization

D.F. Williams. "Embedded multiconductor transmission line characterization." 1997 MTT-S International Microwave Symposium Digest 3. (1997 Vol. III [MWSYM]): 1773-1776.

This paper presents a measurement method that characterizes lossy printed multiconductor transmission lines embedded in transitions, connectors, or packages with significant electrical parasitics. We test the method on a pair of lossy coupled asymmetric microstrip lines and compare to previous results.



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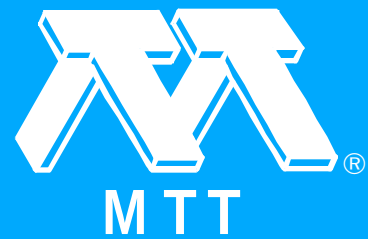


Abstracts

Characterization of multiconductor coupled lines from multiport TDR measurements

A. Tripathi and V.K. Tripathi. "Characterization of multiconductor coupled lines from multiport TDR measurements." 1997 MTT-S International Microwave Symposium Digest 3. (1997 Vol. III [MWSYM]): 1777-1780.

A new procedure to characterize nonuniform coupled multiconductor lines based on a one dimensional peeling algorithm is presented. The measured multiport reflection (scattering parameter) parameters in the time domain are used to construct piece-wise uniform configuration oriented models for multiple coupled lines. Examples of nonuniform two and three coupled striplines are included to illustrate the technique.



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Abstracts

Experimental circuit model generation of non-uniform coupled multi-conductor structures

S. Sercu and L. Martens. "Experimental circuit model generation of non-uniform coupled multi-conductor structures." 1997 MTT-S International Microwave Symposium Digest 3. (1997 Vol. III [MWSYM]): 1781-1784.

In the paper a new method is described for the experimental circuit modeling of non-uniform coupled multi-conductor structures. The method can handle a large number of coupled conductors N since it reduces the modeling of the $2N$ -port to the modeling of a number easier to model 4-port structures. All electrical properties, such as reflection, transmission, backward and forward crosstalk between the conductors of the structure are included in the model. To illustrate the method, a 35-pins high density backplane connector is modeled.



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Abstracts

Waveform relaxation synthesis of time-domain characteristic model of coupled transmission lines from FDTD simulation

Qing-Xin Chu and Fung-Yuel Chang. "Waveform relaxation synthesis of time-domain characteristic model of coupled transmission lines from FDTD simulation." 1997 MTT-S International Microwave Symposium Digest 3. (1997 Vol. III [MWSYM]): 1785-1788.

By use of a waveform relaxation iteration algorithm and numerical convolution and deconvolution techniques, a time-domain characteristic model of symmetric two-conductor coupled transmission lines is synthesized from the terminal responses which are simulated by the FDTD method. The extracted model is applied to simulate the responses of the coupled lines with step pulse excitation and typical loads to validate the accuracy of the model. Results favorably compare with the direct FDTD simulation.



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Excitation of the parasitic parallel-plate line mode at coplanar discontinuities

K. Beilenhoff and W. Heinrich. "Excitation of the parasitic parallel-plate line mode at coplanar discontinuities." 1997 MTT-S International Microwave Symposium Digest 3. (1997 Vol. III [MWSYM]): 1789-1792.

The excitation of the parasitic parallel-plate line mode at conductor-backed coplanar MMIC discontinuities and package feed-throughs is analyzed. The basic mechanism is investigated and a simplified description is presented. The model is validated by comparison to 3D Finite-Difference results.

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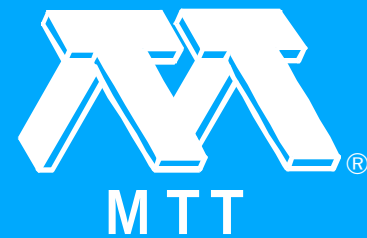


Abstracts

Investigation of MMIC inductor coupling effects

M. Werthen, I. Wolff, R. Keller and W. Bischof. "Investigation of MMIC inductor coupling effects." 1997 MTT-S International Microwave Symposium Digest 3. (1997 Vol. III [MWSYM]): 1793-1796.

The coupling effects of two closely placed coplanar spiral inductors are investigated using the FDTD method. Different configurations of two inductors are simulated and the simulation results are compared with measurements. The investigations show an unexpected high impact of the orientation of the coils to the coupling of the two inductors.



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Wavelet-based CAD modeling of microstrip discontinuities using least square Prony's method

K.F. Sabett, L.P.B. Katehi and K. Sarabandi. "Wavelet-based CAD modeling of microstrip discontinuities using least square Prony's method." 1997 MTT-S International Microwave Symposium Digest 3. (1997 Vol. III [MWSYM]): 1799-1802.

This paper presents a sparse-based moment method (MoM) approach for the full-wave modeling of microstrip planar structures. Rooftop multiresolution expansions, introduced as the natural extension of the conventional rooftop basis functions, are incorporated into the integral equation formulation to achieve highly sparse linear systems. The application of the fast wavelet transform (FWT) makes it possible to easily "sparsify" the existing rooftop-based CAD programs. The scattering parameters of the network under study are determined using a least square Prony's method, which extracts the characteristics of the dominant-mode incident and reflected traveling waves on the port feed lines. Numerical results are presented for various examples of microstrip discontinuities.

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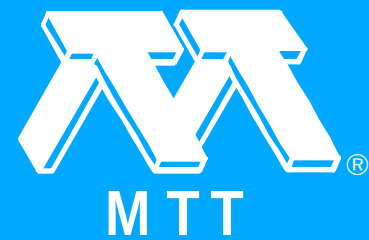


Abstracts

Diakoptics and the multilevel moments method for planar circuits

S. Ooms and D. De Zutter. "Diakoptics and the multilevel moments method for planar circuits." 1997 MTT-S International Microwave Symposium Digest 3. (1997 Vol. III [MWSYM]): 1803-1806.

The Method of Moments matrix equation, resulting from the electromagnetic simulation of a high frequency planar circuit can take much memory and time to solve, typically $O(n/\sup 2/)$ resp. $O(n/\sup 3/)$. This paper proposes a new solution strategy combining a Multilevel Moments Method scheme with a Modified Diakoptics technique and a Block Gauss-Seidel iterative technique, effectively reducing the solution time.



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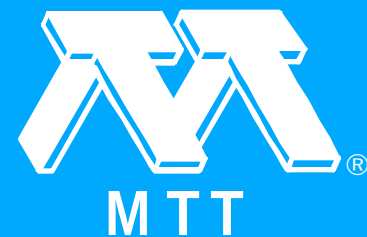


Abstracts

Design of planar circuit structures with an efficient magneto-static field solver

S. Lindenmeier and P. Russer. "Design of planar circuit structures with an efficient magneto-static field solver." 1997 MTT-S International Microwave Symposium Digest 3. (1997 Vol. III [MWSYM]): 1807-1810.

We introduce a highly efficient magneto-static field solver for the design of lossless planar circuit elements with arbitrary shape and size far below the wavelength. The field solver is based on a finite difference formulation of a scalar magnetic potential, using potential partitioning surfaces (PPS). We present numerical results at the examples of various planar circuit elements.



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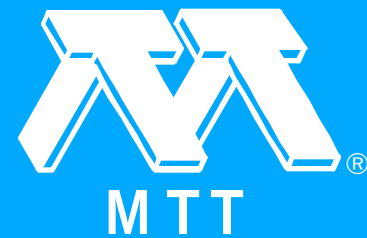


Abstracts

Influence of conductor loss and thickness in coplanar circuit elements

L. Vietzorreck and W. Pascher. "Influence of conductor loss and thickness in coplanar circuit elements." 1997 MTT-S International Microwave Symposium Digest 3. (1997 Vol. III [MWSYM]): 1811-1814.

The small dimensions of CPWs require due consideration of finite conductivity and metallization thickness. For this purpose an efficient Method of Lines approach for full-wave analysis of microstrip discontinuities is considerably extended. Two alternative loss models are employed depending on the skin depth. Several cascaded coplanar discontinuities including a quarterwave transformer and a double step are characterized.



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A unified method for characterization of microstrip and waveguide discontinuities of irregular shape

Tzyy-Sheng Horng. "A unified method for characterization of microstrip and waveguide discontinuities of irregular shape." 1997 MTT-S International Microwave Symposium Digest 3. (1997 Vol. III [MWSYM]): 1815-1818.

A unified numerical method is proposed to analyze the discontinuities of two major waveguide structures, microstrips and rectangular waveguides, at microwave frequencies. Roof-top and rectangular-pipe subdomain functions are used in an electric-field integral-equation formulation to adequately expand the three-dimensional current densities of an irregularly-shaped conductor. The method is therefore applicable to general configurations of microstrip and waveguide discontinuities. Shielded microstrips, which are a combination of microstrips and rectangular waveguides, can be evaluated efficiently using this technique.



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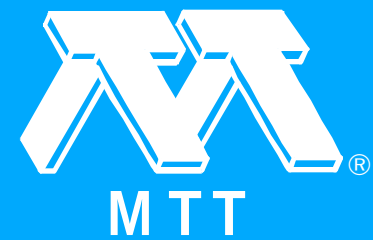
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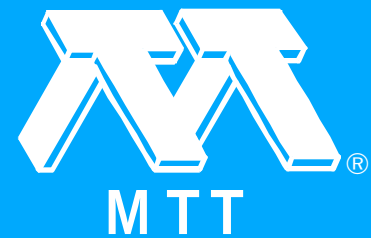


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ARFTG (Automatic RF Techniques Group) Cumulative Index: 1989-1996

"ARFTG (Automatic RF Techniques Group) Cumulative Index: 1989-1996." 1997 MTT-S International Microwave Symposium Digest 3. (1997 Vol. III [MWSYM]).

This is a cumulative index of all papers presented at the semiannual Automatic RF Techniques Group (ARFTG) Conference, from the 33rd Conference in Spring of 1989 through the 48th Conference in Fall of 1996. The listing is alphabetical by author, with a separate listing for each author of each paper.



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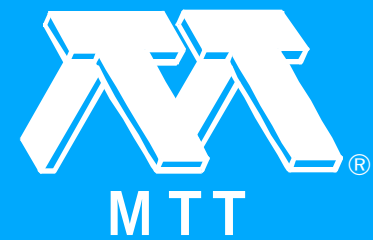
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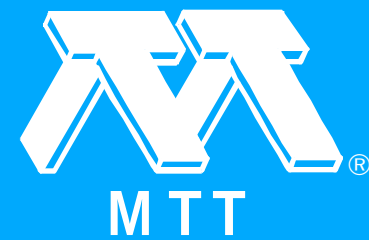
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1997 IEEE Radio Frequency Integrated Circuits Symposium Schedule

"1997 IEEE Radio Frequency Integrated Circuits Symposium Schedule." 1997 Radio Frequency Integrated Circuits (RFIC) Symposium 97. (1997 [RFIC]).



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Message from the General Chairman (1997 [RFIC])

L.C.T. Liu. "Message from the General Chairman (1997 [RFIC])." 1997 Radio Frequency Integrated Circuits (RFIC) Symposium 97. (1997 [RFIC]).

On behalf of the Steering Committee, I would like to welcome you to the 1997 IEEE Radio Frequency Integrated Circuits (RFIC) Symposium. This new and exciting Symposium expands from our previous Microwave & Millimeter-wave Monolithic Circuits (MMWMC) Symposium. The MMWMC Symposium was created in 1982 to provide a focused forum for emerging MMIC technology. For the past 15 years, this Symposium encouraged the rapid advancement of the technology and facilitated its application in DOD and commercial systems. Today, approximately half of all papers presented during Microwave Week are related to the monolithic technology. We are very pleased that the MMWMC Symposium has served our society and membership well and has made a significant impact on our technology development.

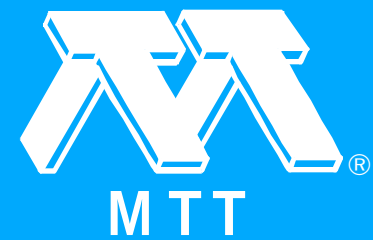
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Steering Committee (1997 [RFIC])

"Steering Committee (1997 [RFIC])." 1997 Radio Frequency Integrated Circuits (RFIC) Symposium 97. (1997 [RFIC]).



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Abstracts

Workshops (1997 [RFIC])

"Workshops (1997 [RFIC])." 1997 Radio Frequency Integrated Circuits (RFIC) Symposium 97. (1997 [RFIC]).

The basic RF components required for the wireless communication markets operating in the 800 MHz - 2.5 GHz frequency range are undergoing a revolutionary change in terms of DC power consumption. On both the research and production front, the reduced power consumption in ICs is recognized as a key competitive advantage. Next to low cost, minimum power consumption is the most translates into smaller, lighter batteries and longer battery lifetime. The power consumption issue is complicated by secondary considerations including cost of required auxiliary circuitry to provide dual polarity supply, reduced off current leakage and isolation or ruggedness. This workshop will consider different device technologies and circuit techniques suitable for reducing DC power especially in receiver and power amplifier portions of the RFICs. Si BJT, MOSFET, GaAS MESFET, HBT and PHEMT technologies will be examined for their inherent properties relative to low voltage requirements. Specific process improvements that would lead to improved low power consumption design will be discussed. Circuit design techniques to reduce power consumption at low voltage will also be considered. Trends in current and future portable system architectures will also affect power consumption issues, and this will be addressed.



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Panel Session: Device Technology Choices for Commercial Portable Power Amplifier Products (1997 [RFIC])

"Panel Session: Device Technology Choices for Commercial Portable Power Amplifier Products (1997 [RFIC])." 1997 Radio Frequency Integrated Circuits (RFIC) Symposium 97. (1997 [RFIC]).

Both Silicon and compound semiconductor device technologies have been pursued as solutions for use in commercial communications applications. While GaAs technologies (MESFET, PHEMT, HBT) have met the technical requirements, their cost is considered prohibitive relative to Silicon devices for many of the commercial products. In contrast, RF silicon MOSFETs have found application for many of the low tier radio products, but have failed to match the performance of GaAs devices. A pattern has emerged with compound semiconductor devices winning the competition for initial high tier product introductions, but losing to Silicon devices for higher volume/lower cost products. These factors include a trend to streamline device processing, incorporation of innovative design ideas, emphasis on emerging digitally modulated systems, as well as a continuing evolution and maturity of device technologies. This panel will focus on device technology and designs in regards to low cost commercial power amplifiers. The panelists will present their choices for best technology for commercial power amplifiers.



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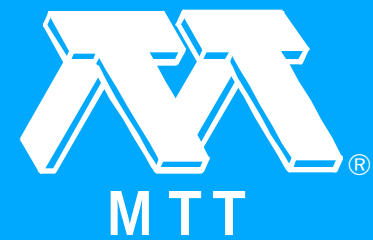
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Table of Contents (1997 [RFIC])

"Table of Contents (1997 [RFIC])." 1997 Radio Frequency Integrated Circuits (RFIC) Symposium 97. (1997 [RFIC]).



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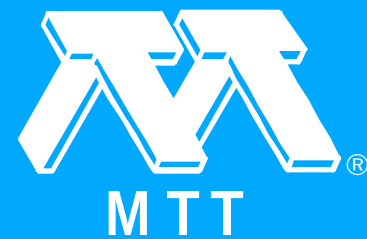
Abstracts

Wireless portable communications trends and challenges

J.S. Escher. "Wireless portable communications trends and challenges." 1997 Radio Frequency Integrated Circuits (RFIC) Symposium 97. (1997 [RFIC]): 1-3.

The electronic wireless communications age has its earliest origins with Thomas Edison and Guglielmo Marconi about 100 years ago. Early R&D on portable communications systems was carried out over forty years ago at AT&T Bell Labs, who led much of the earliest development in communications in the United States. Motorola pursued mobile wireless communications research beginning in the 1960s resulting in the first mobile cellular telephone service in the early 1980s. Decades of continuous cost/performance improvements from the semiconductor and IC packaging industry have had a dramatic impact on reducing the costs, and hence affordability, of all forms of commercial electronics and communications systems.

Furthermore, the recent decade has seen an increased desire for personal and business communications mobility, security and access to information at any time, anywhere. Many of these factors have launched numerous commercial wireless communications systems, such as paging and cellular phone systems from a relatively high-end niche market into the multi-billion dollar consumer electronics businesses of today.



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Abstracts

Traditional and emerging technologies and applications in the radio frequency identification (RFID) industry

J.R. Tuttle. "Traditional and emerging technologies and applications in the radio frequency identification (RFID) industry." 1997 Radio Frequency Integrated Circuits (RFIC) Symposium 97. (1997 [RFIC]): 5-8.

The Radio Frequency Identification (RFID) industry is growing exponentially. Although RFID has been used for automatic data collection since World War II, its growth has been relatively slow through the 1990s. Recent technological developments have opened the door to many new applications of RFID technology that, combined with end-user education, should drive excellent growth through the end of this decade and beyond. Current and emerging uses for RFID technology include a variety of applications such as: toll road and parking area access, intermodal freight container identification, pallet tracking, railroad and truck (rolling stock) tracking, animal identification, work-in-progress tracking, and matching passengers with bags at airports. The strongest new trend in the industry is entry of large semiconductor companies into the marketplace.



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On-chip matching Si-MMIC for mobile communication terminal application

N. Suematsu. "On-chip matching Si-MMIC for mobile communication terminal application." 1997 Radio Frequency Integrated Circuits (RFIC) Symposium 97. (1997 [RFIC]): 9-12.

Recent developments of BiCMOS Si-MMICs for wireless communication applications are reviewed. Among these MMIC's, on-chip matching Si-MMICs are suitable for use in compact transceivers. The use of coplanar waveguide (CPW) type spiral inductors is one of the solutions to achieve low loss matching circuits on a low resistive Si substrate used in standard BiCMOS process. An on-chip matching Si-MMIC front-end has been fabricated, in which CPW type spiral inductors are employed. The measured performance at 1.9 GHz with low d.c. power consumption shows the possibility of application to mobile handset terminals. In addition, the feasibility to implement the system on-chip concept is discussed by referring to an IF/PLL IC fabricated in the same process.

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Abstracts

High gain, high efficiency, low voltage, medium power Si-bipolar transistor suitable for integration

F. van Rijs, R. Dekker, P.H.C. Magnee, R. Vanoppen, E. v.d. Heijden, B.N. Balm and L.C. Colussi. "High gain, high efficiency, low voltage, medium power Si-bipolar transistor suitable for integration." 1997 Radio Frequency Integrated Circuits (RFIC) Symposium 97. (1997 [RFIC]): 15-18.

Medium power transistors in a high performance double polysilicon bipolar process have been fabricated. On-wafer loadpull measurements show high gain (15 dB) and high maximum efficiency (60%) at 1.8 GHz with 27 dBm of output power. These results were obtained with a low supply voltage of 3.5 V. More importantly, these results were obtained with transistors with a buried layer having a collector contact at the top, which makes it possible to integrate power amplifiers on chip.



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A 5.8-GHz 1-V low-noise amplifier in SiGe bipolar technology

M. Soyuer, J.-O. Plouchart, H. Ainspan and J. Burghartz. "A 5.8-GHz 1-V low-noise amplifier in SiGe bipolar technology." 1997 Radio Frequency Integrated Circuits (RFIC) Symposium 97. (1997 [RFIC]): 19-22.

A 5.8-GHz monolithic low-noise amplifier (LNA) with a minimum noise figure of 1.65 dB and an associated gain of 15 dB is implemented in a standard SiGe bipolar technology. It dissipates 13 mW from a 1-V supply (with only 9 mW in the gain stages). The measured transducer gain is 13 dB with a noise figure of 2.1 dB at 5.8 GHz. This is believed to be the lowest noise figure reported for a 5.8-GHz LNA in any production-level technology. The transducer gain is above 10 dB from 3.8 to 8 GHz. At 5.8 GHz, the input return loss and reverse isolation are 6 and 28 dB, respectively.



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A silicon MOS MMIC upconverter for CATV applications

J. Birkeland and R. Sherman. "A silicon MOS MMIC upconverter for CATV applications." 1997 Radio Frequency Integrated Circuits (RFIC) Symposium 97. (1997 [RFIC]): 23-26.

We present the design and performance of a new silicon MOS upconverter designed for use in CATV tuners and related components. The upconverter contains a double balanced mixer, a VCO, and a buffer amplifier. It converts frequencies in the CATV band from 50-860 MHz to an IF in the range of 1000-1250 MHz. The silicon upconverter is an economical alternative to GaAs parts, and shows comparable performance.

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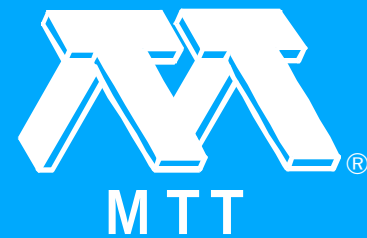


Abstracts

A GaAs MMIC MMDS downconverter

J. Birkeland, R. Sherman, R. Potyka, M. Zou and J. Carbacio. "A GaAs MMIC MMDS downconverter." 1997 Radio Frequency Integrated Circuits (RFIC) Symposium 97. (1997 [RFIC]): 29-32.

We present design and performance of a new GaAs multichannel multipoint distribution system (MMDS) downconverter IC. The IC consists of an integrated mixer, VCO, and buffer amp on a single GaAs die. The downconverter is designed for use in an MMDS receiver converting a block of 32 analog TV channels in the 2500-2686 MHz band to an IF in the 200-400 MHz range.



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A low-cost packaged MMIC chip set for 5.8 GHz ISM band applications

M.D. Pollman, C. Trantanella, M. Shifrin, V. Aparin and D. Upton. "A low-cost packaged MMIC chip set for 5.8 GHz ISM band applications." 1997 Radio Frequency Integrated Circuits (RFIC) Symposium 97. (1997 [RFIC]): 33-36.

This paper describes a packaged MMIC chip set which was developed for low-cost communication equipment operating in the unlicensed 5.725 to 5.850 GHz Industrial, Scientific, and Medical (ISM) band (FCC rule 15.247). The GaAs MMIC chip set described consists of: (1) Transmit/Receive (T/R) switch, (2) low noise amplifier (LNA), (3) double-balanced downconverter mixer, (4) QPSK/BPSK modulator, and (5) variable-gain medium power amplifier. The MMIC designs are discussed and the measured performance of the packaged chip set is presented.

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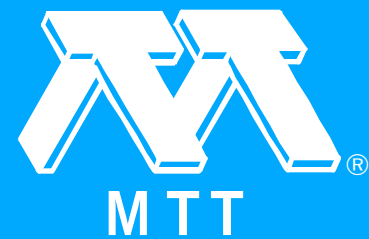


Abstracts

Single 2.2 V operation MMIC power amplifier utilizing SrTiO/sub 3/ capacitors for 2.4 GHz wireless communication systems

T.B. Nishimura, K. Yamaguchi, N. Iwata, M. Tomita, K. Takemura, M. Kuzuhara and Y. Miyasaka. "Single 2.2 V operation MMIC power amplifier utilizing SrTiO/sub 3/ capacitors for 2.4 GHz wireless communication systems." 1997 Radio Frequency Integrated Circuits (RFIC) Symposium 97. (1997 [RFIC]): 37-40.

This paper describes single 2.2 V operation of a two-stage MMIC power amplifier for 2.4 GHz wireless local area network applications. The MMIC with 0.76/spl times/ 0.96 mm/sup 2/ area is composed of n-AlGaAs/InGaAs/n-AlGaAs FETs with a shallow threshold voltage of -0.24 V and SrTiO/sub 3/ capacitors. The capacitors with a high relative dielectric constant of 180 were employed. Under single 2.2 V operation, the developed MMIC delivered an output power of 22.6 dBm (182 mW) and a power-added efficiency of 33.2% with an associated gain of 22.7 dB at 2.48 GHz.



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Abstracts

Embedded transmission line (ETL) MMIC for low-cost, high-density wireless communication applications

Hua-Quen Tserng, P. Saunier, A. Ketterson, L. Witkowski and T. Jones. "Embedded transmission line (ETL) MMIC for low-cost, high-density wireless communication applications." 1997 Radio Frequency Integrated Circuits (RFIC) Symposium 97. (1997 [RFIC]): 41-44.

A new embedded transmission line (ETL) MMIC approach which allows flexibility in mixing different transmission line types (i.e., coplanar and striplines) for maximum MMIC (Monolithic Microwave Integrated Circuits) design flexibility and permits the elimination of back-side processing for low production cost is described. This ETL MMIC approach is an enabling technology allowing for low-cost, batch fabrication, and high-density integration of microwave and RF components (including silicon mixed signal products) for emerging wireless communication applications.



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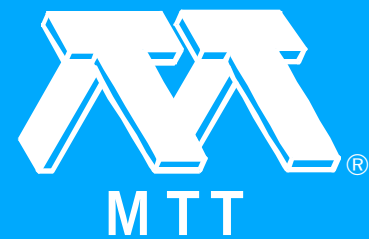
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Monolithic GaAs multi-throw switches with integrated low-power decoder/driver logic

J. Smuk and M. Shifrin. "Monolithic GaAs multi-throw switches with integrated low-power decoder/driver logic." 1997 Radio Frequency Integrated Circuits (RFIC) Symposium 97. (1997 [RFIC]): 47-50.

SP4T, SP6T and SP8T GaAs MMIC switches with integrated low-power decoder/driver logic are described. The integrated decoder/driver significantly reduces the number of on chip control lines, lowering cost, improving RF performance and easing PCB integration. Reflective and terminated versions are realized. Insertion losses range from 0.5-1.7 dB, isolations range from 20-45 dB, 1 dB input power compressions range from 20-24 dBm and single tone third order intercepts range from 40 to 42 dBm at 2 GHz. The logic operates over temperatures from 196/spl deg/C to 125/spl deg/C and supply voltages from 3-7 V while consuming under 25 mW of DC power. Control current requirements are under 200 /spl mu/A, allowing standard CMOS and TTL logic families to interface. Switching times are under 100 nsec.

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Low power, monolithic tunable recursive filters having variable and uniform gain

Jin-Su Ko and Kwyro Lee. "Low power, monolithic tunable recursive filters having variable and uniform gain." 1997 Radio Frequency Integrated Circuits (RFIC) Symposium 97. (1997 [RFIC]): 51-54.

We suggest the new monolithic, tunable, recursive filters having variable, uniform, and high gain. We change the location of amplifier to achieve higher gain. We use the cascode amplifier as VGA to get the variable, uniform and high gain. To achieve higher Q and low power consumption, we also fabricate the second-order filter using only one amplifier. The measured results are similar to our estimations.

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AlGaAs/GaAs HBT limiting amplifier for 10 Gbps optical transmission system

Bongsin Kwark and Moon Soo Park. "AlGaAs/GaAs HBT limiting amplifier for 10 Gbps optical transmission system." 1997 Radio Frequency Integrated Circuits (RFIC) Symposium 97. (1997 [RFIC]): 55-58.

A 10 Gbit/s limiting amplifier IC for optical transmission system was implemented with AlGaAs HBT technology. Amplifier was designed to support differential input and output. Small signal performance of the packaged IC achieves 26 dB gain and $f_{\text{sub 3dB}}$ of 8 GHz. A single output has 800 mV/sub p-p/ swing with more than 26 dB dynamic range. The performance of the limiting amplifier was verified through single mode fiber 320 km transmission link test.



Analog RF-optoelectronic integrated circuit receivers

D. Yap, R.H. Walden, Y.-M. Xie, Y.K. Brown, J. Vivilecchia and A.C. Yee. "Analog RF-optoelectronic integrated circuit receivers." 1997 Radio Frequency Integrated Circuits (RFIC) Symposium 97. (1997 [RFIC]): 59-62.

Optoelectronic Integrated Circuit (OEIC) receivers have been demonstrated for analog rf-photonic links. The photodetector and preamplifier are both based on the same InGaAs/InAlAs/InP heterojunction bipolar transistor structure. On-chip AC-coupling filters accommodate links having low modulation depths. The receivers operate in 1-6 GHz and 2-18 GHz bands.



Abstracts

The future of RFIC transceiver technology

C. Kermarrec, G. Dawe, T. Tewksbury and T. Brown. "The future of RFIC transceiver technology." 1997 Radio Frequency Integrated Circuits (RFIC) Symposium 97. (1997 [RFIC]): 65-68.

RFIC Technology is still in the infancy phase. The requirement for extremely low-cost, high-performance RF transceivers will drive dramatic changes in system architecture, semiconductor technology, and circuit implementation in the next few years. This paper addresses some of these issues and presents results that illustrate new directions in RFIC transceiver technology development.



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Abstracts

Highly integrated RF-ICs for GSM and DECT

J. Fenk. "Highly integrated RF-ICs for GSM and DECT." 1997 Radio Frequency Integrated Circuits (RFIC) Symposium 97. (1997 [RFIC]): 69-72.

TDMA based digital systems like GSM for cellular and DECT for cordless application have created an increasing market within Europe and gained widespread acceptance also outside Europe. This paper gives an overview of both systems. The system requirements and their influences on highly integrated RF ICs for GSM and DECT are discussed. The various trends of progress in integration of both systems are considered.



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A novel 12-24 GHz broadband HBT distributed active balanced mixer

K.W. Kobayashi, L.T. Tran, M. Lammert, T.R. Block, A.K. Oki and D.C. Streit. "A novel 12-24 GHz broadband HBT distributed active balanced mixer." 1997 Radio Frequency Integrated Circuits (RFIC) Symposium 97. (1997 [RFIC]): 75-78.

Here we present a novel HBT distributed active balanced Schottky mixer design that demonstrates octave-band balanced frequency performance in a compact 3/spl times/3.9 mm/sup 2/ MMIC while operating with a reduced LO power of +9 dBm. The MMIC mixer features a unique HBT distributed active balun design which employs a novel HBT active IF center-tap combiner that provides gain and also functions as an active load termination for the distributed LO and RF baluns. High performance vertical Schottky diodes made from the existing HBT epitaxy comprise the active mixer device. The HBT active balanced Schottky mixer achieves 8-12 dB conversion loss over a simultaneously swept 12-24 GHz RF and LO octave input band. An LO-IF isolation /spl ges/20 dB, LO-RF isolation /spl ges/30 dB, and 2-2 spur suppression of 24-30 dBc were also achieved across the band and are attributed to the excellent bipolar threshold and beta matching properties of the high speed 1 /spl mu/m GaAs HBTs ($f_{\text{sub T}}=43$ GHz). The new HBT distributed active balanced mixer design has potential use in wideband mixer applications such as direct-conversion receivers.



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A monolithic 24-GHz frequency source using InP-based HEMT-HBT integration technology

H. Wang, E. Lin, D.C.W. Lo, R. Lai, L. Tran, J. Cowles, Y.C. Chen, T. Block, P.H. Liu, H.C. Yen and K. Stamper. "A monolithic 24-GHz frequency source using InP-based HEMT-HBT integration technology." 1997 Radio Frequency Integrated Circuits (RFIC) Symposium 97. (1997 [RFIC]): 79-81.

This paper presents the development of a 24-GHz monolithic frequency source using InP-based HEMT-HBT integration technology. This frequency source consists of a 24-GHz HBT voltage controlled oscillator (VCO) and a HEMT buffer amplifier, and was fabricated on a single 3-mil thick InP substrate. It exhibits a measured oscillation frequency of 24.6 GHz with an output power of 4.2 dBm. This is the first successful demonstration of MMIC using InP-based HEMT-HBT integration technology.

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A novel monolithic HEMT-HBT Ka-band VCO-mixer design

K.W. Kobayashi, A.K. Oki, D.K. Umemoto, T.R. Block and D.C. Streit. "A novel monolithic HEMT-HBT Ka-band VCO-mixer design." 1997 Radio Frequency Integrated Circuits (RFIC) Symposium 97. (1997 [RFIC]): 83-86.

Here we present a novel demonstration of a HEMT-HBT VCO-mixer which utilizes a unique active topology and is the first Ka-band MMIC demonstrated using GaAs HEMT-HBT IC technology. The MMIC integrates a novel HEMT-HBT cascode active mixer topology which operates similar to a dual-gate mixer. An all active HEMT-HBT VCO is constructed from the HBT of the cascode by providing a HEMT tunable active inductor-resonator. The VCO can be tuned from 28.5 to 29.3 GHz while providing 10 dBm of output power. Operated as an upconverter, the HEMT-HBT VCO-mixer achieves 6-9 dB conversion-loss over a 31 to 39 GHz output frequency band. The compact MMIC is 1.44/spl times/0.76 mm/sup 2/ in area due to the use of novel active circuit topologies and relies on minimal use of passive matching. The novel miniature active RF IC techniques demonstrated here have direct implications for future high complexity HEMT-HBT millimeter-wave MMICs.

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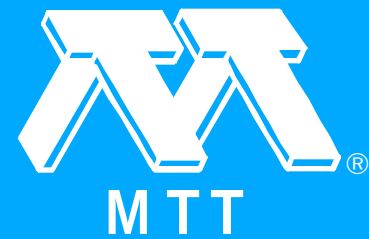


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Ultra-fast, low-power integrated circuits in a scaled submicron HBT IC technology

M. Hafizi and J.F. Jensen. "Ultra-fast, low-power integrated circuits in a scaled submicron HBT IC technology." 1997 Radio Frequency Integrated Circuits (RFIC) Symposium 97. (1997 [RFIC]): 87-90.

We have developed fast, dense, and low-power integrated circuits using a new scaled IC process. We have fabricated HBTs of $0.3 \mu\text{m}/\mu\text{m}^2$ emitter and circuit metalization pitch of $4 \mu\text{m}/\mu\text{m}$ to reduce power and compact the chip size. Submicron HBTs exhibited $f_{\text{sub T}}$ of over 160 GHz. We have demonstrated a number of circuits including a low-power comparator test chip clocked at 40 GHz.



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Monolithic 77- and 94-GHz InP-based HBT MMIC VCOs

H. Wang, L. Tran, J. Cowles, E. Lin, P. Huang, T. Block, D. Streit and A. Oki. "Monolithic 77- and 94-GHz InP-based HBT MMIC VCOs." 1997 Radio Frequency Integrated Circuits (RFIC) Symposium 97. (1997 [RFIC]): 91-94.

This paper presents the development of 77- and 94-GHz monolithic fundamental mode VCOs using InP-based HBT MMIC technology. The InP-based HBT performance was improved by base mesa undercutting the base ohmic along two sides to reduce the base-collector junction capacitor by 40% which results in $f_{sub T}$ and $f_{sub max}$ of 70 and 170 GHz, respectively. By using this improved HBT device, the 77-GHz VCO exhibits a measured oscillation frequency of 77.6 GHz with a peak output power of -3 dBm, while the 94-GHz VCO demonstrates a measured oscillation frequency of 94.7 GHz with a peak output power of -3.5 dBm. The 94-GHz VCO is the highest frequency fundamental mode oscillator ever reported using bipolar device technology.

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50-100 GHz octave band MMIC mixers

K. Kamozaqi, N. Kurita, T. Tanimoto, H. Ohta, T. Nakamura and H. Kondoh. "50-100 GHz octave band MMIC mixers." 1997 Radio Frequency Integrated Circuits (RFIC) Symposium 97. (1997 [RFIC]): 95-98.

Single-balanced MMIC mixers covering RF and LO bands of 50-100 GHz have been developed. A Marchand balun and a side-coupled balun in microstrip configurations were compared for LO drive ports of the mixers. The Marchand balun type demonstrated a conversion loss of 11.6 dB/spl plusmn/2.8 dB over a 50-103.5 GHz band, whereas the side-coupled balun type achieved a conversion loss of 11.6/spl plusmn/2.2 dB from 50 GHz to 95 GHz. These results represent the widest bandwidth reported to date in MM-wave bands.

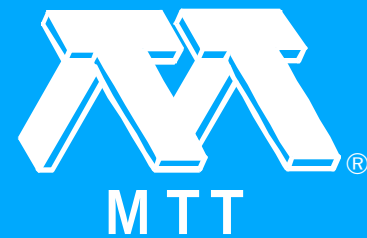


Abstracts

High frequency interconnects on silicon substrates

G.E. Ponchak, A.N. Downey and L.P.B. Katehi. "High frequency interconnects on silicon substrates." 1997 Radio Frequency Integrated Circuits (RFIC) Symposium 97. (1997 [RFIC]): 101-104.

The measured propagation constant of coplanar waveguide (CPW) on silicon wafers as a function of the line dimensions and the resistivity of the Si wafer; CPW on GaAs wafers as a function of the line dimensions; and thin film microstrip (TFMS) fabricated with polyimide on the surface of a silicon wafer is presented. It is shown that the attenuation of CPW on 2500 $\Omega\text{-cm}$ Si wafers and of TFMS with a polyimide thickness of 4 μm or greater is comparable to the attenuation of similar lines on GaAs.



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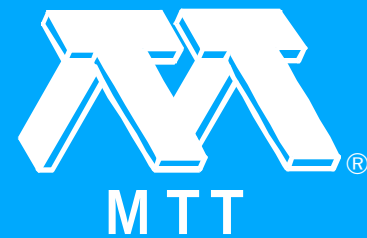


Abstracts

SiGe SIMMWICs

J.-F. Luy and P. Russer. "SiGe SIMMWICs." 1997 Radio Frequency Integrated Circuits (RFIC) Symposium 97. (1997 [RFIC]): 105-108.

Millimeterwave transit time devices are monolithically integrated on a high resistivity silicon substrate. The resonant structure acts as an active antenna at 76.5 GHz with a synchronisation network. Acting as a subharmonic synchronisation oscillator, a coplanar SiGe MMIC for 25.5 GHz power generation is described. The realized module shows a frequency tuning range of >250 MHz which can be adjusted by the frequency of the synchronisation oscillator.



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A fully monolithic HMIC low noise amplifier

T. Boles. "A fully monolithic HMIC low noise amplifier." 1997 Radio Frequency Integrated Circuits (RFIC) Symposium 97. (1997 [RFIC]): 109-112.

A two/three stage monolithic silicon low noise amplifier has been designed utilizing SPICE modeling techniques. The circuit design architecture is based on high frequency, small signal BJTs, consisting of an grounded emitter stage at the input and a Darlington configured pair at the device output. A resistor network, with a bypass capacitor, is utilized not only to provide proper DC biasing for each stage, but also obtain impedance matching to 50 ohms at the circuit input and output and to provide RF feedback for the desired broad band gain response. A patented HMIC (Heterolithic Microwave Integrated Circuit) glass process is employed to provide both the required collector isolation between active device stages and as an extremely low loss dielectric medium for minimum parasitic, high Q passive, reactive elements.

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Three-dimensional masterslice MMIC on Si substrate (1997 [RFIC])

I. Toyoda, K. Nishikawa, T. Tokumitsu, K. Kamogawa, C. Yamaguchi, M. Hirano and M. Aikawa. "Three-dimensional masterslice MMIC on Si substrate (1997 [RFIC])." 1997 Radio Frequency Integrated Circuits (RFIC) Symposium 97. (1997 [RFIC]): 113-116.

This paper describes Si based three-dimensional MMIC technology. This technology greatly improves the operating frequency of Si MMICs up to the Ku-band and makes them competitive with GaAs MMICs in the higher frequency band. An X-band amplifier and highly integrated single-chip receiver using Si bipolar transistors are demonstrated to highlight the advantages of the Si 3-D MMIC technology. Cost estimation compared with conventional GaAs 2-D MMICs is also discussed.

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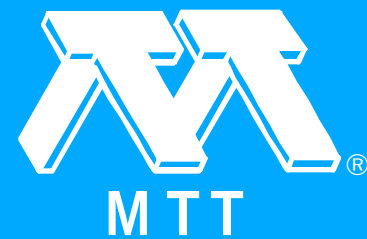


Abstracts

SiGe MMICs and flip-chip MICs for low-cost microwave systems

M. Case. "SiGe MMICs and flip-chip MICs for low-cost microwave systems." 1997 Radio Frequency Integrated Circuits (RFIC) Symposium 97. (1997 [RFIC]): 117-120.

Recent Progress in SiGe device technology has improved cutoff frequencies of these devices to beyond 200 GHz. This work describes two approaches for implementing distributed structures with Si substrates: microstrip transmission lines using thick polyimide over a ground plane on the substrate (polyimide MMIC) and small Si devices or chips flip-chip mounted onto a microwave circuit board containing the distributed elements (flip-chip MIC). Microwave circuits such as amplifiers, oscillators, mixers, and frequency dividers have been demonstrated using both techniques.



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Silicon low noise amplifier chips for multi-chip module integration on a silicon-based substrate

Jenshan Lin, J.S. Weiner, Huan-Shang Tsai, G. Georgiou, Young-Kai Chen, K.L. Tai, M.Y. Lau and D.P. Kossives. "Silicon low noise amplifier chips for multi-chip module integration on a silicon-based substrate." 1997 Radio Frequency Integrated Circuits (RFIC) Symposium 97. (1997 [RFIC]): 121-125.

A method of designing low noise amplifier (LNA) using multi-chip module (MCM) technology is described here. First, low noise amplifier blocks using silicon BiCMOS process were fabricated. Noise figure and gain from 2-6 GHz were measured at different bias voltages after chips were fabricated. These chips were designed for multi-chip module integration on a newly developed low cost, low loss silicon substrate on which high-Q matching inductors are fabricated. Since the electrical characteristics of passive components on MCM are well controlled and the electrical characteristics of active devices are measured after fabrication, design accuracy and high yield can be achieved. Two design examples of low noise amplifiers at 2 GHz and 5 GHz are discussed. The 2 GHz LNA design utilizes high-Q spiral inductors as matching components whereas the 5 GHz LNA design utilizes microstrip lines as matching inductors.

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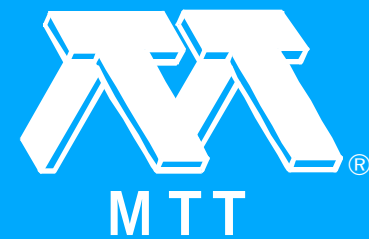


Abstracts

An integrated bipolar transmitter for DECT

S. Heinen, K. Hadjizada, U. Matter, W. Geppert, V. Thomas, S. Weber, S. Beyer and J. Fenk.
"An integrated bipolar transmitter for DECT." 1997 Radio Frequency Integrated Circuits (RFIC) Symposium 97. (1997 [RFIC]): 127-130.

An integrated bipolar transmitter IC for DECT is presented. The influence of the open loop architecture commonly used for the DECT system on the TX-IC concept is discussed in detail. It is shown that a two chip radio can achieve a higher integration level than a single chip solution.



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A highly integrated radio transceiver chipset for DECT

J. Strang and S. Atkinson. "A highly integrated radio transceiver chipset for DECT." 1997 Radio Frequency Integrated Circuits (RFIC) Symposium 97. (1997 [RFIC]): 131-134.

A two chip solution for the DECT (Digital Enhanced Cordless Telecommunications) system has been implemented using Si bipolar technologies. A front end device implements up and down converting mixers, a VCO, driver amplifiers etc. Using a high speed 24-GHz NPN bipolar process. The IF device includes a down converting mixer, VCO, IF limiting strip with RSSI, on chip band-pass Gm-C filters and a fully integrated PLL demodulator. This device is implemented using a high speed complementary bipolar process. Both IC's include on-chip voltage regulation and power management.

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Noise figure & associated conversion gain of a GaAs heterojunction bipolar transistor mixer

B.A. Xavier and C.S. Atkinson. "Noise figure & associated conversion gain of a GaAs heterojunction bipolar transistor mixer." 1997 Radio Frequency Integrated Circuits (RFIC) Symposium 97. (1997 [RFIC]): 135-138.

An analytical technique is developed to predict the noise performance of the GaAs Heterojunction Bipolar transistor (HBT) mixer. The measured versus modelled data shows good agreement. The measured noise figure of the HBT mixer is 15.7dB with an associated conversion gain of +13dB (RF=950MHz, IF=50MHz).

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Abstracts

An integrated 2 GHz 500 mW bipolar amplifier

S. Weber and G. Donig. "An integrated 2 GHz 500 mW bipolar amplifier." 1997 Radio Frequency Integrated Circuits (RFIC) Symposium 97. (1997 [RFIC]): 139-142.

A low cost integrated 2 GHz 500 mW amplifier for DECT and other applications is presented. The total efficiency is 35% with a 3.3 V supply voltage and 0 dBm input signal. The chip is based on the Siemens B6HF 26 GHz-f/sub T/-technology and is to our knowledge the first commercial 500 mW 2 GHz amplifier in bipolar technology. The device also features functions which are previously not available from PA ICs including power down, power selection and supply voltage compensation.



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A new paradigm for base station receivers: high IF sampling + digital filtering

T. Gratzek, B. Brannon, J. Camp and F. Murden. "A new paradigm for base station receivers: high IF sampling + digital filtering." 1997 Radio Frequency Integrated Circuits (RFIC) Symposium 97. (1997 [RFIC]): 143-146.

A dual-channel, IF sampling receiver IC with fast RSSI and AGC is described. The ADC samples with only 200 femto second aperture jitter and is used to digitize intermediate frequencies (IFs) up to 250 MHz. A companion digital filter and mixer processor provides 1657 MOPs; together they provide a flexible platform for use in a new generation of digital receivers for various radio standards.



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A self calibrating quadrature generator with wide frequency range

D. Lovalace and J. Durec. "A self calibrating quadrature generator with wide frequency range." 1997 Radio Frequency Integrated Circuits (RFIC) Symposium 97. (1997 [RFIC]): 147-151.

A quadrature local oscillator generator that produces 0/spl deg/ and 90/spl deg/ amplitude matched signals over a wide frequency range was fabricated using a high performance bipolar technology. This circuit employs a unique phase shifting circuit combined with an improved high frequency phase detector to produce quadrature outputs. RC based circuits, which have typically been used to generate high frequency quadrature signals, can operate only over a narrow frequency range. Other quadrature generation methods such as frequency dividers, use a reference LO frequency at least twice that of the desired quadrature signal and require a duty cycle adjustment circuit which has bandwidth limitations. The circuit described in this paper operates over a frequency range of 400 MHz through 700 MHz with low amplitude and phase imbalance.





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Silicon RF GCMOS performance for portable communications applications (1997 [RFIC])

E. Spears, D. Ngo, Jun Ma, Han-Bin Liang, D. Spooner, J. Ford, S. Cheng, B. Courson, B. Yeung, J. Avalrez, J. Bhalla and D. Lamey. "Silicon RF GCMOS performance for portable communications applications (1997 [RFIC])." 1997 Radio Frequency Integrated Circuits (RFIC) Symposium 97. (1997 [RFIC]): 153-156.

A submicron silicon Radio Frequency Graded Channel MOS (RFGCMOS) technology has been developed for portable communications applications. A 12 mm device at 900 MHz has +29 dBm output power with 12 dB gain and 78% power added efficiency (PAE) at a drain to source voltage of 3.4 V, and drain to source quiescent current of 150 mA. A 256 /spl mu/m device at 900 MHz has 18.9 dB of small signal gain and an associated noise figure of 1.1 dB at VDS=3.0 volts and IDS=2 mA.





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High dynamic range variable gain amplifier for CDMA applications (1997 [RFIC])

M. Kasashima, S. Tachi and K. Tanaka. "High dynamic range variable gain amplifier for CDMA applications (1997 [RFIC])." 1997 Radio Frequency Integrated Circuits (RFIC) Symposium 97. (1997 [RFIC]): 157-160.

A new attenuator and threshold voltage (V_{th}) compensation circuits using GaAs MESFETs were designed and developed and this circuit was applied to develop a variable gain amplifier (VGA) for CDMA cellular phone systems. This VGA is packaged in an 8 pin plastic package and demonstrated high dynamic variable gain range (80 dB/100 MHz 70 dB/250 MHz 55 dB/500 MHz). High gain of 60 dB is observed for 85 MHz with low power consumption ($V_{dd}=+2.7$ V, $I_{dd}=6$ mA). Since depletion mode MESFETs are used no negative supply is needed for gain control.

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A novel integrated microwave bias network for low cost multistage amplifiers (1997 [RFIC])

H. Morkner, M. Frank, K. Negus and Tsong-Ming Kao. "A novel integrated microwave bias network for low cost multistage amplifiers (1997 [RFIC])." 1997 Radio Frequency Integrated Circuits (RFIC) Symposium 97. (1997 [RFIC]): 161-164.

A novel MMIC bias network topology utilizing FETs has been developed. The bias network is very compact, providing low DC path loss with high, broad band RF isolation. This bias network consists of two FETs and a capacitor, and is implemented in pseudomorphic HEMT. The bias network is useful in multi-stage amplifiers where stage-to-stage RF isolation is critical to system stability and performance. A VGA (Variable gain amplifier) is shown with measured results as a application example of the bias network. There is no other known published information or patents on this bias network topology.

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MMIC GaAs transimpedance amplifiers for optoelectronic applications (1997 [RFIC])

P. Dueme, M. Schaller, D. Mathoorasing, S. Bouchoule, C. Kazmierski, S. Maricot and C. Rumelhard. "MMIC GaAs transimpedance amplifiers for optoelectronic applications (1997 [RFIC])." 1997 Radio Frequency Integrated Circuits (RFIC) Symposium 97. (1997 [RFIC]): 165-168.

This paper demonstrates the feasibility of MMICs able to improve the global performances of an optical link, over a typical 1 to 20 GHz frequency range. A distributed laser driver and a photodiode bootstrap follower provide active matching between 50 Ω and optoelectronic transducers.

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Ka-band ultra low noise MMIC amplifier using pseudomorphic HEMTs (1997 [RFIC])

S. Fujimoto, T. Katoh, T. Ishida, T. Oku, Y. Sasaki, T. Ishikawa and Y. Mitsui. "Ka-band ultra low noise MMIC amplifier using pseudomorphic HEMTs (1997 [RFIC])." 1997 Radio Frequency Integrated Circuits (RFIC) Symposium 97. (1997 [RFIC]): 169-172.

A Ka-band monolithic low noise two stage amplifier has been developed using an AlGaAs-InGaAs-GaAs pseudomorphic HEMTs with a gate length of 0.15 μm . For a superior noise figure, the MMIC was optimized by inserting a low loss resonator type stabilizing circuit without sacrificing the gain performance. The amplifier has achieved a 1.0 dB noise figure with an associated gain of 18.0 dB at 32 GHz. These results are the best of AlGaAs-InGaAs-GaAs P-HEMT MMICs ever reported to date.





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Silicon RF-GCMOS IC technology for RF mixed-mode wireless applications (1997 [RFIC])

Jun Ma, Han-Bin Liang, D. Ngo, E. Spears, B. Yeung, B. Courson, D. Spooner, D. Lamey, J. Alvarez, T. Teraji, J. Ford and S. Cheng. "Silicon RF-GCMOS IC technology for RF mixed-mode wireless applications (1997 [RFIC])." 1997 Radio Frequency Integrated Circuits (RFIC) Symposium 97. (1997 [RFIC]): 175-180.

A submicron silicon Radio Frequency Graded-Channel MOS (RF-GCMOS) IC technology has been developed for wireless communication applications. The technology is based on a low power, low cost GCMOS VLSI technology with fully integrated passive components and optimized GC-MOSFETs for RF mixed-mode operations. For the first time, excellent RF and mixed-mode performance is demonstrated by the highly integrated RF GCMOS technology. The results show that this technology is most promising for battery-powered system-on-a-chip applications.

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Optimization of high Q CMOS-compatible microwave inductors using silicon CMOS technology (1997 [RFIC])

Min Park, Seonghearn Lee, Hyun Kyu Yu and Kee Soo Nam. "Optimization of high Q CMOS-compatible microwave inductors using silicon CMOS technology (1997 [RFIC])." 1997 Radio Frequency Integrated Circuits (RFIC) Symposium 97. (1997 [RFIC]): 181-184.

We present the extensive experimental results showing the important dependences of layout parameters on RF performance of rectangular spiral inductors, in order to determine the optimized layout parameters for designing the high Q inductors used in RF ICs at 2 GHz. The detailed comparative analysis is also carried out to investigate substrate effects by varying the substrate resistivity.

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Low-frequency noise characteristics of self-aligned AlGaAs/GaAs HBTs with a noise corner frequency below 3 kHz (1997 [RFIC])

Jin-Ho Shin, Jiyoung Kim, Yujin Chung, Joonwoo Lee, Kyu Hwan Ahn and Bumman Kim. "Low-frequency noise characteristics of self-aligned AlGaAs/GaAs HBTs with a noise corner frequency below 3 kHz (1997 [RFIC])." 1997 Radio Frequency Integrated Circuits (RFIC) Symposium 97. (1997 [RFIC]): 185-188.

We have investigated the surface recombination and its $1/f$ noise properties of AlGaAs/GaAs HBT's as a function of the emitter-base structure and the surface passivation condition. It is found that the surface recombination $1/f$ noise can be significantly reduced by the heterojunction launcher of the abrupt junction with 30% Al mole fraction emitter. The depleted AlGaAs ledge surface passivation further suppresses the surface recombination currents. Consequently, we have achieved a very low $1/f$ noise corner frequency of 2.8 kHz at the collector current density of 10 kA/cm². The dominant noise source of the HBT is not a surface recombination current, but a bulk current noise. This is the lowest $1/f$ noise corner frequency among the III-V compound semiconductor devices, and comparable to those of low-noise Si BJTs.

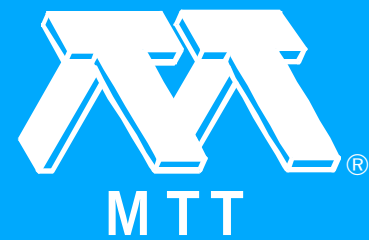


Abstracts

28 V low thermal impedance HBT with 20 W CW output power (1997 [RFIC])

D. Hill and Tae Kim. "28 V low thermal impedance HBT with 20 W CW output power (1997 [RFIC])." 1997 Radio Frequency Integrated Circuits (RFIC) Symposium 97. (1997 [RFIC]): 189-192.

AlGaAs/GaAs heterojunction bipolar transistors have been fabricated which exhibit record output power for GaAs flip-chip technology, and record operating voltage for GaAs microwave power devices. Transistors with 2 mm emitter length readily achieve 20 W CW output power at 2 GHz when biased at 28 V, with typical power-added efficiencies of 62% (typical collector efficiencies of 70%). Maximum CW output power of 25 W has been obtained, corresponding to a power density of 12.5 W/mm.



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High-reliability GaAs HBT monolithic microwave amplifier (1997 [RFIC])

F.M. Yamada, A.K. Oki, D.C. Streit, D.K. Umemoto, L.T. Tran, T.R. Block, D.T. Okazaki, M.M. Hoppe and E.A. Rezek. "High-reliability GaAs HBT monolithic microwave amplifier (1997 [RFIC])." 1997 Radio Frequency Integrated Circuits (RFIC) Symposium 97. (1997 [RFIC]): 193-196.

High-reliability performance of an X-band high-intercept MMIC amplifier fabricated using a production GaAs/AlGaAs HBT process technology is reported. Operating at 20 kA/cm² quiescent collector current density, the single-stage balanced amplifier with on-chip regulation has a projected median-time-to-failure (MTF) of 4/spl times/10/sup 7/ hours at a 125/spl deg/C junction temperature. MTF was determined by three-temperature constant-stress accelerated lifetest using $|S_{21}| > 1.0$ dB as the failure criterion. Additionally, an activation energy (Ea) of 1.2 eV and log-standard deviation (σ) of 0.7 was measured. This is the first report of HBT reliability based on small-signal microwave characteristics of HBT MMIC amplifiers under lifetest.

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Systematic investigations on MESFETs and passive components transplanted by epitaxial lift off onto host materials with various resistivities (1997 [RFIC])

T. Morf, C. Biber and W. Bachtold. "Systematic investigations on MESFETs and passive components transplanted by epitaxial lift off onto host materials with various resistivities (1997 [RFIC])." 1997 Radio Frequency Integrated Circuits (RFIC) Symposium 97. (1997 [RFIC]): 197-200.

In this paper we present RF measurements on MESFETs and spiral inductors fabricated on GaAs and transplanted by epitaxial lift off (ELO). ELO is a technology by which epitaxially grown layers are lifted off from their growth substrate and are subsequently reattached to a new host substrate.

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Compact integrated coplanar T/R-modules for automotive applications (1997 [RFIC])

L. Verweyen, A. Bangert, H. Massler, T. Fink, M. Neumann, R. Osorio, T. Krems, T. Jakobus, W.H. Haydl and M. Schlechtweg. "Compact integrated coplanar T/R-modules for automotive applications (1997 [RFIC])." 1997 Radio Frequency Integrated Circuits (RFIC) Symposium 97. (1997 [RFIC]): 203-206.

Integrated transmit and receive MMICs for automotive applications have been realized in coplanar waveguide technology, using a 0.15 μm PHEMT process. The transmitter chip delivers an output power of 10 dBm at the antenna and the LO-ports. The receiver has an overall conversion gain of 10 dB for an LO-power of -10 dBm. Both chips only require an area of 3/spl times/2 mm/sup 2/. For an improved higher power version of the transmitter, a new nonlinear HEMT-model has been used for the design of a power amplifier, resulting in excellent agreement between predicted and measured output performance at 76 GHz.

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Abstracts

A V-band GaAs MMIC chip set on a highly reliable WSi/Au refractory gate process (1997 [RFIC])

J. Mizoe, T. Matsumura, K. Unosawa, Y. Akiba, K. Nagai, H. Sato, T. Saryo and T. Inoue. "A V-band GaAs MMIC chip set on a highly reliable WSi/Au refractory gate process (1997 [RFIC])." 1997 Radio Frequency Integrated Circuits (RFIC) Symposium 97. (1997 [RFIC]): 207-210.

A compact V-band GaAs MMIC chip set consisting of 1) a single highly integrated receiver MMIC with 6.5 dB N.F. and 2 dB conversion gain using a subharmonically pumped mixer and 2) a transmitter MMIC having a state-of-the-art 30-60 GHz doubler with 14.3 dB maximum conversion gain, 17.7 dBm output power and broadband RF characteristics has been successfully implemented with a refractory WSi/Au gate for high reliability. The HJFETs of these MMICs exhibited an MTTF of 4E7 hours at a channel temperature (Tch) of 130/spl deg/C. This result demonstrates high potential of our MMIC technology and to enable highly reliable and highly integrated V- and W-band systems.



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A D-LDD (double lightly-doped drain) structure H-MESFET for MMIC applications (1997 [RFIC])

Y. Yamane, K. Onodera, T. Nittono, K. Nishimura, K. Yamasaki and A. Kanda. "A D-LDD (double lightly-doped drain) structure H-MESFET for MMIC applications (1997 [RFIC])." 1997 Radio Frequency Integrated Circuits (RFIC) Symposium 97. (1997 [RFIC]): 211-214.

This paper proposes a new D-LDD (Double Lightly-Doped Drain) structure for InGaP-InGaAs H-MESFETs (Heterostructure-MESFET). A D-LDD H-MESFET has three kinds of low resistant layers in the drain region, while a conventional H-MESFET has two layers. This structure improves MAG accompanied by Rd reduction with minimized gate-breakdown-voltage degradation and Cgd increase. These trade-offs between Rd and breakdown voltage are discussed in detail. Consequently, a typical MAG at 50 GHz exhibits 8.9 dB S21 in a MESFET and 7.7 dB S21 in a 1-stage amplifier. The high-frequency circuit operation proves that this technology is one of the most promising for MMIC applications.

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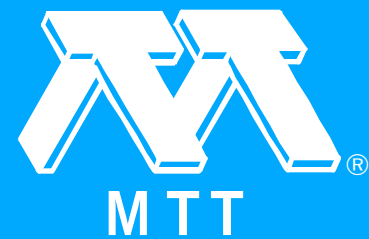


Abstracts

Low phase noise Ka-band VCOs using InGaP/GaAs HBTs and coplanar waveguide (1997 [RFIC])

M.S. Heins, D.W. Barlage, M.T. Fresina, D.A. Ahmari, Q.J. Hartmann, G.E. Stillman and M. Feng. "Low phase noise Ka-band VCOs using InGaP/GaAs HBTs and coplanar waveguide (1997 [RFIC])." 1997 Radio Frequency Integrated Circuits (RFIC) Symposium 97. (1997 [RFIC]): 215-218.

Ka-band voltage controlled oscillators (VCOs) have been designed using InGaP/GaAs HBT technology. The best measured VCO shows a phase noise of -95 dBc/Hz at 100 kHz offset and -112 dBc/Hz at 1 MHz offset, delivering 5.3 dBm output power at 40.8 GHz. Variations of circuit topology and resonator type were fabricated to evaluate their contribution to phase noise and tuning range.



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1 Watt, 65% PAE K-band AlGaAs/GaAs heterojunction bipolar transistors using emitter air-bridge technology (1997 [RFIC])

Hin-Fai Chau, D. Hill, R. Yarborough and Tae Kim. "1 Watt, 65% PAE K-band AlGaAs/GaAs heterojunction bipolar transistors using emitter air-bridge technology (1997 [RFIC])." 1997 Radio Frequency Integrated Circuits (RFIC) Symposium 97. (1997 [RFIC]): 219-222.

We report on the state-of-the-art power performance of K-band AlGaAs-GaAs heterojunction bipolar transistors (HBTs) which had emitter air-bridges to connect individual emitter fingers within the unit cells to reduce the emitter inductance and device thermal impedance. A 8/spl times/(1.6/spl times/30) /spl mu/m/sup 2/ HBT achieved 1.04 W CW output power and 65.7% power-added efficiency with 6.3 dB associated gain at 20 GHz. The maximum power-added efficiency measured was 67.5% at an output power level of 0.93 W.





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A monolithic GaAs PIN switch network for a 77 GHz automotive collision warning radar (1997 [RFIC])

J. Putnam, M. Barter, K. Wood and J. LeBlanc. "A monolithic GaAs PIN switch network for a 77 GHz automotive collision warning radar (1997 [RFIC])." 1997 Radio Frequency Integrated Circuits (RFIC) Symposium 97. (1997 [RFIC]): 225-228.

This paper presents the design, fabrication, and performance of a 77 GHz monolithic GaAs PIN switch network developed for an automotive collision warning radar. The RF front end of the radar contains three control circuits which were initially realized by a hybrid approach using a duroid circuit and beam lead diodes. These three circuits were successfully integrated into a single 77 GHz MMIC. The MMIC uses vertical GaAs PIN diodes with a switching cutoff frequency of over 3000 GHz, attaining low insertion loss and high isolation. Insertion loss is comparable to that obtained with a hybrid circuit, while the isolation improved from a typical level of 16 dB for a single hybrid switch to over 25 dB in the MMIC. The use of GaAs PIN diodes also allowed switching speeds of less than 2 ns to be attained, a key requirement for the radar.

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Temperature analysis and on-chip compensation for an UHF VCO

Y. Sun, H.G. van Veenendaal and J.L. Tauritz. "Temperature analysis and on-chip compensation for an UHF VCO." 1997 Radio Frequency Integrated Circuits (RFIC) Symposium 97. (1997 [RFIC]): 229-232.

This paper treats the study of on-chip temperature compensation of a broad-band UHF VCO. Analysis, design and evaluation of IC oscillators are described. Excellent agreement between simulation and measurement is demonstrated. The frequency deviation drift specification over a 25/spl deg/C temperature range has been reduced to <0.5 MHz within the frequency range of 470/spl sim/930 MHz.

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Multilayer passive components for uniplanar Si/SiGe MMICs (1997 [RFIC])

T. Gokdemir, U. Karacaoglu, D. Budimir, S.B. Economides, A. Khalid, A.A. Rezazadeh and I.D. Robertson. "Multilayer passive components for uniplanar Si/SiGe MMICs (1997 [RFIC])." 1997 Radio Frequency Integrated Circuits (RFIC) Symposium 97. (1997 [RFIC]): 233-236.

This paper describes results for novel multilayer passive components, fabricated on silicon substrates for Si/SiGe uniplanar MMICs. Results are compared for high resistivity silicon, high resistivity silicon with an added polyimide layer, and silicon with silicon dioxide (to represent SOI bonded silicon technology). The components that have been characterized include CPW and TFMS transmission lines and couplers, inductors, capacitors, and planar transformers.

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Abstracts

Analysis of ground bond wire arrays for RFICs (1997 [RFIC])

H. Patterson. "Analysis of ground bond wire arrays for RFICs (1997 [RFIC])." 1997 Radio Frequency Integrated Circuits (RFIC) Symposium 97. (1997 [RFIC]): 237-240.

This paper outlines a method for rapid computation of the inductance of arrays of ground bond wires for RFICs, thus saving a designer considerable time over using inaccurate empirical equations or slowly converging electromagnetic simulators. Results comparable in accuracy to a fully derailed PEEC electromagnetic simulation are shown.



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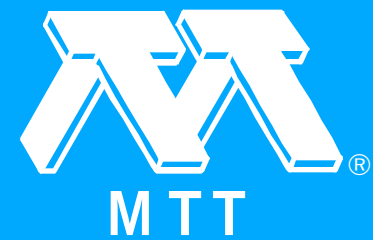
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