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IEEE Microwave Theory and Techniques Society

1995-1996

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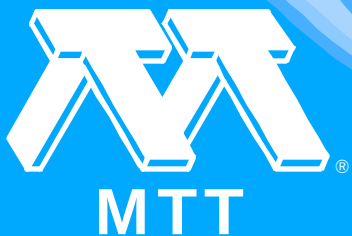
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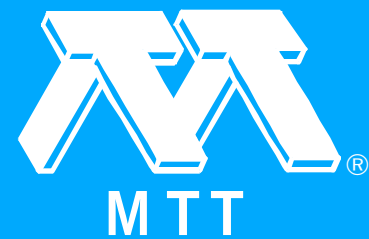
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Thank You and Enjoy!



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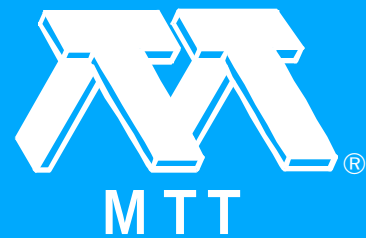
ACKNOWLEDGMENTS

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

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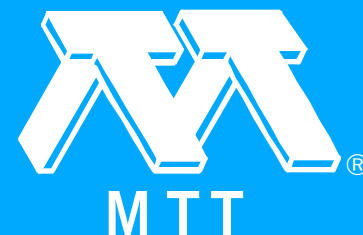
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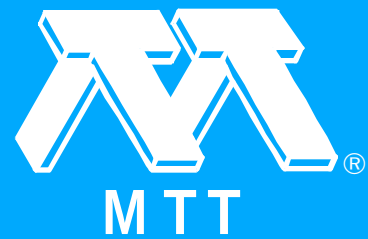
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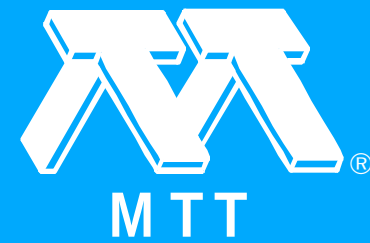
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INTRODUCTION

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.

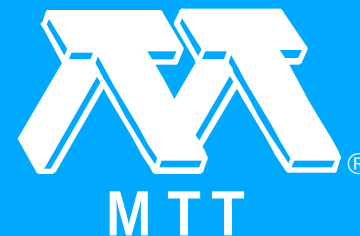


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To make viewing and searching easier, we recommend changing two default Acrobat Preferences (found under File > Preferences on the menu bar.)



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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.

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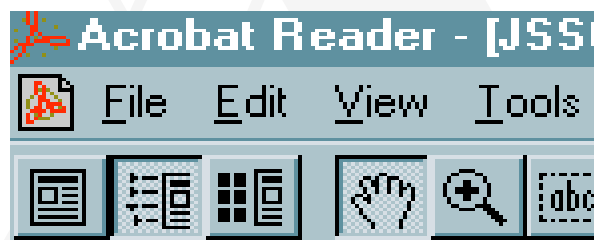
To exit an article after viewing, and return to the electronic guide, select File > Close from the menu bar. To switch between the article and the electronic guide or any other PDF file that is open, select “Window” and pick the open file you wish to return to.



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USING BOOKMARKS

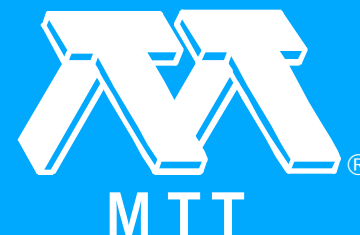
In addition to links, you can navigate through the Electronic Guide using Bookmarks. If they are not already visible, choose View > Bookmarks and Page from the menu bar or press the “Display Page and Bookmarks” button on the tool bar. A panel opens on the left side of the screen displaying Bookmarks 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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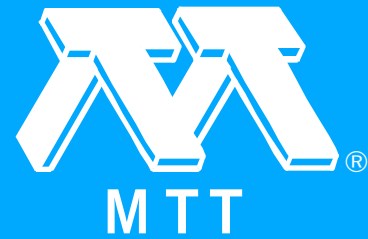
Articles may have text outside normal print-area defaults. We recommend selecting “Shrink to Fit” in the print menu (File > Print) to capture the complete image for your printout. This setting will become your new default.

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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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.

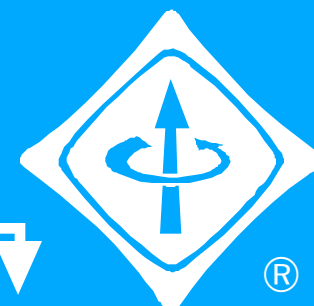
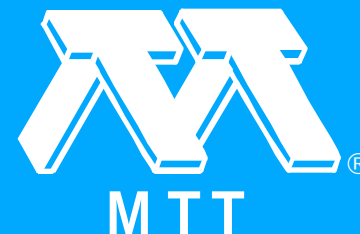
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Click to advance to the next page in the section.

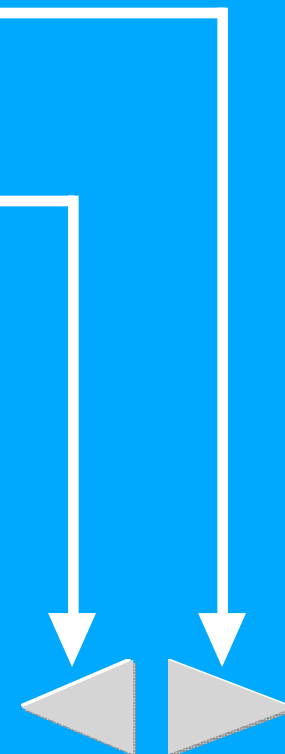
Previous Page button

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.

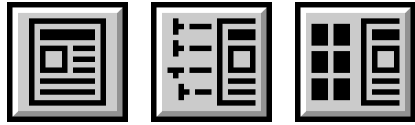


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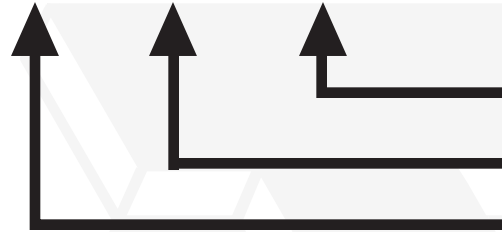


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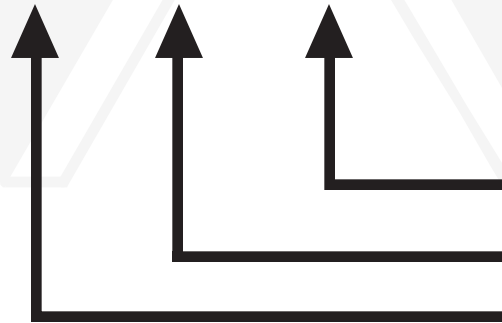
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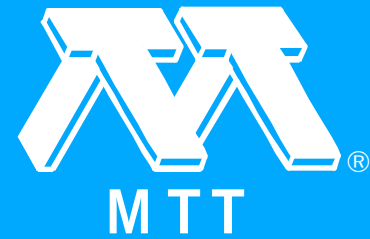
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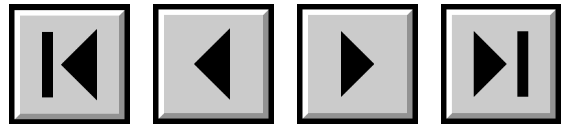
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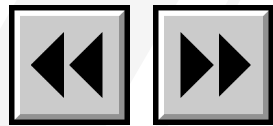
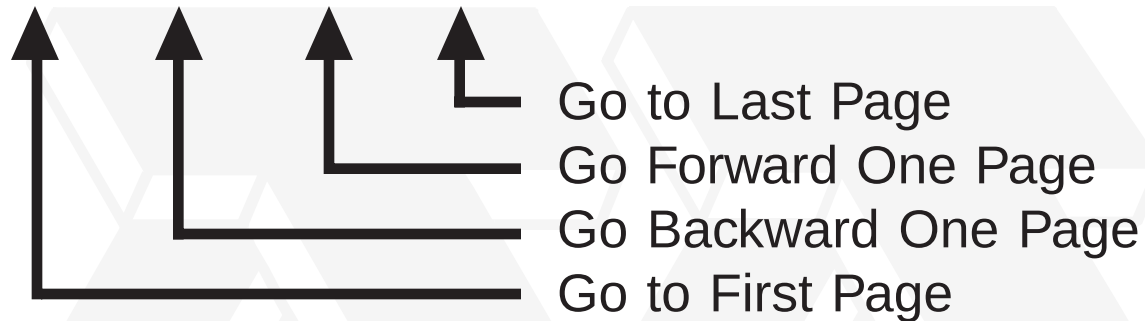


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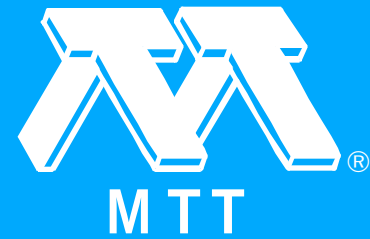
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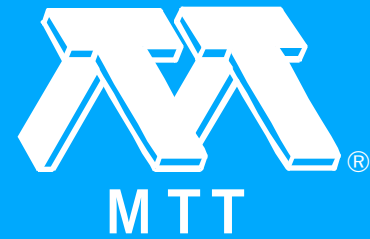
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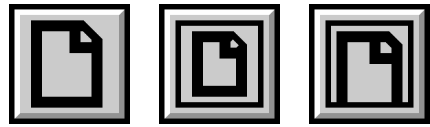
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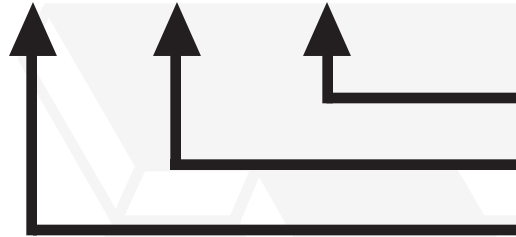
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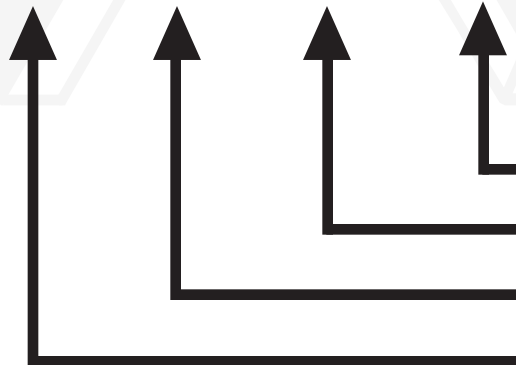
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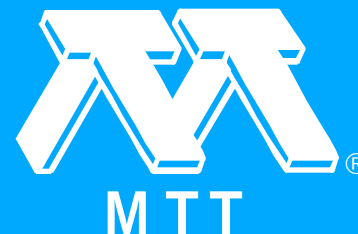
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Two types of searching are possible with Acrobat: Find and full-text Search. Choosing Find (from the Toolbar or Tools > Find) opens a dialog box. Type a search string in the field provided, check the appropriate options and press the “Find” button. 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.



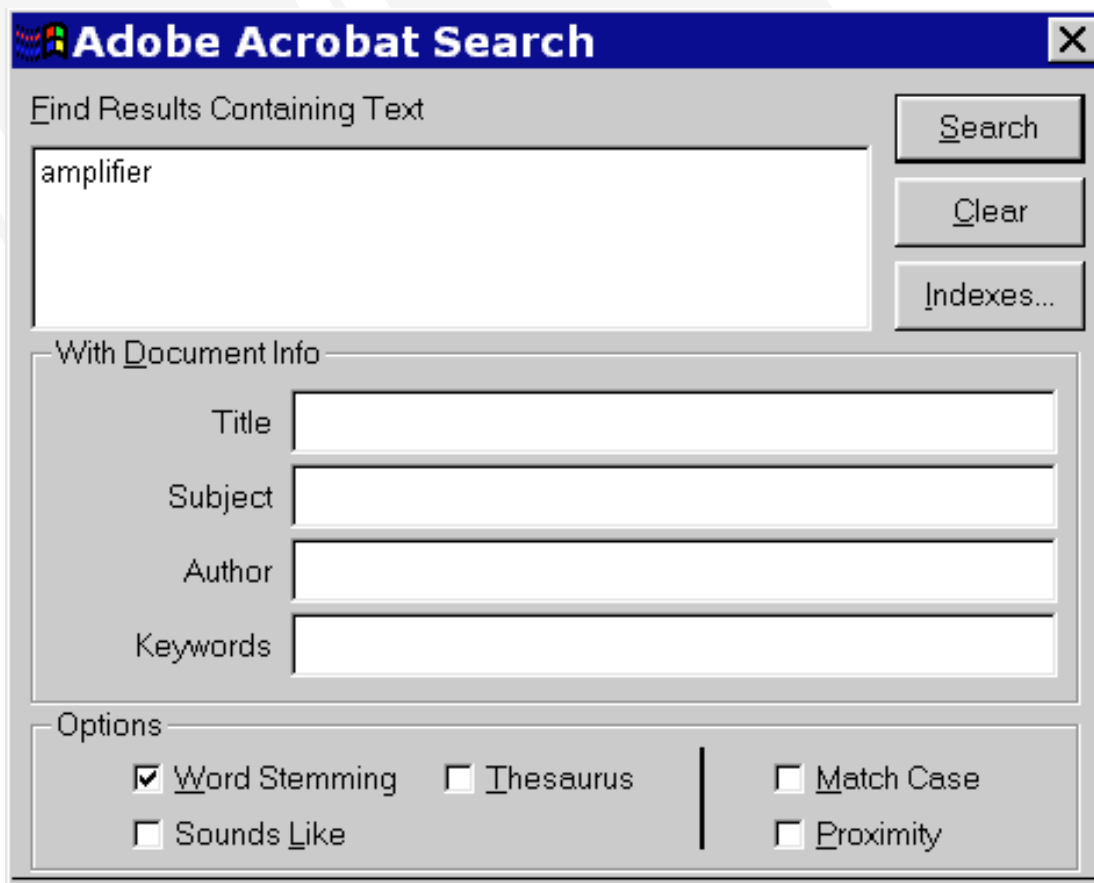
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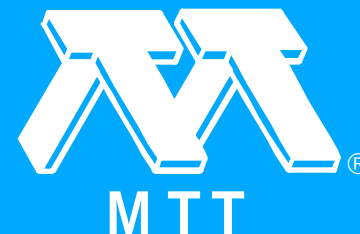
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If you are not finding files you think should show in the results list, Acrobat may not be attached to the correct index file. To check, press the “Indexes...” button for a list of available indexes. If this title is not listed, press the “Add...” 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 the main input field 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 box.



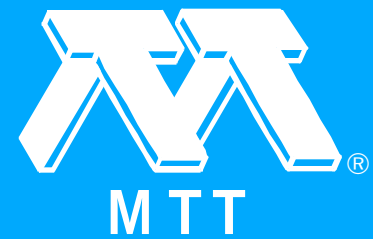
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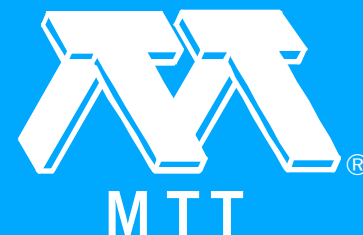
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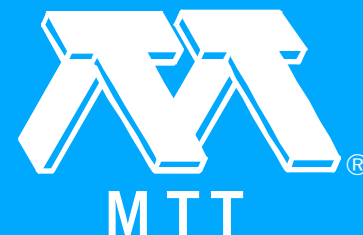
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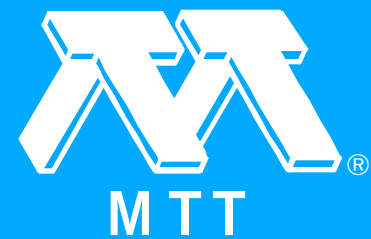
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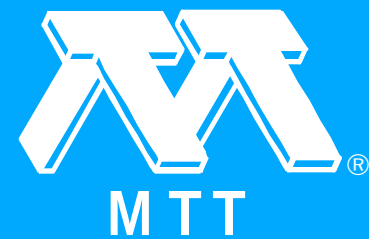
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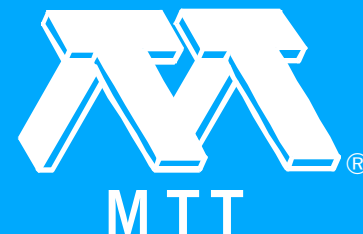
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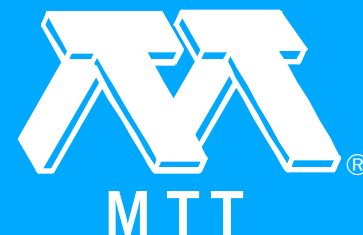
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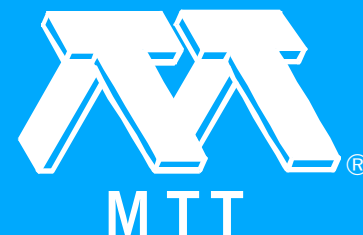
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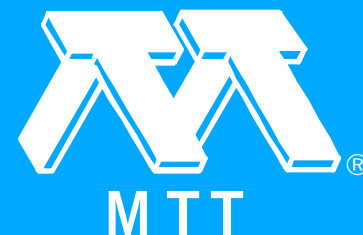
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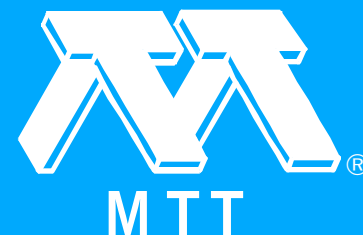


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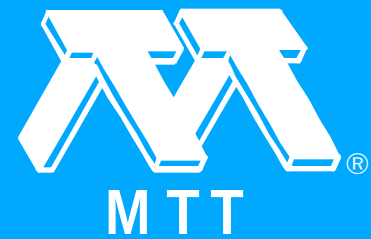
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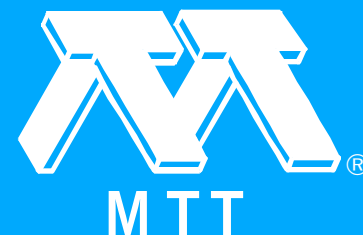
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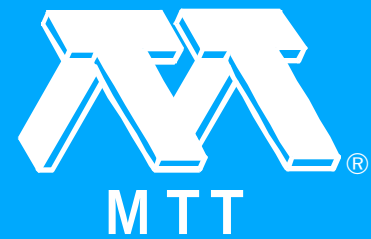
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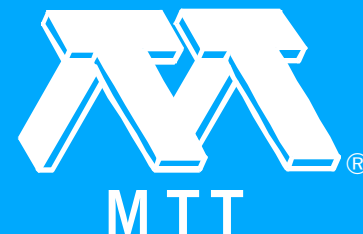
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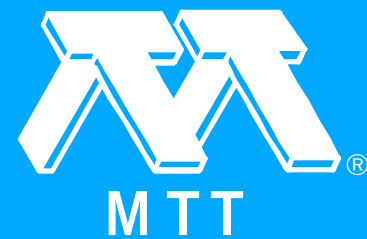
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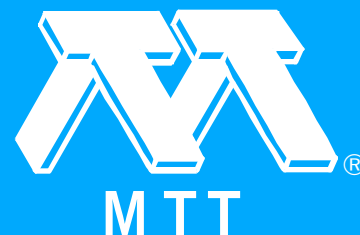


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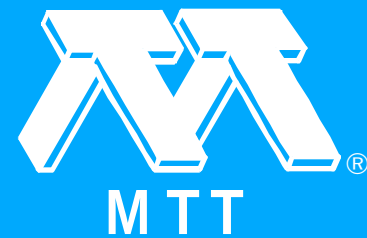
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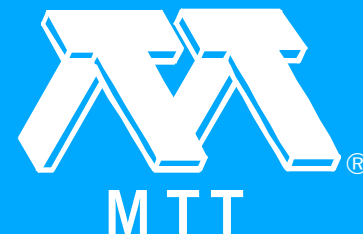
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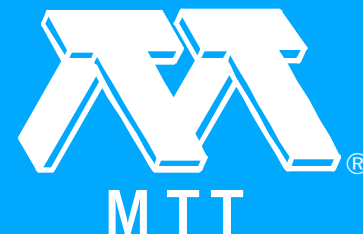
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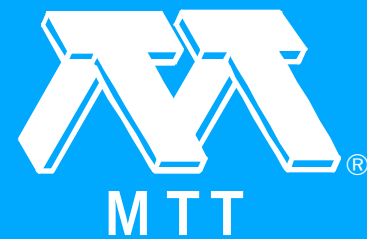
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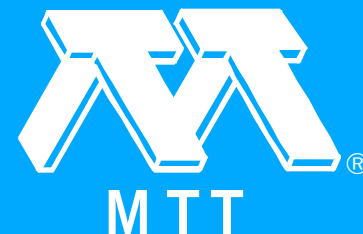
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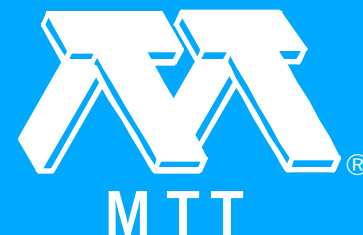
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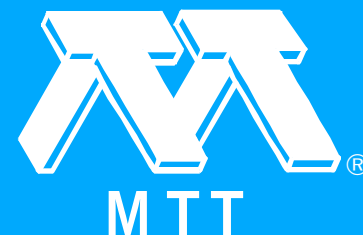
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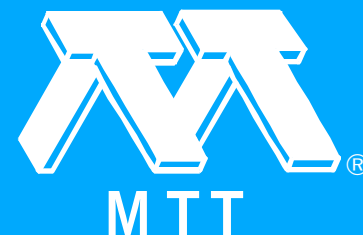
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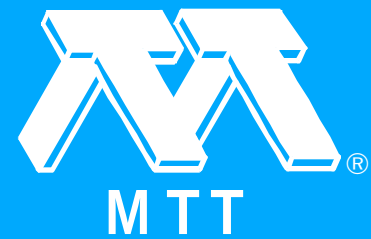
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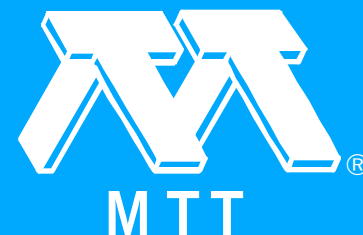


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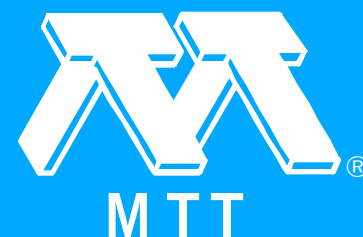
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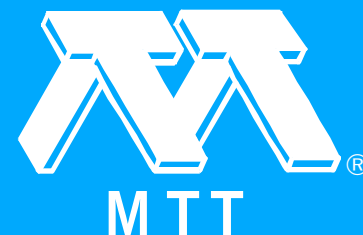
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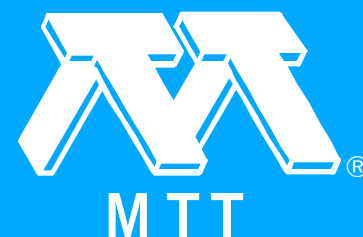
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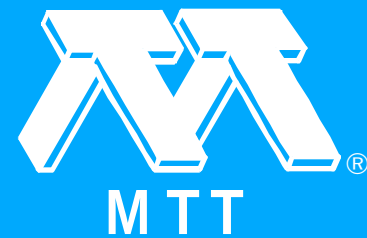
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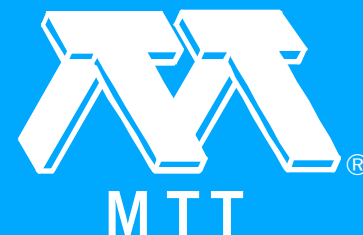
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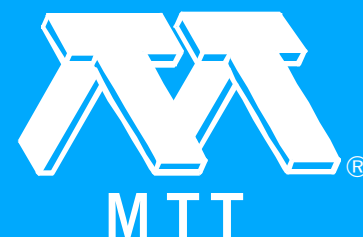
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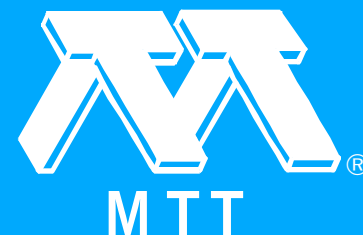
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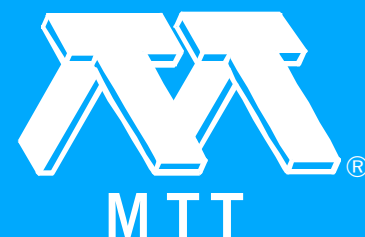
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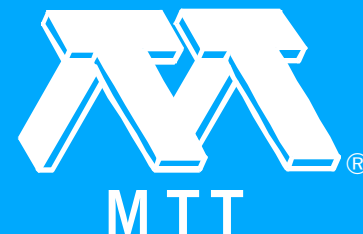
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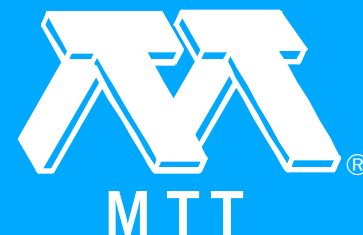
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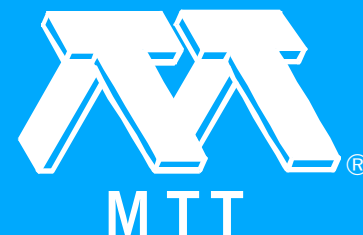
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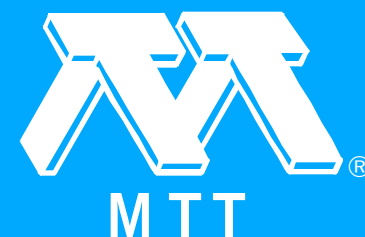
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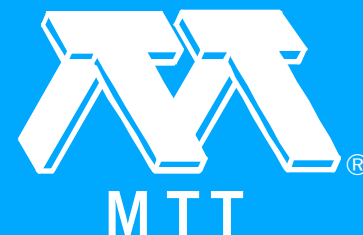
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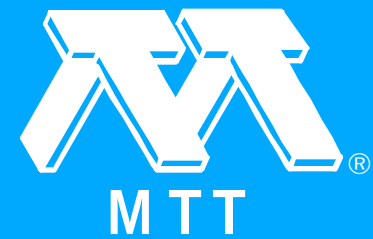
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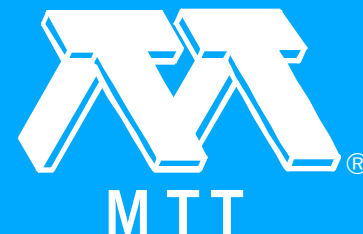
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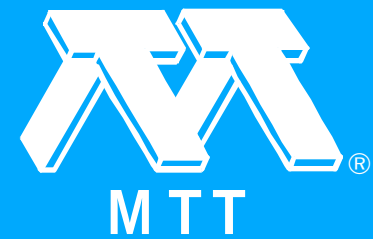
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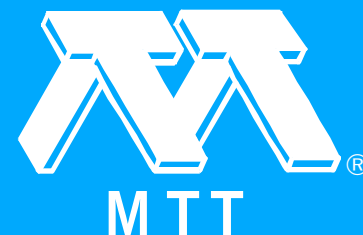
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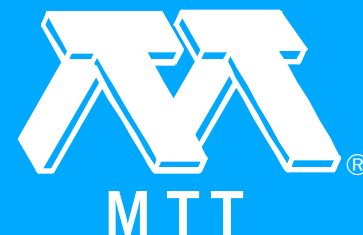
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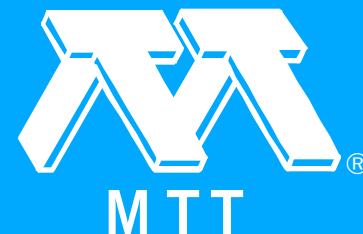
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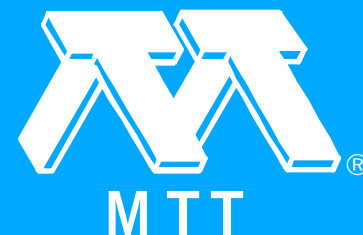
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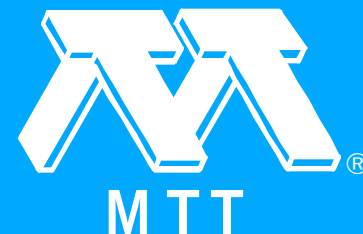


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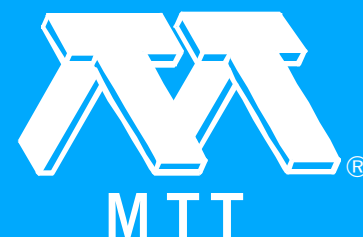
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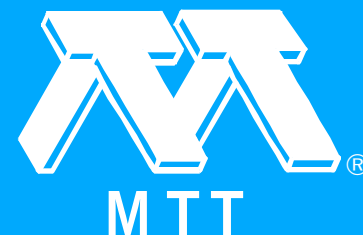
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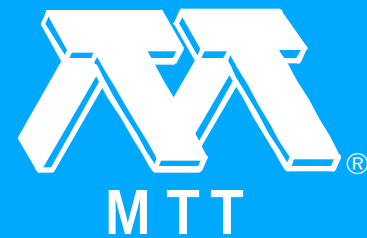
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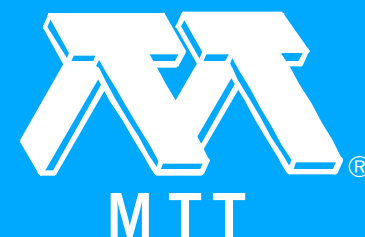
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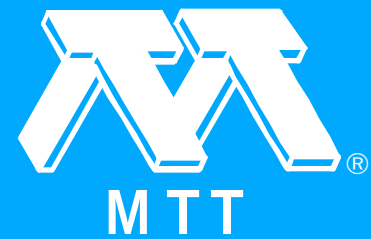
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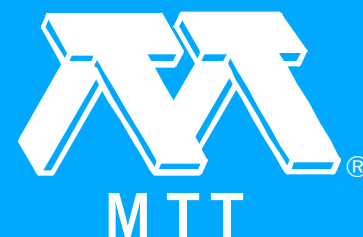
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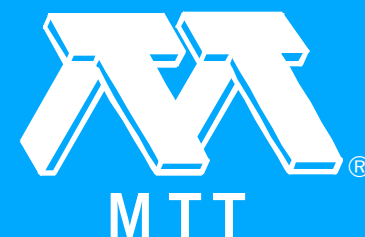
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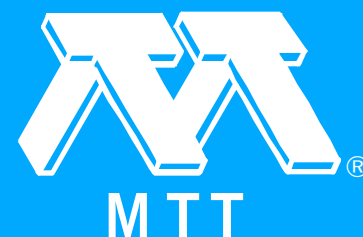
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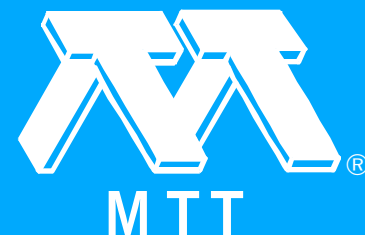
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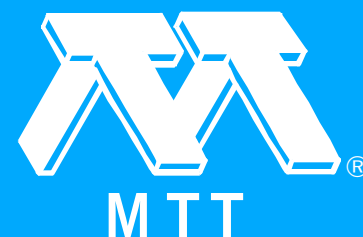
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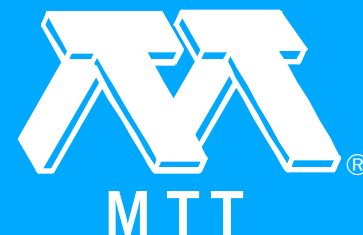
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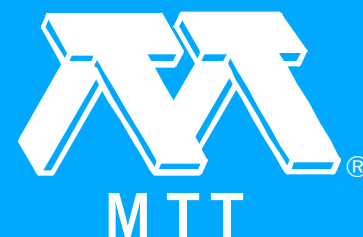
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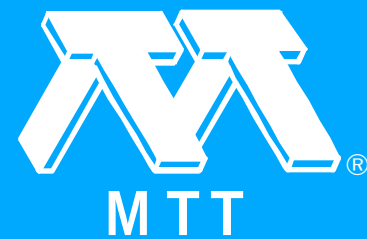
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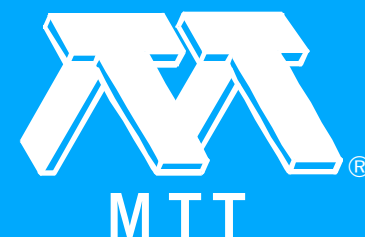
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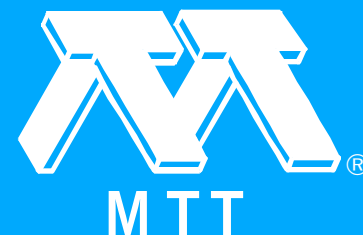
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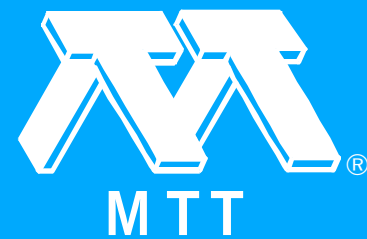
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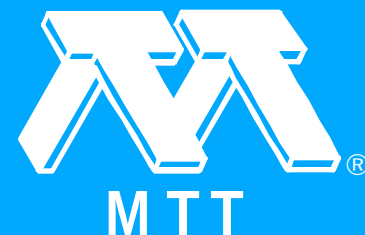
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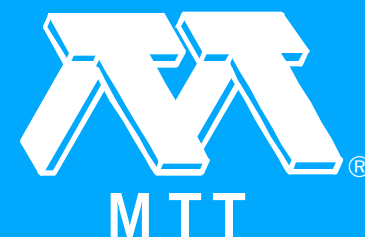
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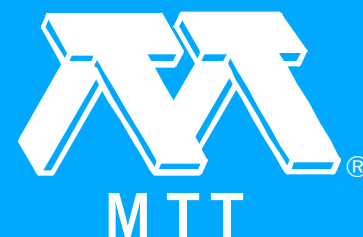
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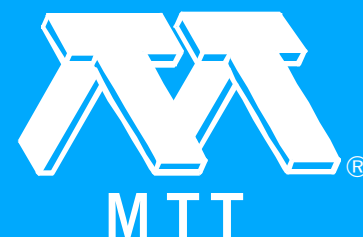
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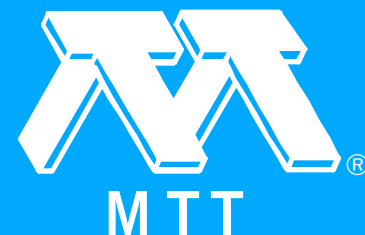
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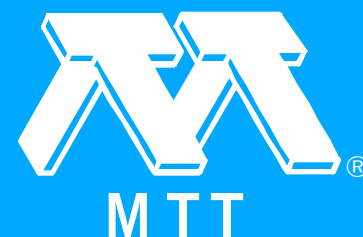
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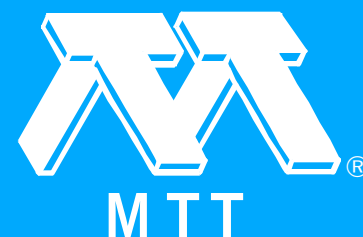
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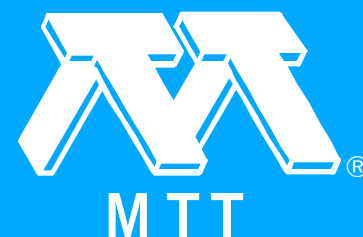
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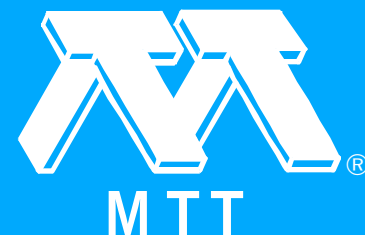
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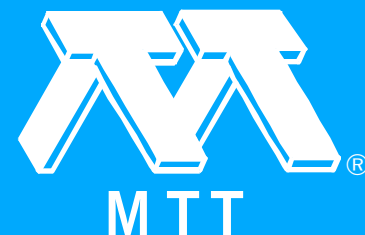
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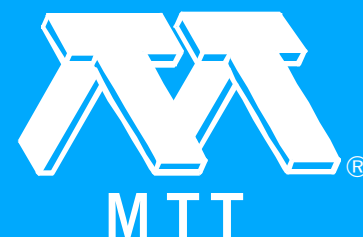
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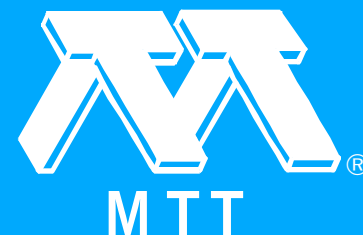
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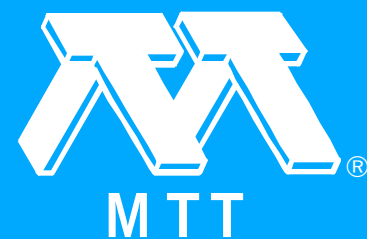
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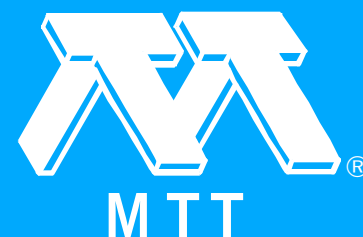
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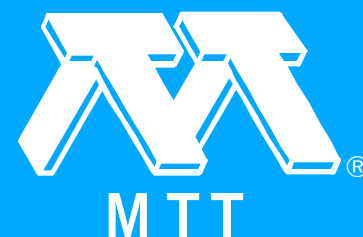
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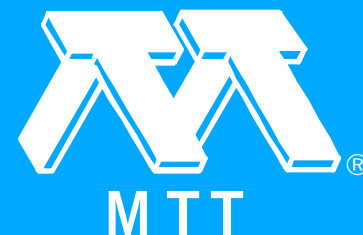
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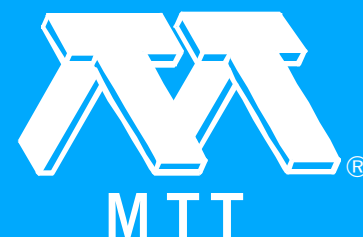
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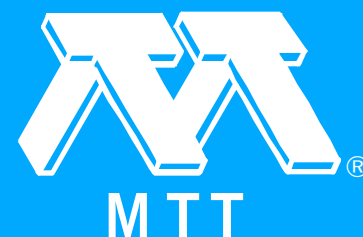
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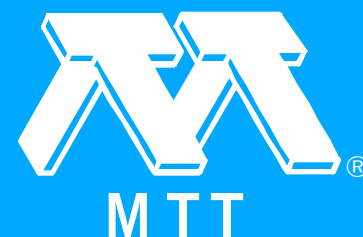
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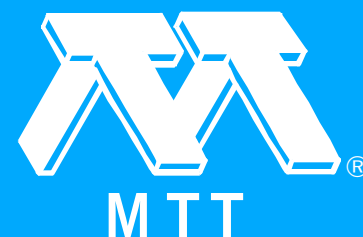
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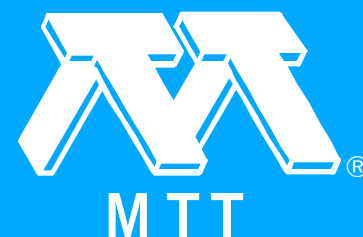
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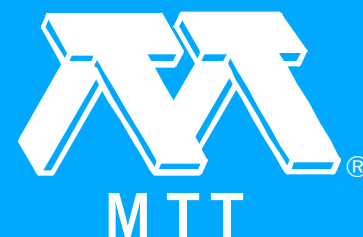
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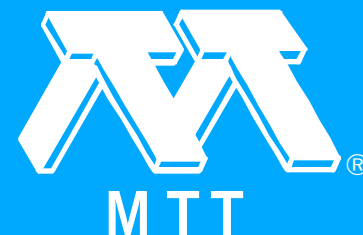
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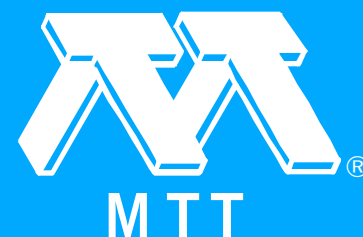
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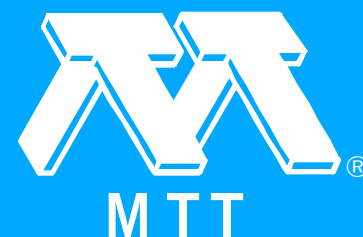
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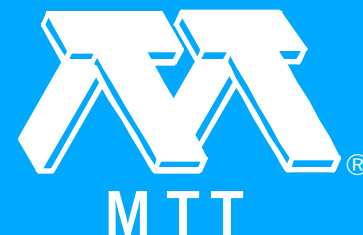
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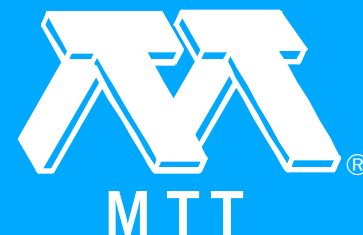
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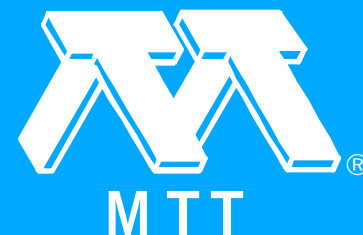
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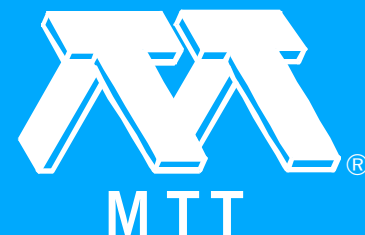
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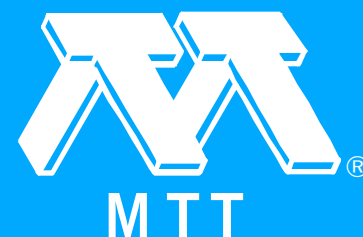
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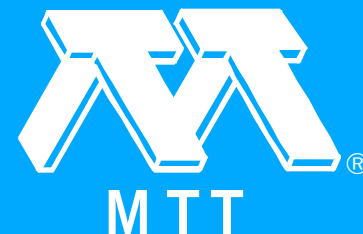
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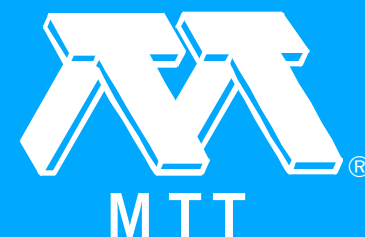
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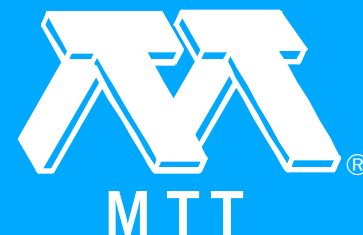
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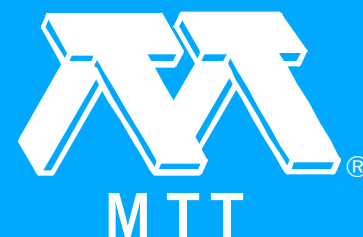
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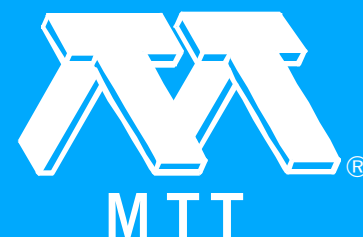
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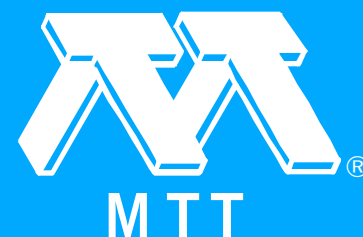
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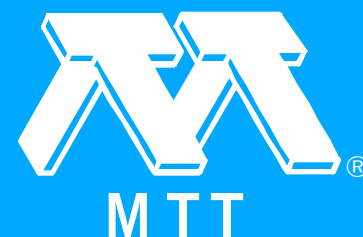
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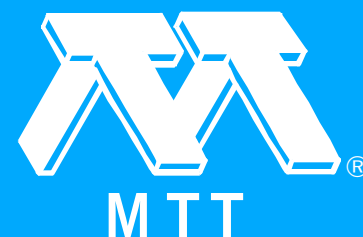
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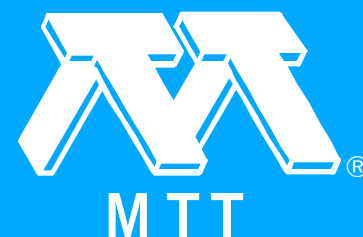
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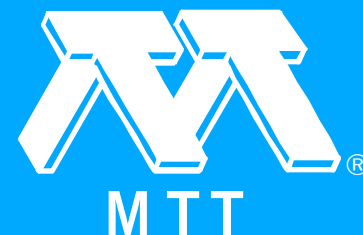
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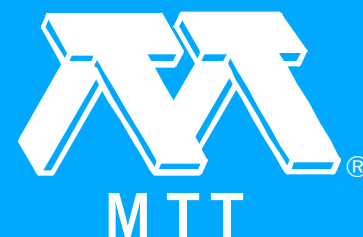
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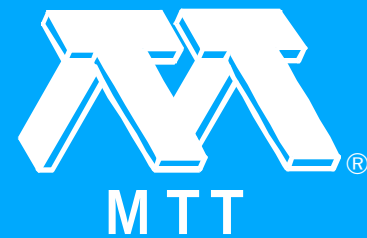
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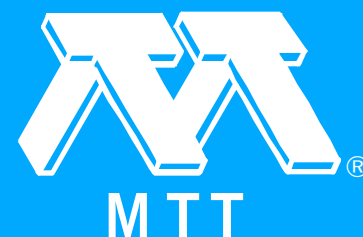
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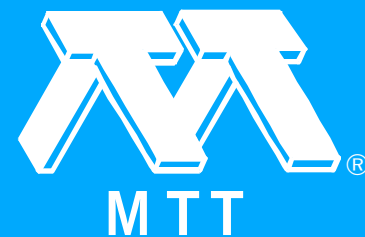
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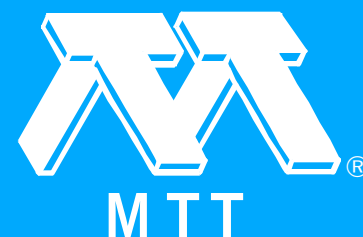
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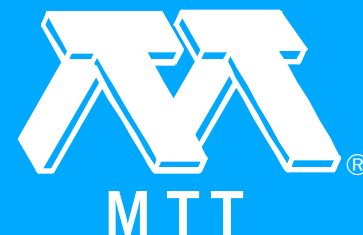
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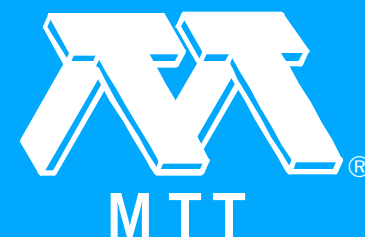
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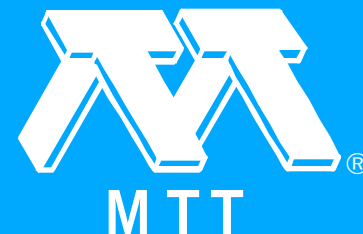
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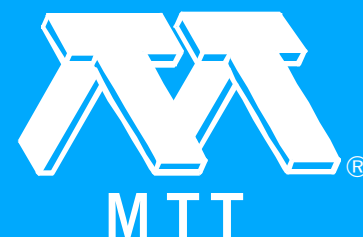
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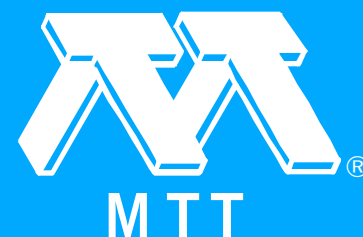
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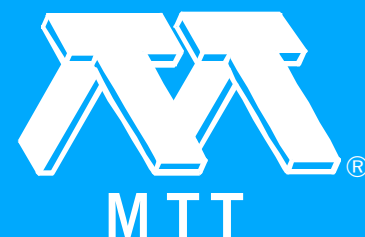
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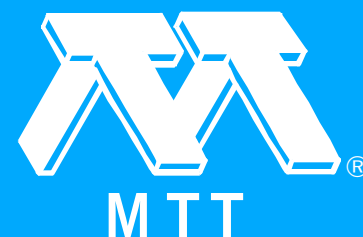
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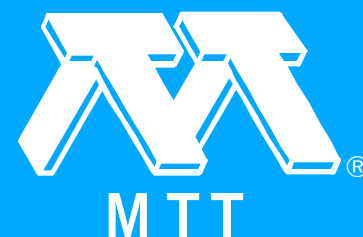
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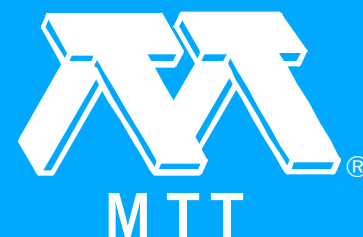
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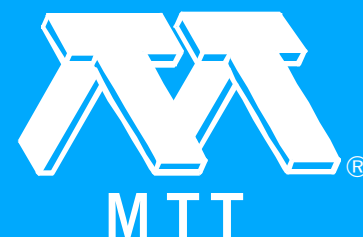
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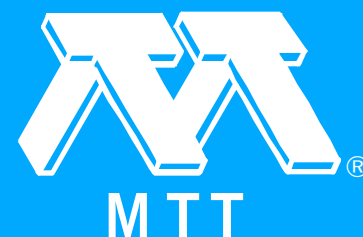
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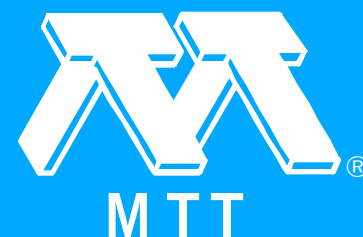
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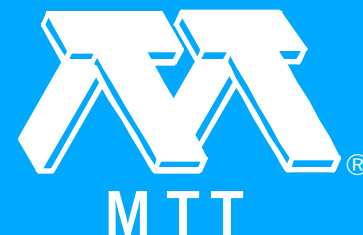
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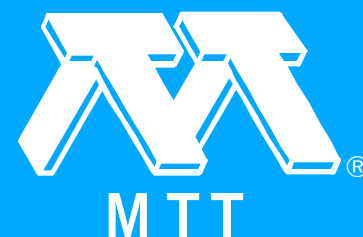
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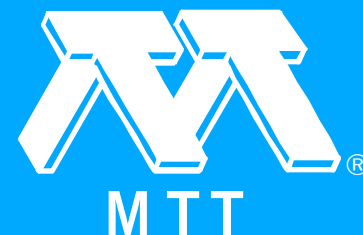
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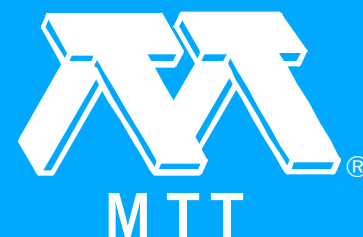
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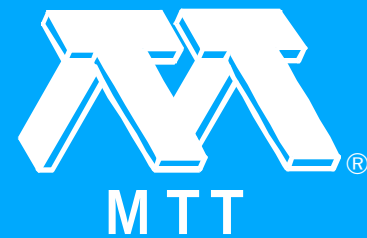
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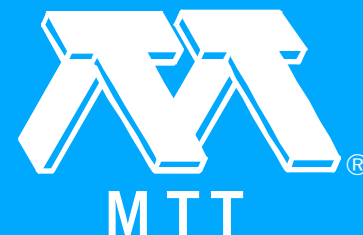
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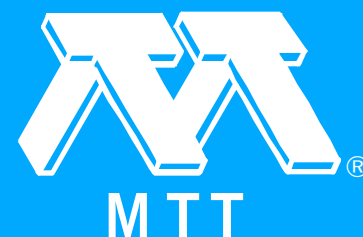
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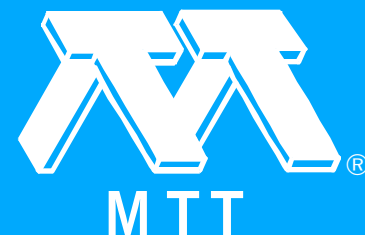
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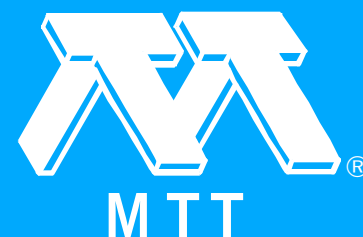
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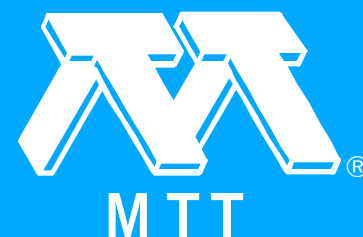
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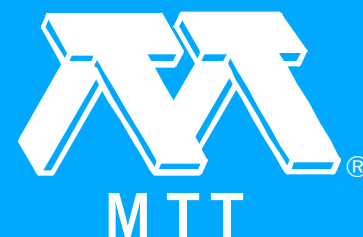
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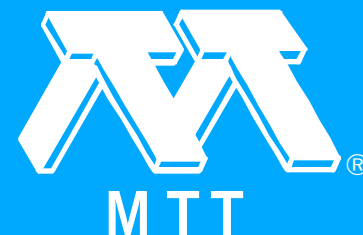
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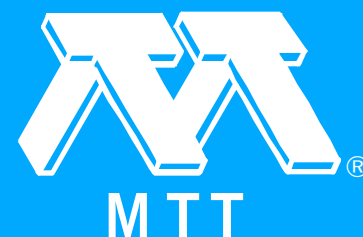
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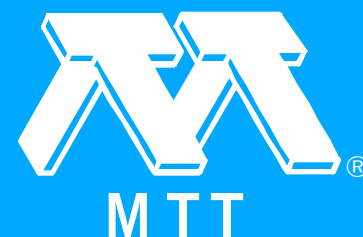
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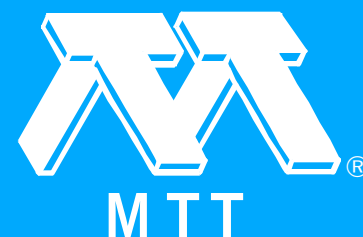
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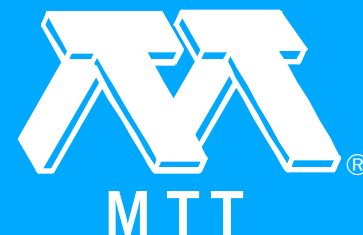
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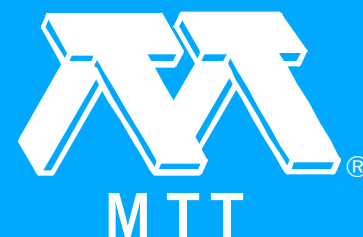
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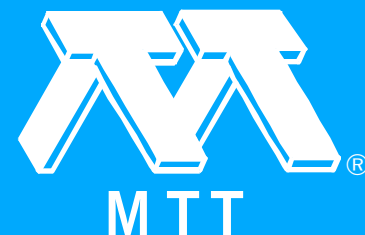
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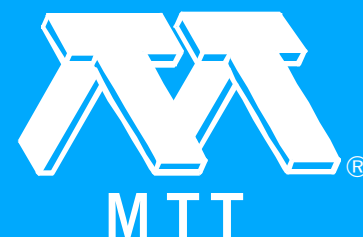
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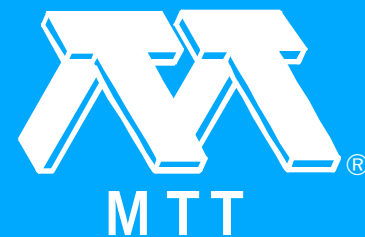
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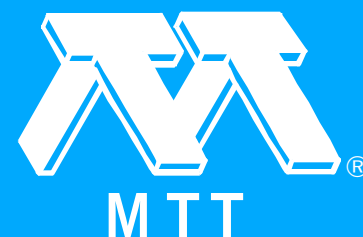
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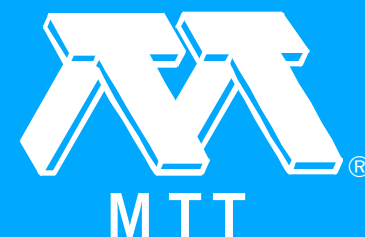
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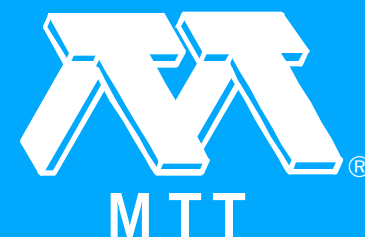
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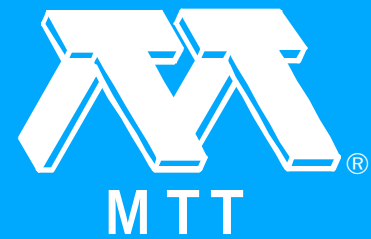
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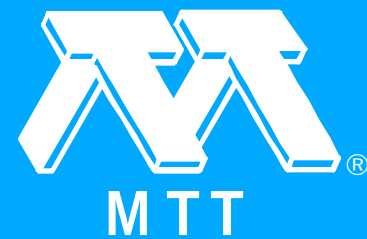
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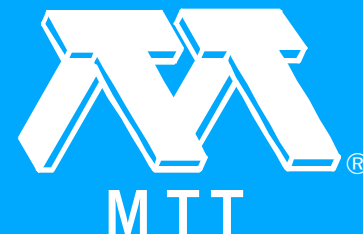
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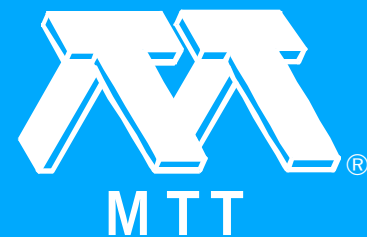
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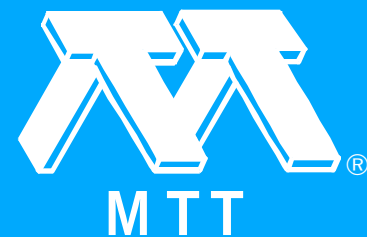
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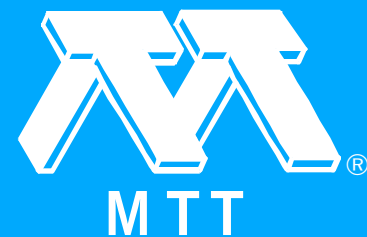
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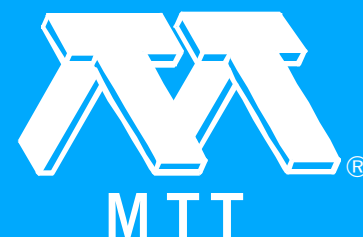
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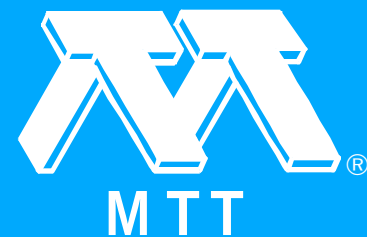
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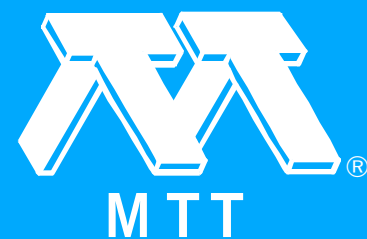
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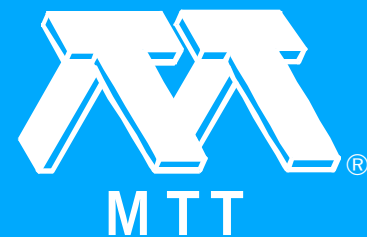
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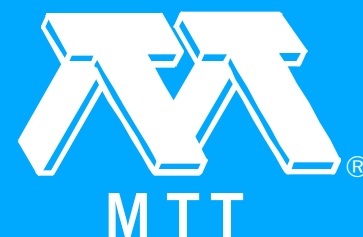
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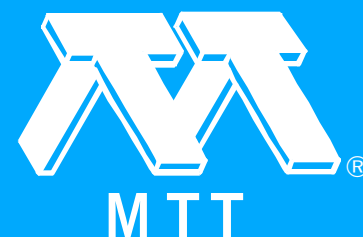
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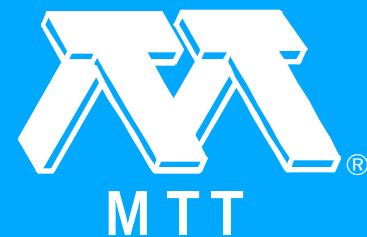
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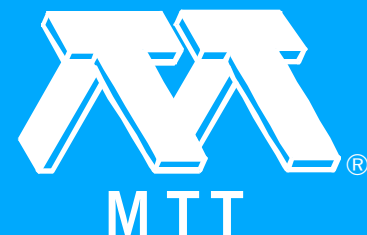
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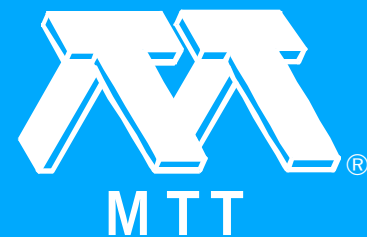
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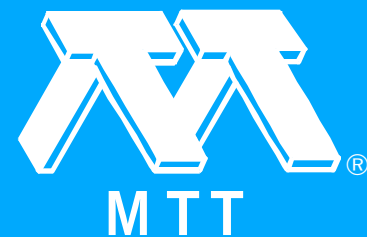
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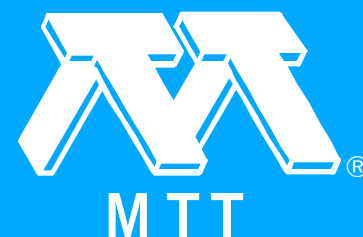
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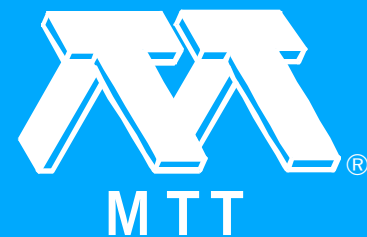
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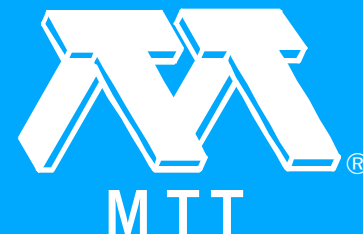
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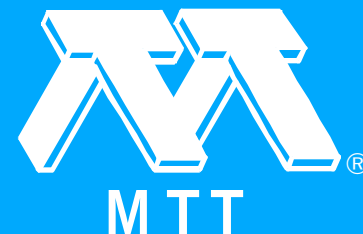
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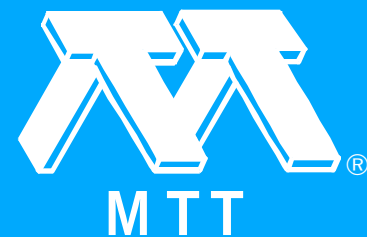
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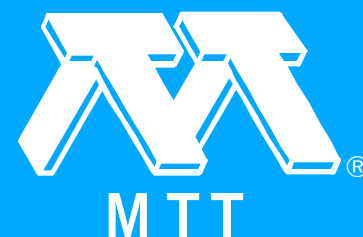
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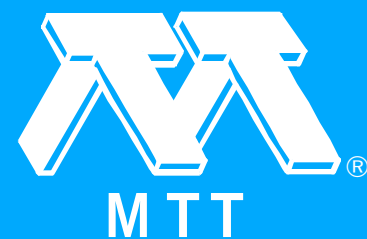
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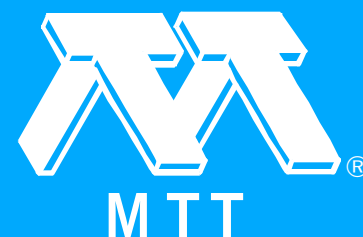
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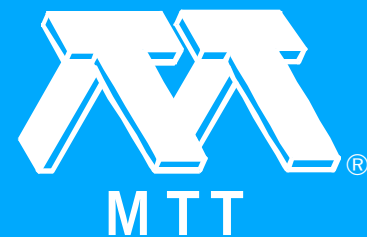
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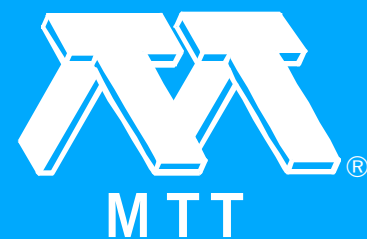
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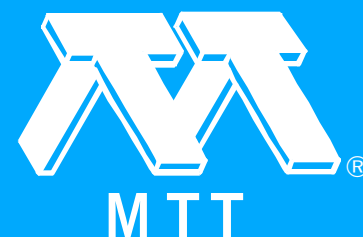
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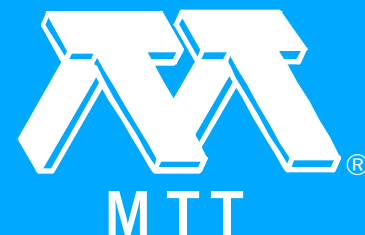
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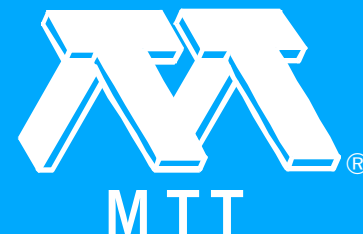
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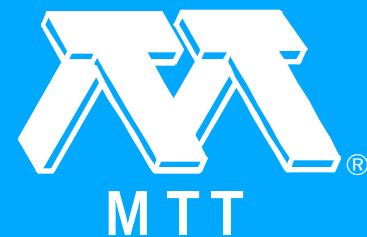
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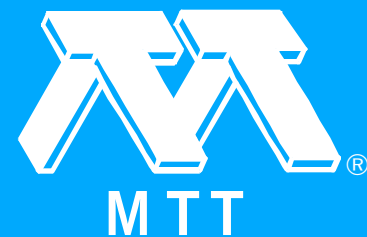
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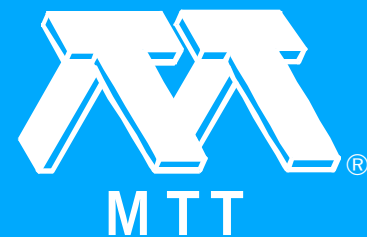
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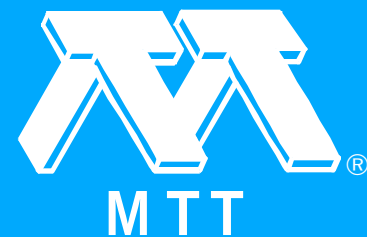
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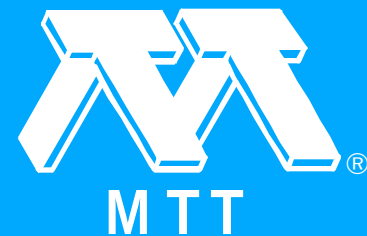
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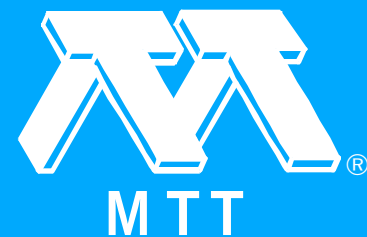
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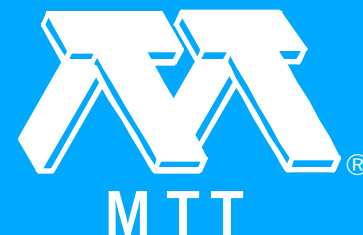
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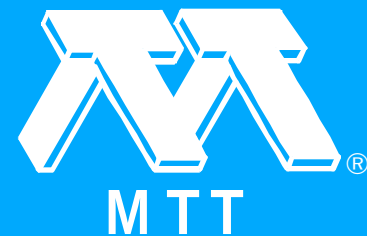
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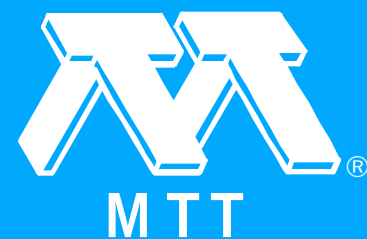
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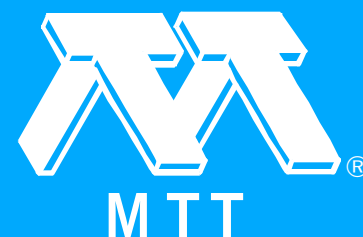
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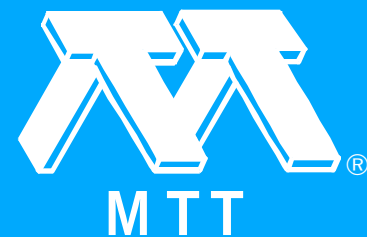
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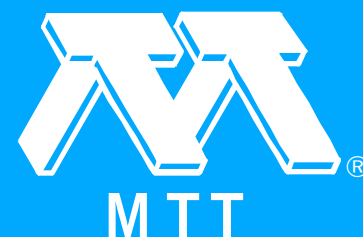
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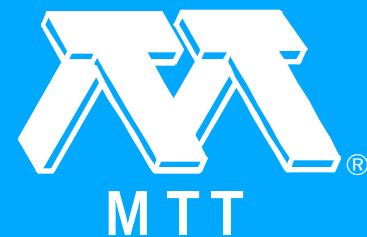
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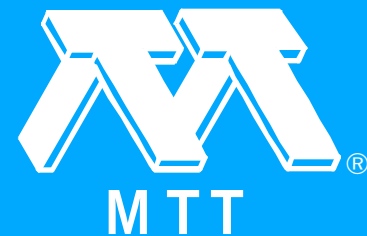
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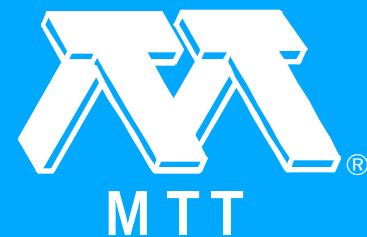
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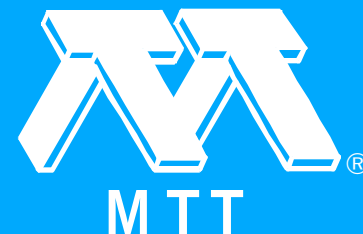
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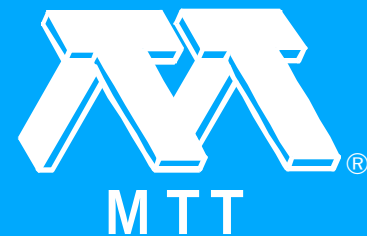
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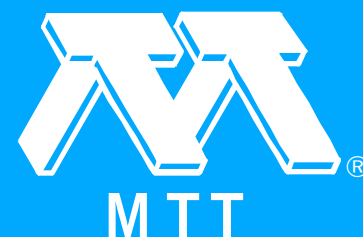
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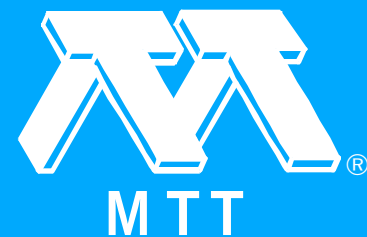
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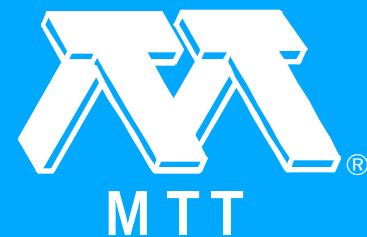
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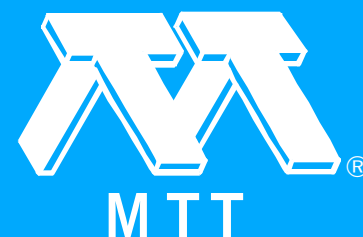
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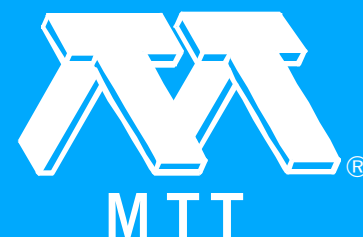
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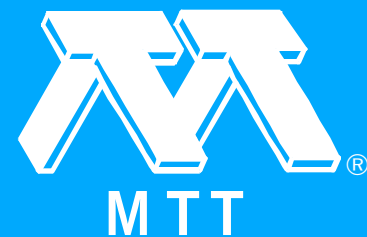
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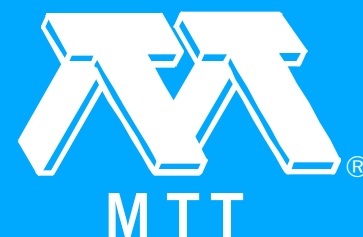
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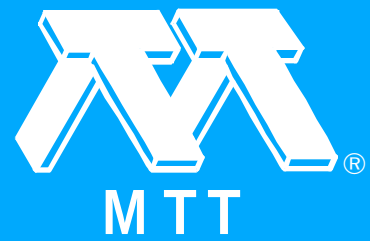
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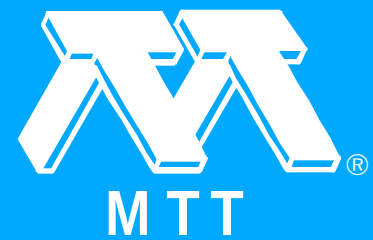
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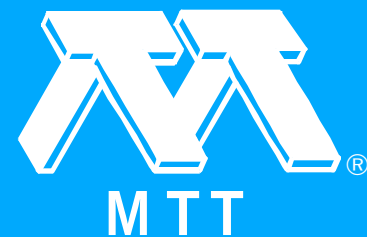
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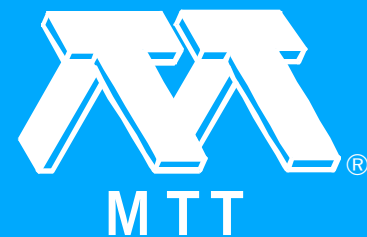
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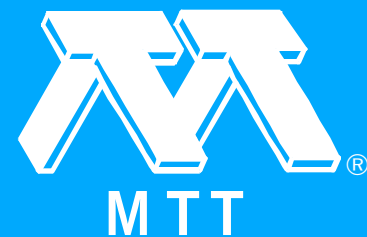
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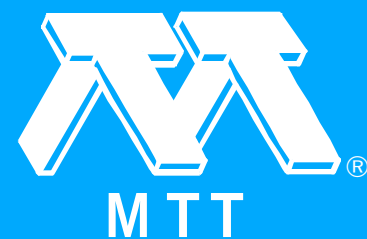
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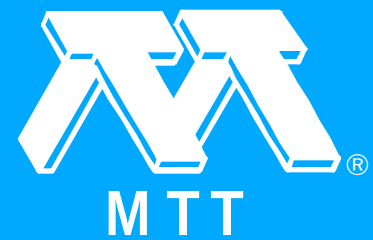
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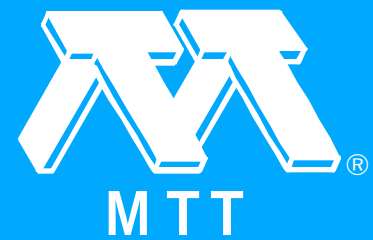
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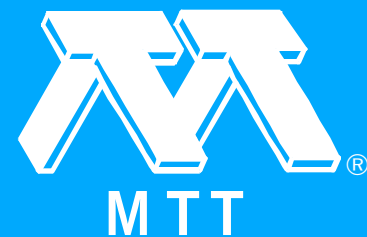
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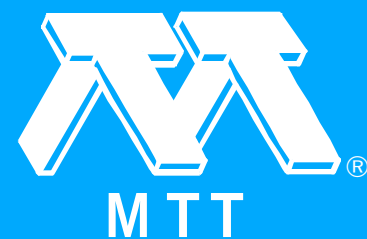
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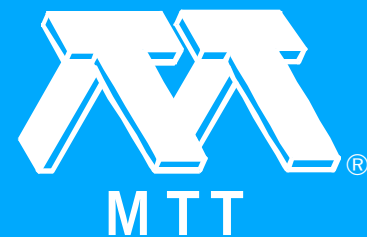
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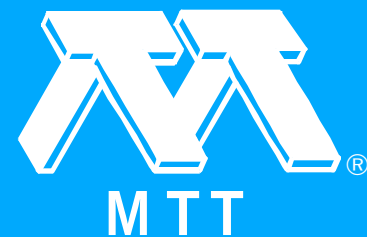
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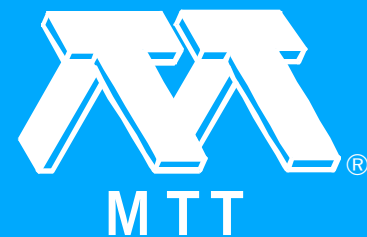
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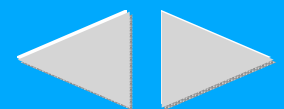
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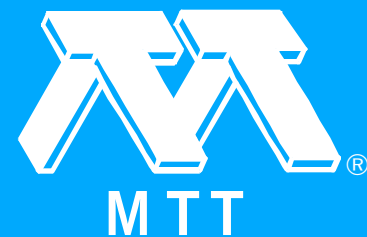
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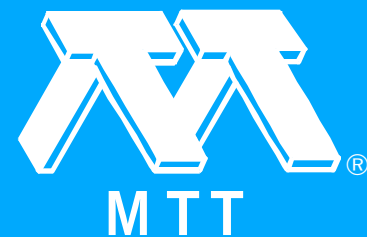
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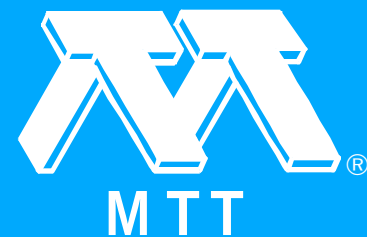
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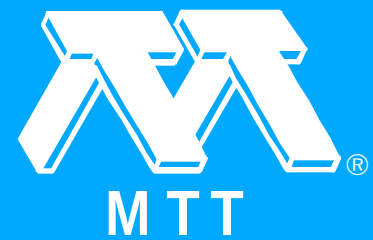
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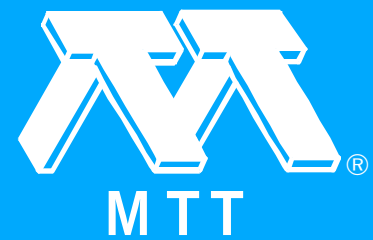
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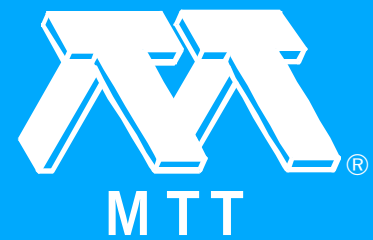
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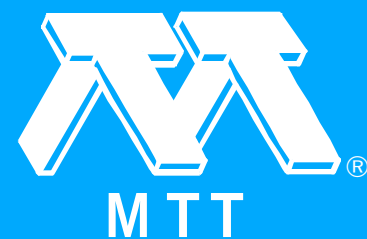
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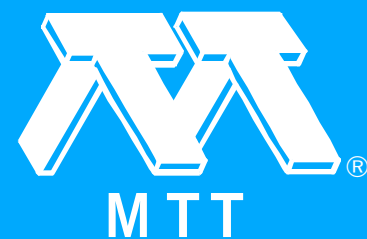
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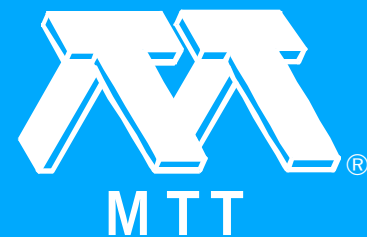
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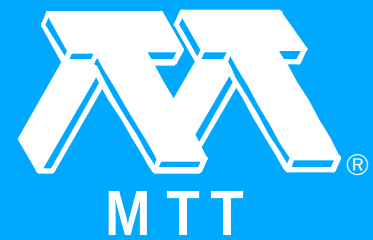
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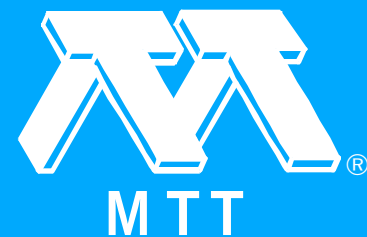
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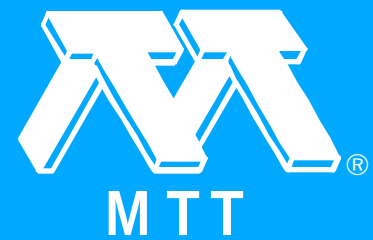
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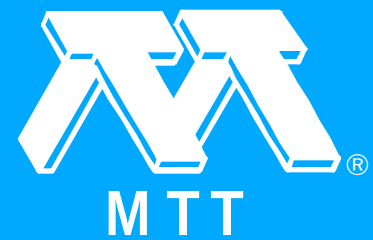
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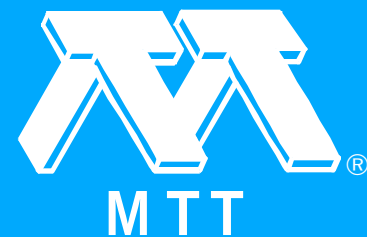
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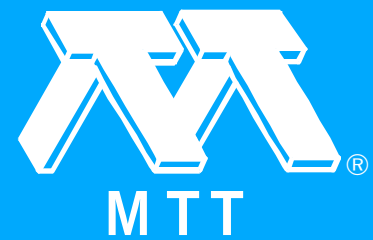
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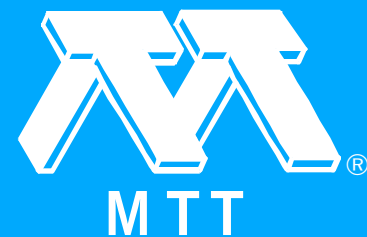
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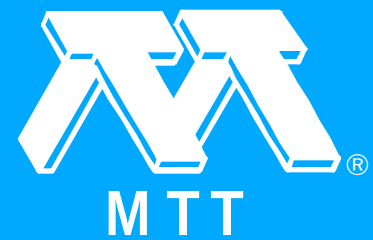
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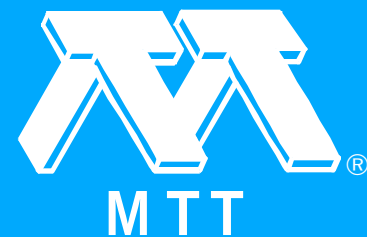
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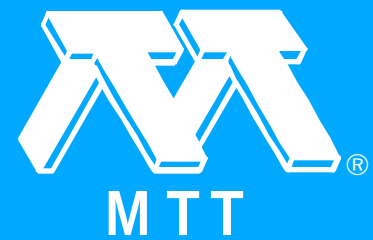
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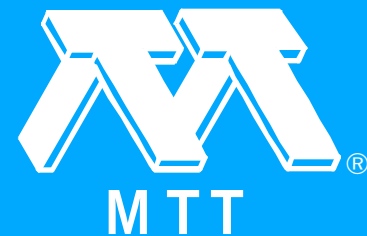
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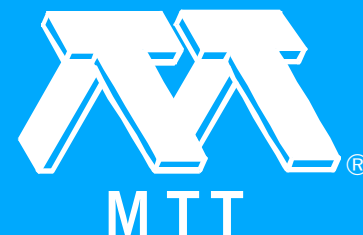
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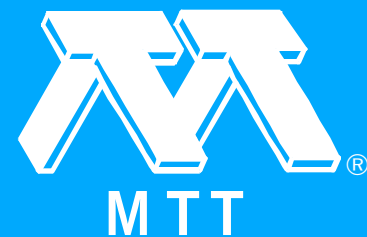
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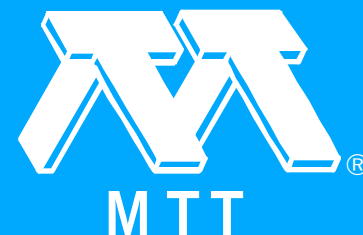


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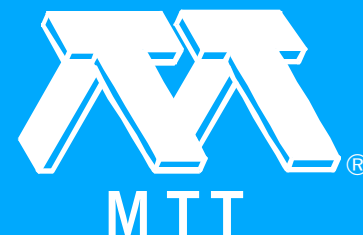
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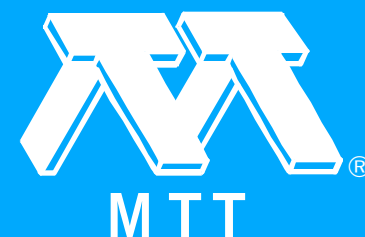
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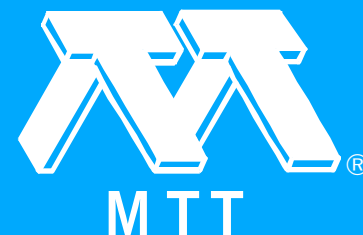
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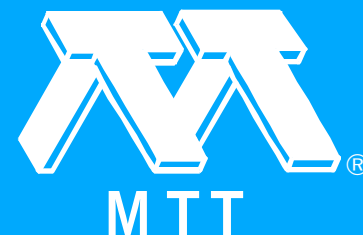
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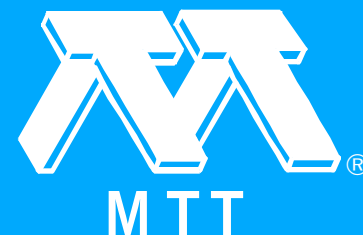
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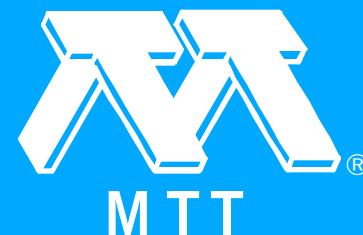


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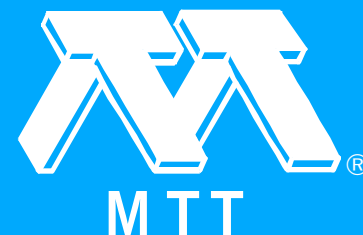
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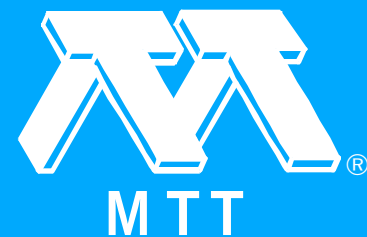
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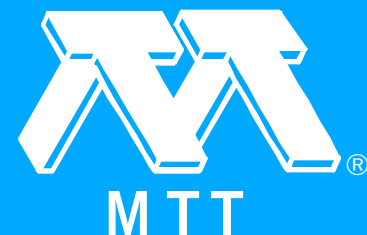
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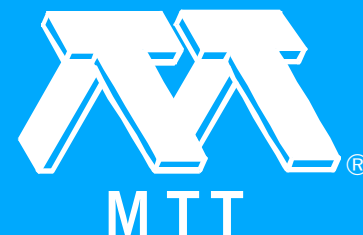
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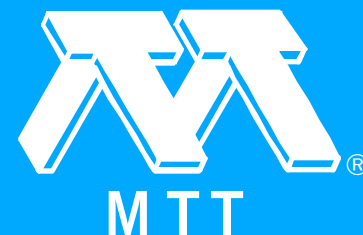
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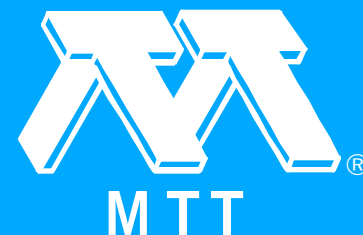
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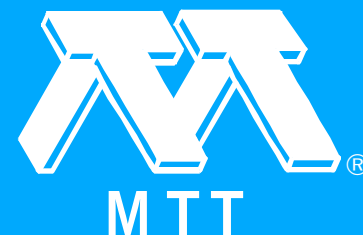
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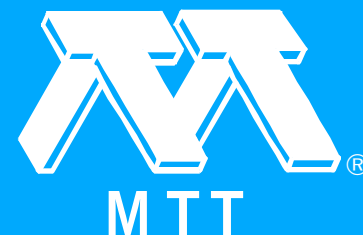
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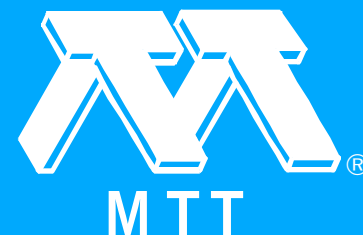
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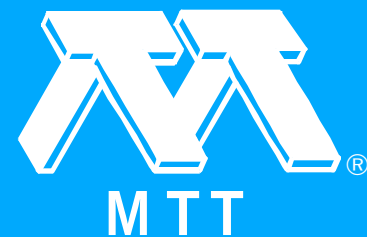
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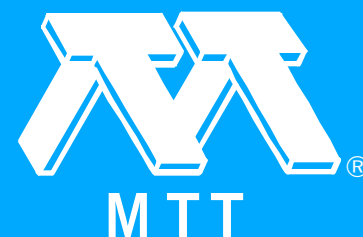
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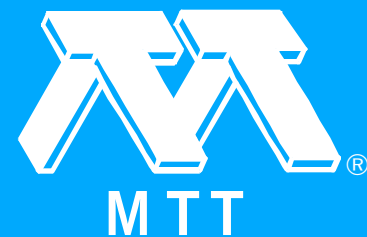
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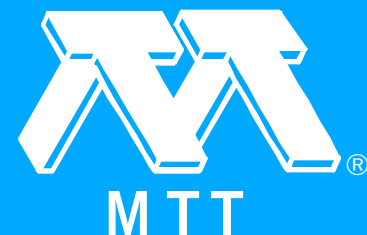
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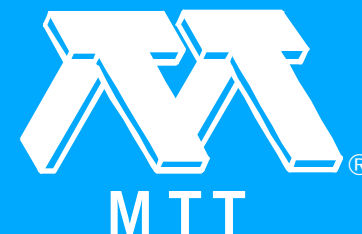
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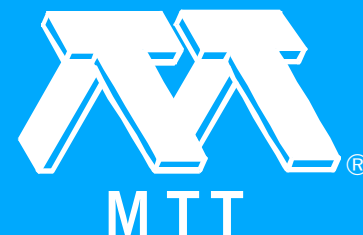
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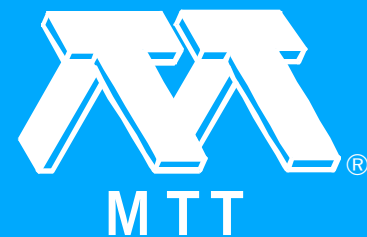
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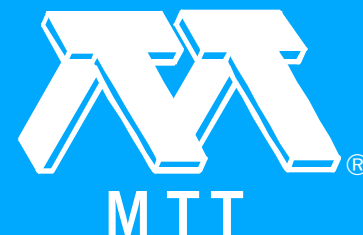
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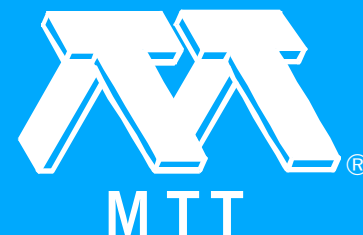
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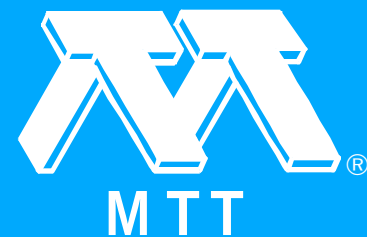
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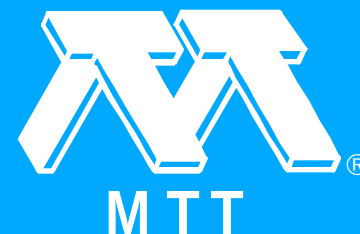
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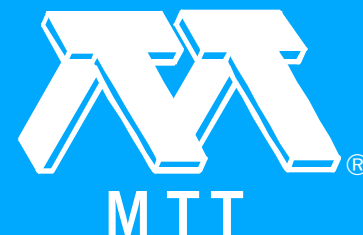
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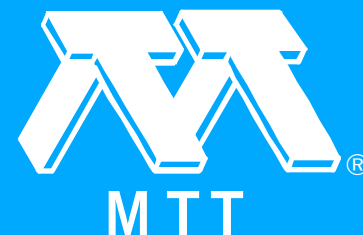
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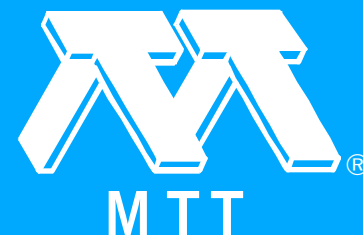
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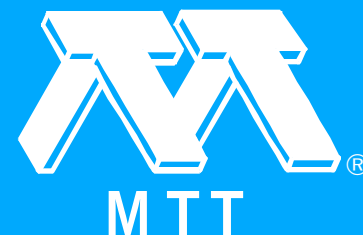
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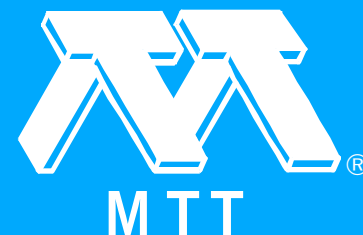
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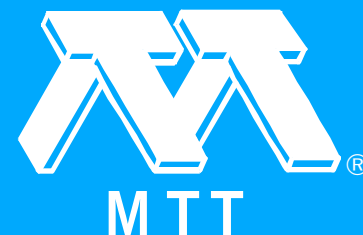
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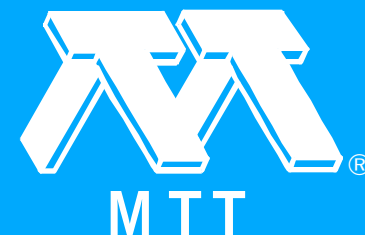
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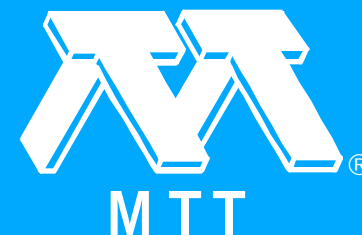
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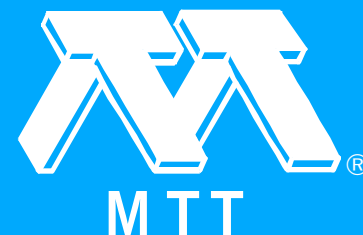
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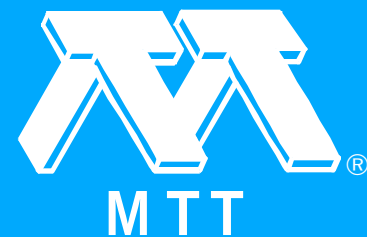
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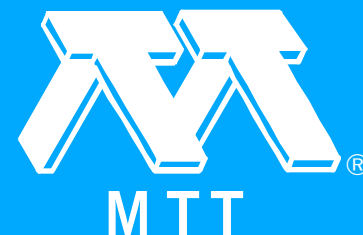


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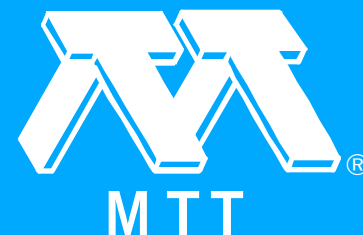
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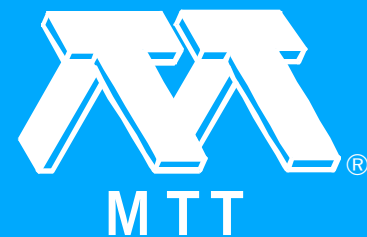
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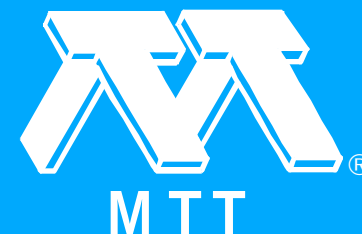
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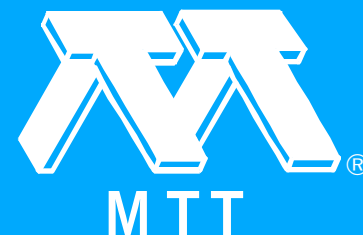
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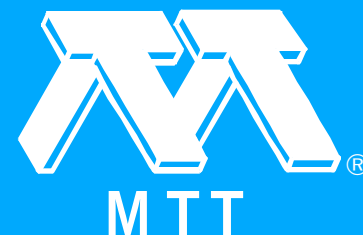
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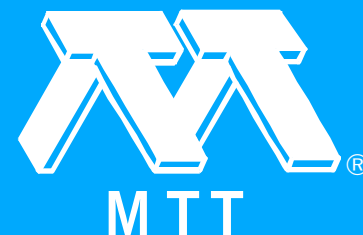
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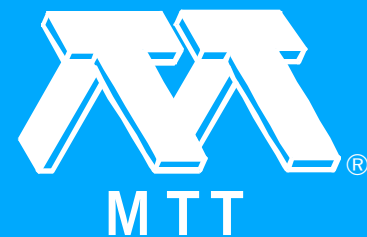
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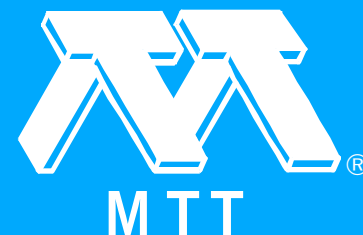
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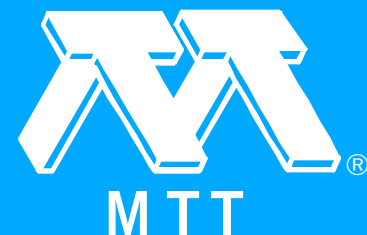
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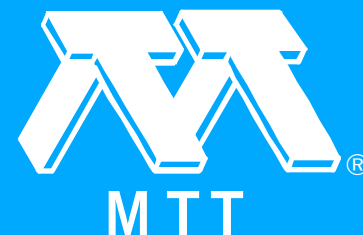
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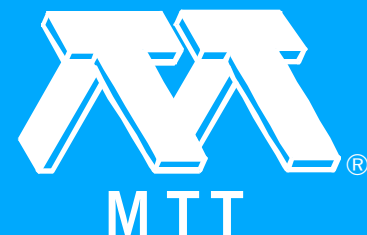
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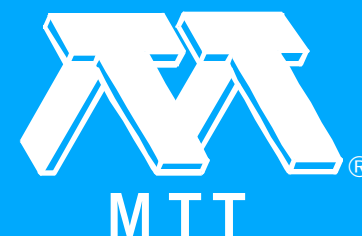
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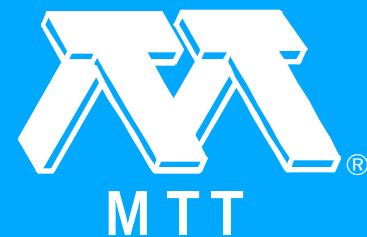
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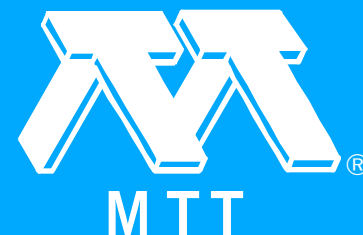


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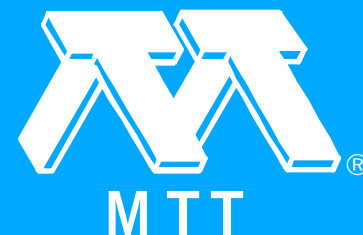
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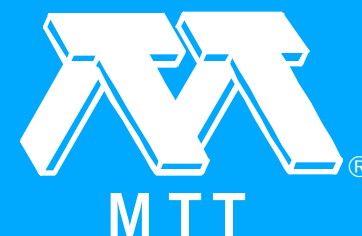


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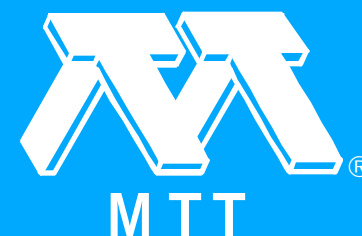
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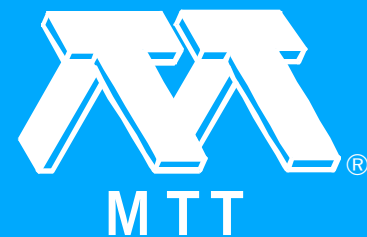
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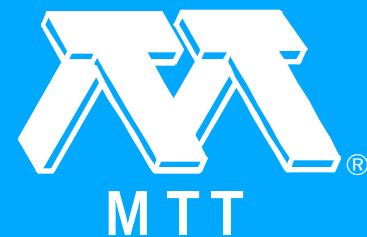
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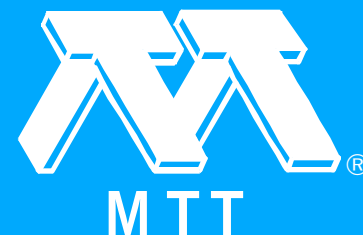
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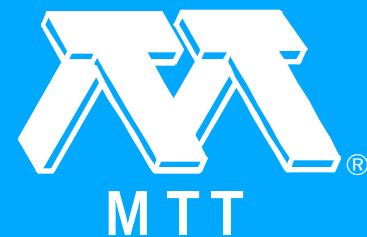
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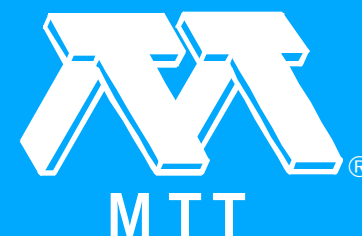


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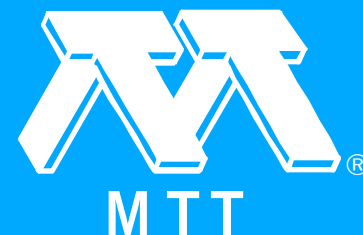
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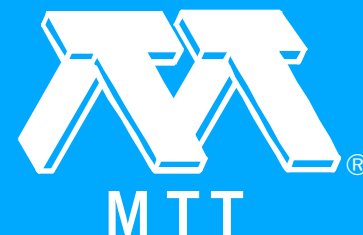
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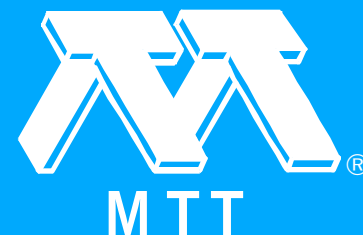
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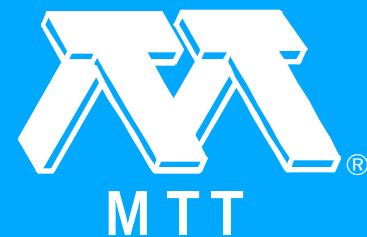
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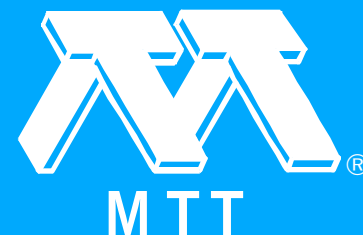
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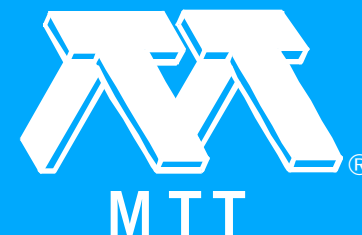
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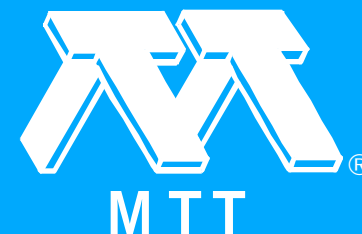
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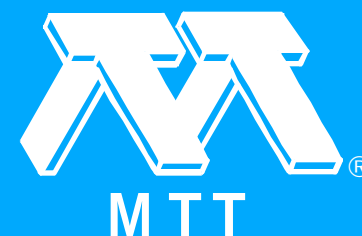
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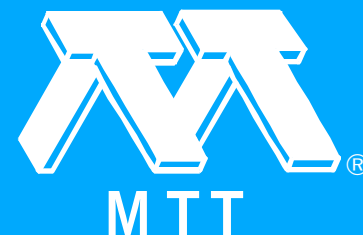
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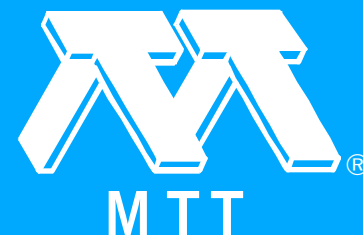
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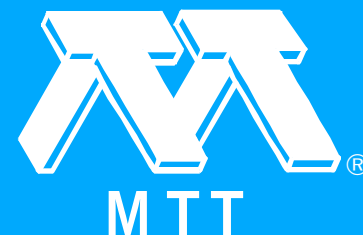
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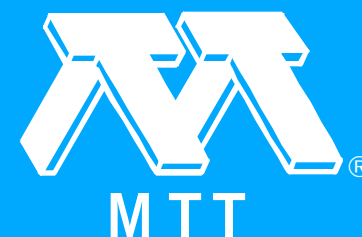
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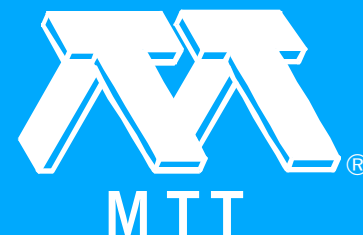
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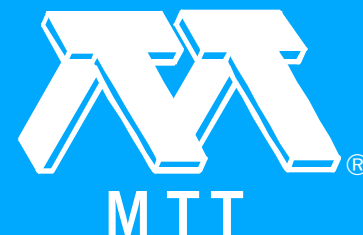
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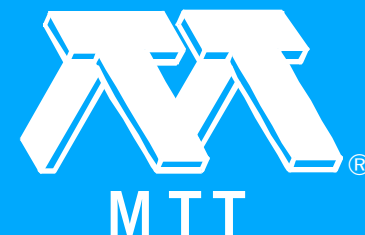
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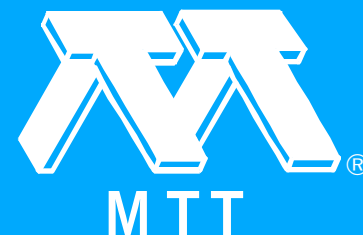
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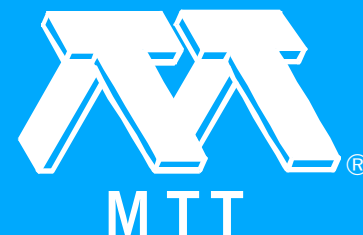
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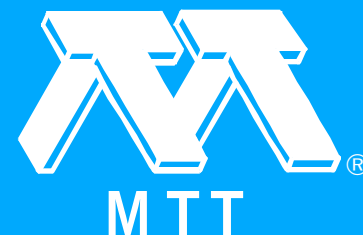
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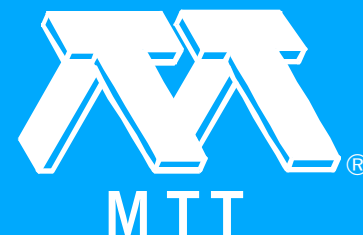
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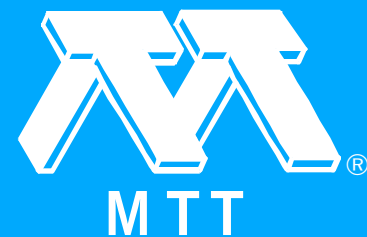
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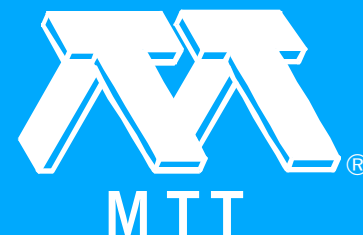
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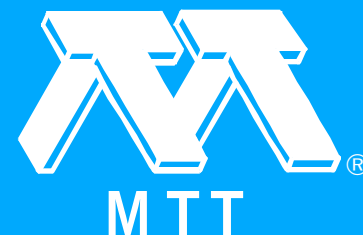
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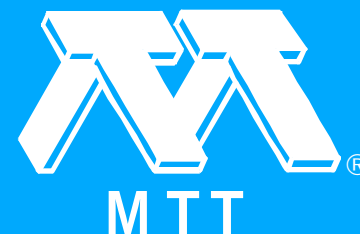
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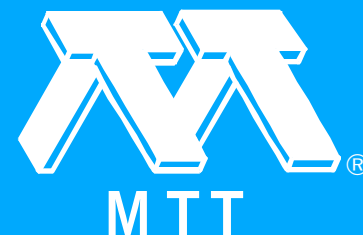
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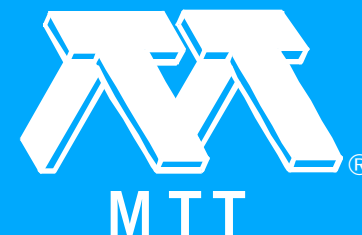
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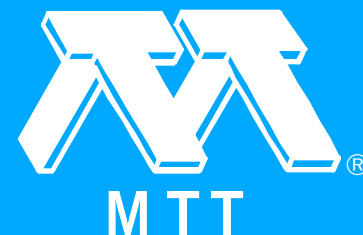
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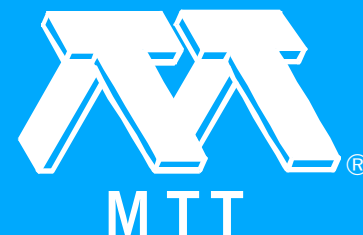
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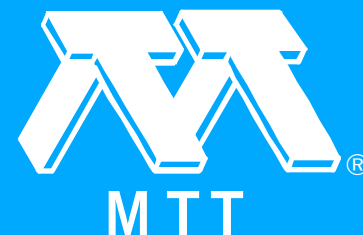
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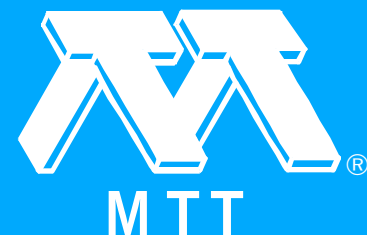
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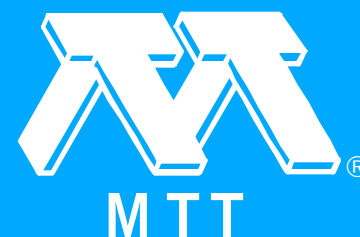
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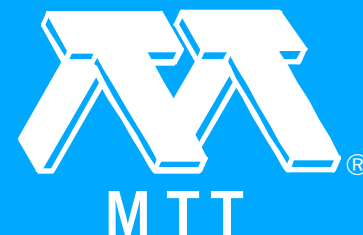
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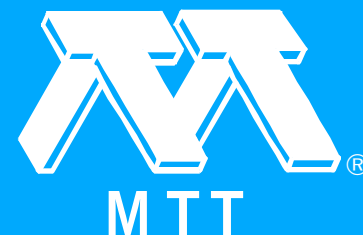
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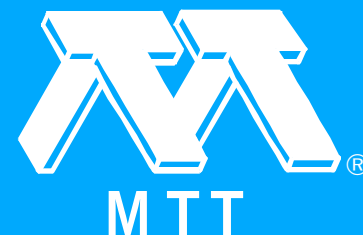


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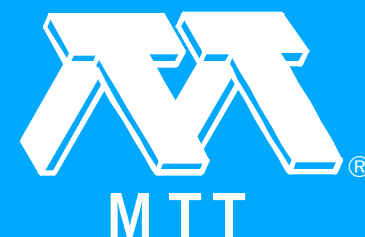
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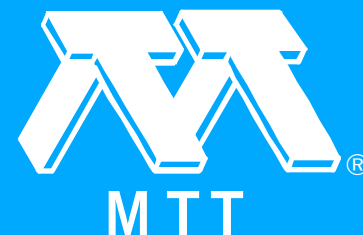
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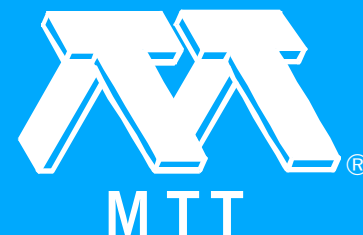
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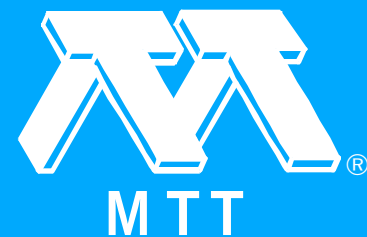
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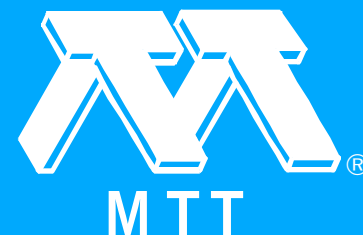
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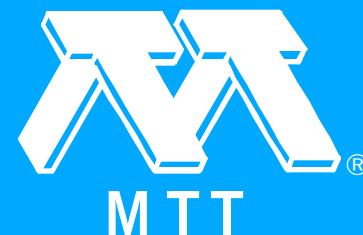


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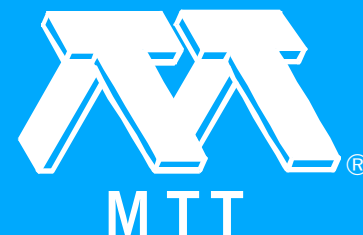
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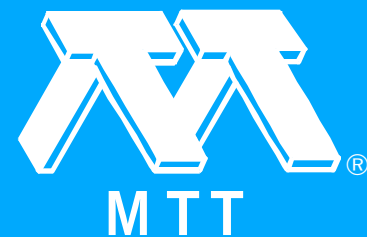
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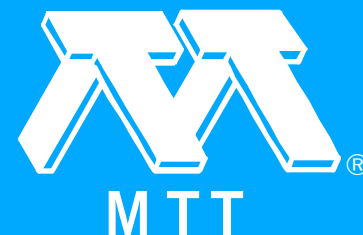
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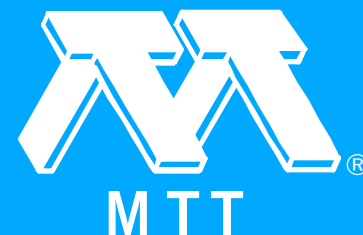
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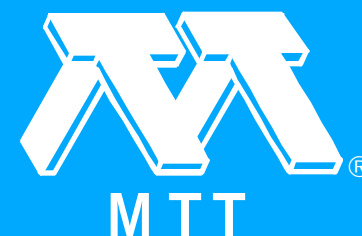
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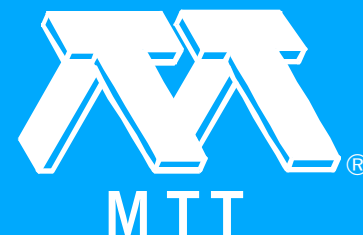
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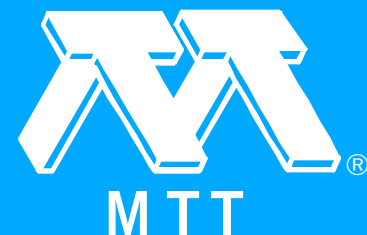
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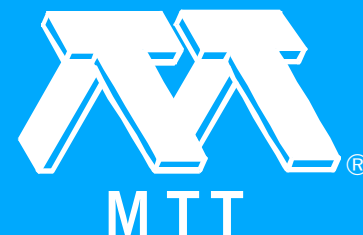
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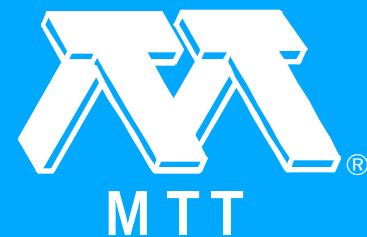
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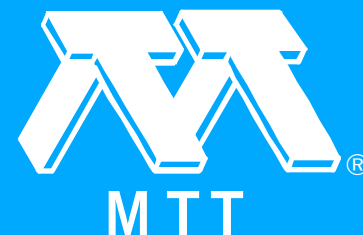
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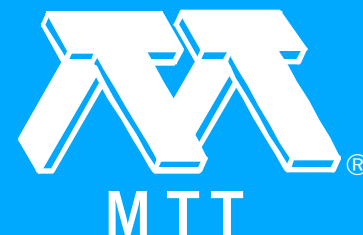
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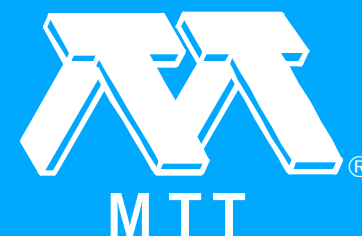
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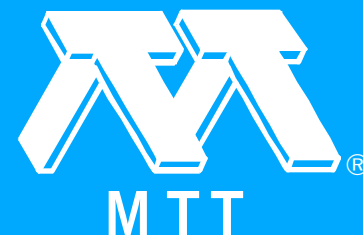
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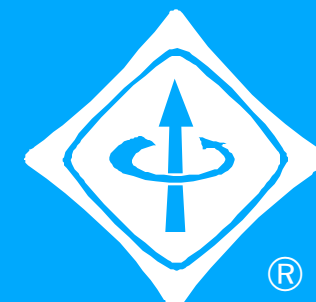
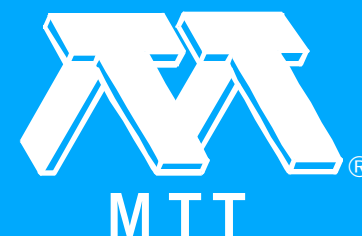
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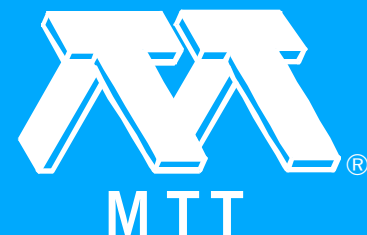
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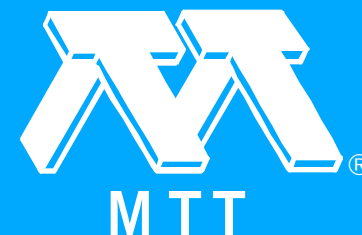
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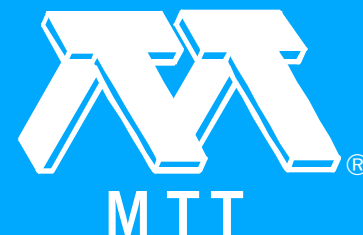
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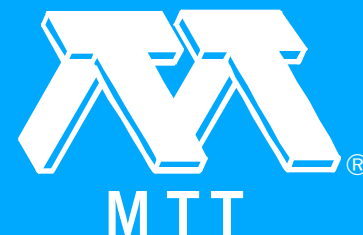
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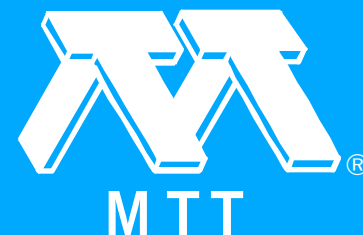
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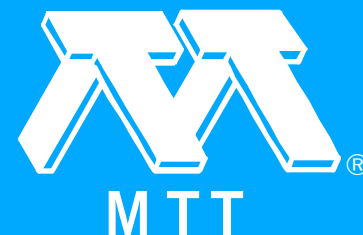
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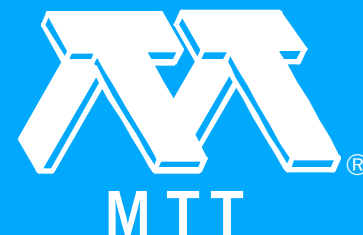
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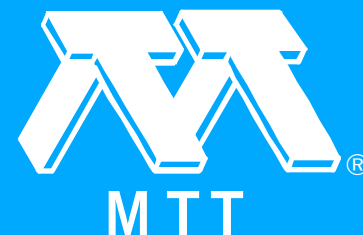
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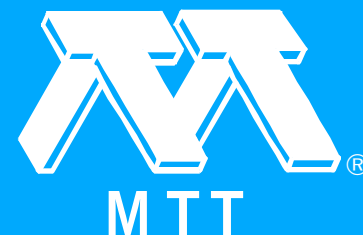
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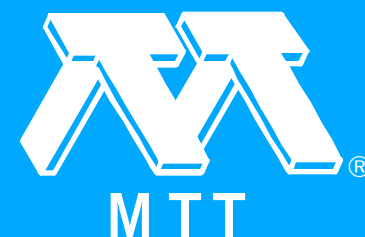
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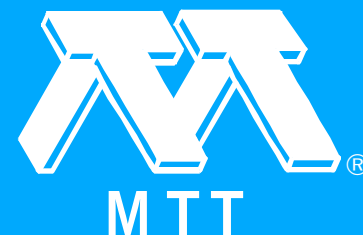
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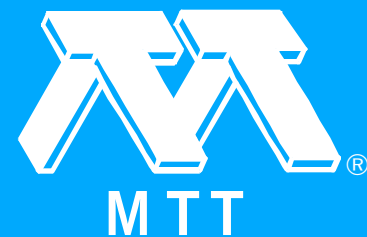
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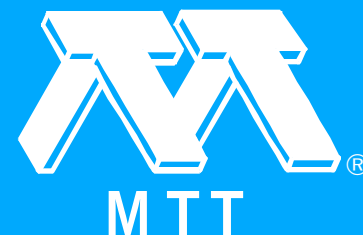
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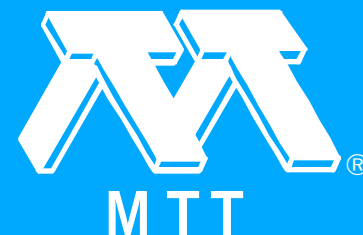
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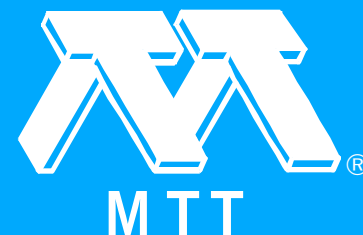
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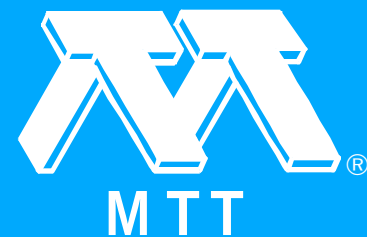
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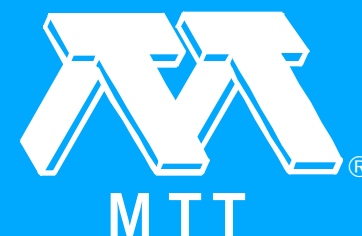
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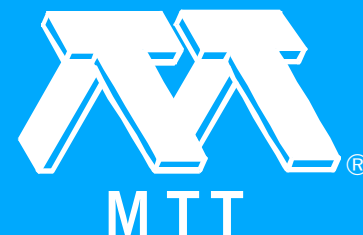
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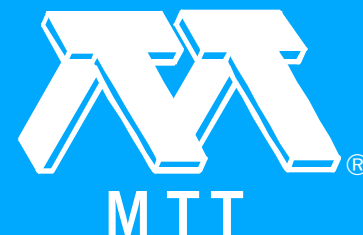
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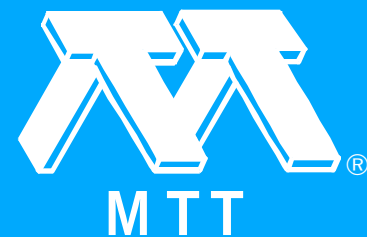
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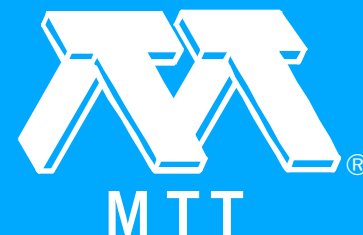
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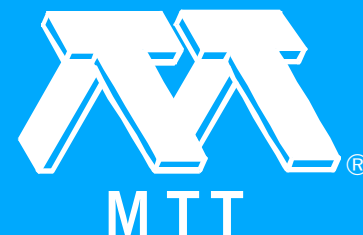


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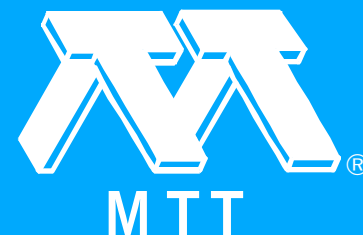
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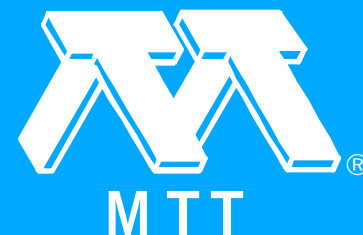
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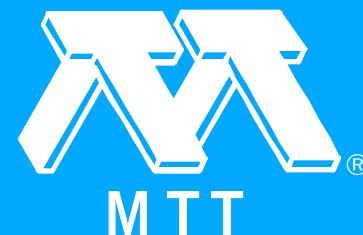
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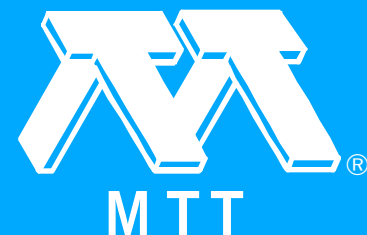
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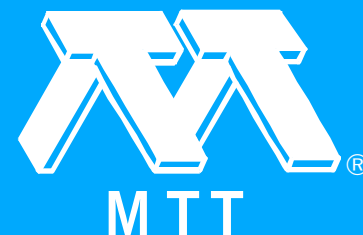
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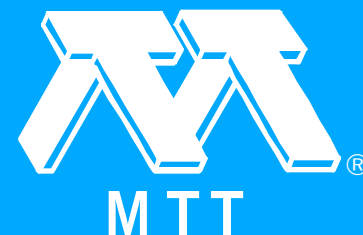
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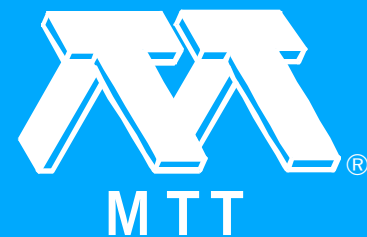
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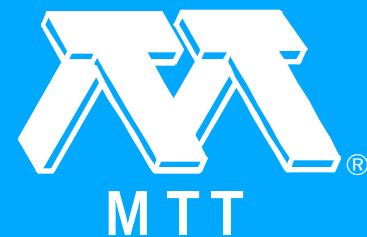
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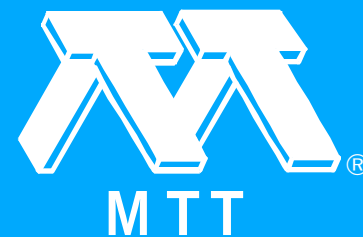
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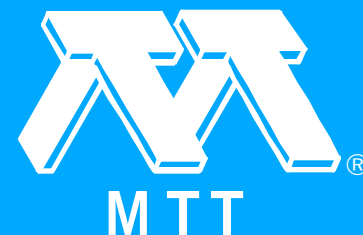
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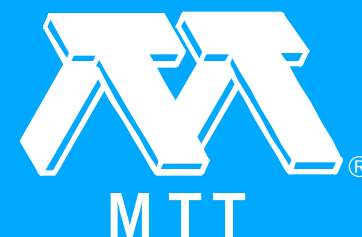
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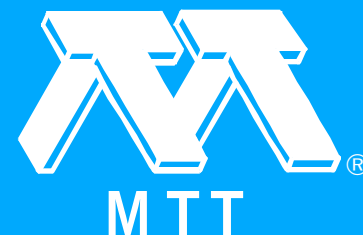
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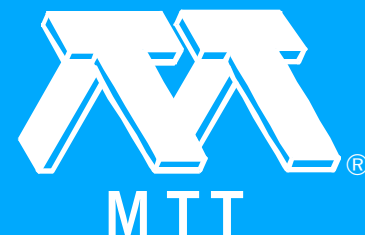
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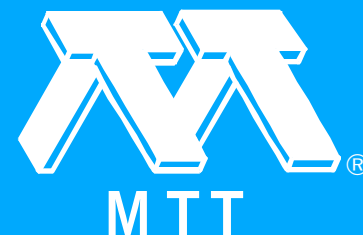
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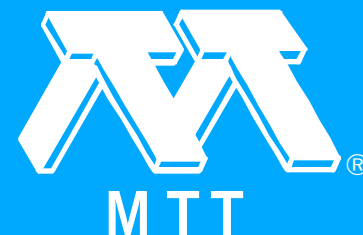
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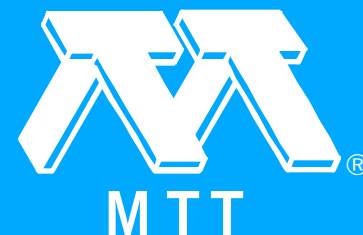
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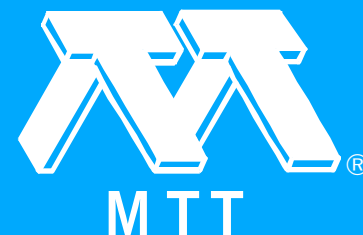
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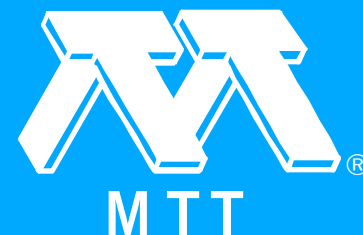
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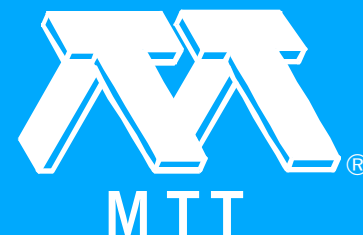
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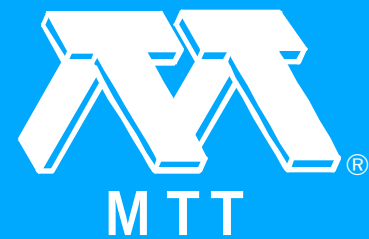
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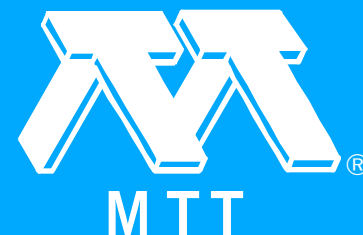


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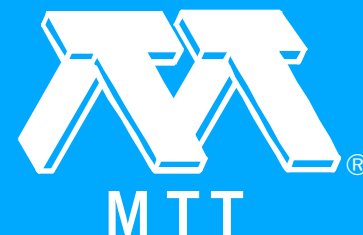
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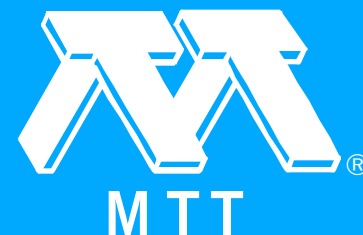
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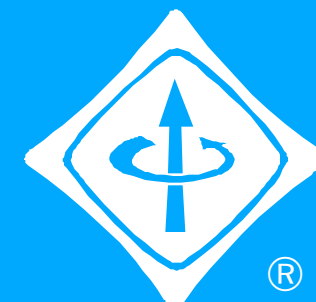
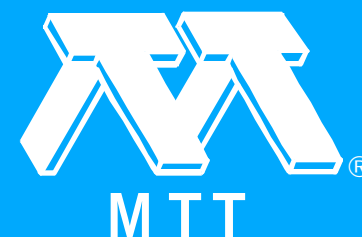
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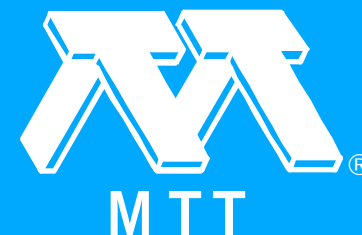
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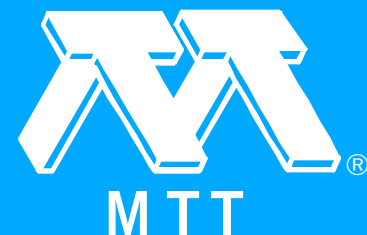
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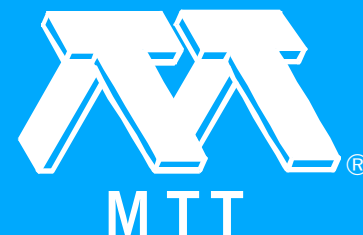
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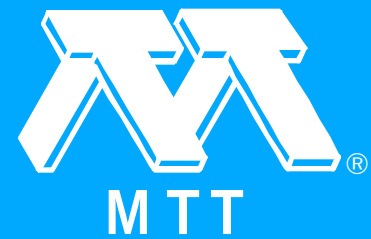
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Editorial (Jan. 1995 [MGWL])

T. Itoh. "Editorial (Jan. 1995 [MGWL])." 1995 Microwave and Guided Wave Letters 5.1 (Jan. 1995 [MGWL]): 1-2.

As of January 1, 1995, I will be retiring as the Editor-in-Chief of the IEEE Microwave and Guided Wave Letters. The responsibility will be turned over to Professor Roberto Sorrentino, who will assume the editorial operation of this increasingly influential archival journal. This decision was approved by the Administrative Committee of the IEEE Microwave Theory and Techniques Society unanimously and with enthusiasm. As you will find from his resume, Professor Sorrentino is highly qualified for this challenging job. In addition, his selection as the new Editor-in-Chief is the manifestation of the MIT Society's determination to become a truly translational organization.



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A 3-Position Transmission/Reflection Method for Measuring the Permittivity of Low Loss Materials

K.-H. Baek, H.-Y. Sung and W.S. Park. "A 3-Position Transmission/Reflection Method for Measuring the Permittivity of Low Loss Materials." 1995 Microwave and Guided Wave Letters 5.1 (Jan. 1995 [MGWL]): 3-5.

A 3-position transmission/reflection method for measuring the permittivity of low loss materials is presented. In this method, the measurement errors of the permittivity due to 1) the mismatch at the connections, 2) the metallic loss of the holder, 3) the uncertainty of sample position in the airline, and 4) the imperfection of the calibration kit can be removed by the measured data for a sample at three different positions. Experimental results for a low loss engineering plastic (tan delta /spl equiv/ 0.025) are included.

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Numerical Errors in the Computation of Impedances by FDTD Method and Ways to Eliminate Them

J. Fang and D. Xeu. "Numerical Errors in the Computation of Impedances by FDTD Method and Ways to Eliminate Them." 1995 Microwave and Guided Wave Letters 5.1 (Jan. 1995 [MGWL]): 6-8.

This paper presents the numerical errors in the computation of impedances by FDTD method. As shown by examples of the paper, substantial numerical errors can be introduced due to the spatial and time offsets of voltages and currents calculated from corresponding field variables in FDTD computations. An impedance calculation formula that completely eliminates such error is also presented.



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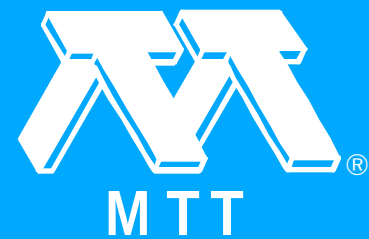
Efficient Modal Analysis of Waveguide Filters Including the Orthogonal Mode Coupling Elements by an MM/FE Method

R. Beyer and F. Arndt. "Efficient Modal Analysis of Waveguide Filters Including the Orthogonal Mode Coupling Elements by an MM/FE Method." 1995 Microwave and Guided Wave Letters 5.1 (Jan. 1995 [MGWL]): 9-11.

An efficient hybrid mode-matching finite element (MM/FE) method is applied for the rigorous analysis of waveguide filters composed of homogeneous standard waveguide cavities together with waveguide coupling sections of nearly arbitrary cross-section. To demonstrate the efficiency of the method, a simple two-pole circular waveguide dual-mode filter is analyzed where the orthogonal modes are coupled by obliquely positioned rectangular post elements with rounded edges and the coupling to the rectangular port waveguides is provided by rectangular irises with rounded corners. Moreover, a four-pole filter is shown where the dual-mode coupling is achieved by asymmetrically located irises. The theory is verified by excellent agreement with measurements.

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A 94-GHz Monolithic Balanced Power Amplifier Using 0.1- μ m Gate GaAs-Based HEMT MMIC Production Process Technology

M. Aust, H. Wang, M. Biedenbender, R. Lai, D.C. Streit, P.H. Liu, G.S. Dow and B.R. Allen. "A 94-GHz Monolithic Balanced Power Amplifier Using 0.1- μ m Gate GaAs-Based HEMT MMIC Production Process Technology." 1995 Microwave and Guided Wave Letters 5.1 (Jan. 1995 [MGWL]): 12-14.

A monolithic W-band two-stage balanced power amplifier has been developed using 0.1- μ m AlGaAs/InGaAs/GaAs pseudomorphic T-gate power HEMT technology. This monolithic power amplifier has demonstrated an output power of 102 mW and a small signal gain of 9 dB with input/output return losses of better than 10 dB at 94 GHz. Moreover, this monolithic chip is fabricated using production GaAs-based HEMT MMIC technology and a good yield is obtained. The circuit design relies on extensive EM analysis of matching structures and accurate device modeling. The success of this monolithic circuit development indicates the maturity of power HEMT MMIC technology at W-band.

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Small-Hole Formalism for the FDTD Simulation of Small-Hole Coupling

B.-Z. Wang. "Small-Hole Formalism for the FDTD Simulation of Small-Hole Coupling." 1995 Microwave and Guided Wave Letters 5.1 (Jan. 1995 [MGWL]): 15-17.

Based on Bethe's small hole coupling theory, a small-hole formalism (SHF) for the finite-difference time-domain simulation of small hole coupling is presented and validated. Much of the computing time and computer resources are saved by the SHF presented here.

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Simulation of a Subharmonic Excitation of Series Integrated Resonant Tunneling Diodes

R. Sun, D.-S. Pan and T. Itoh. "Simulation of a Subharmonic Excitation of Series Integrated Resonant Tunneling Diodes." 1995 Microwave and Guided Wave Letters 5.1 (Jan. 1995 [MGWL]): 18-20.

A subharmonic pulse excitation of an oscillator of series-integrated RTD's is considered and simulated. Linearized considerations are used to analyze the nonlinear system dominated by two major frequencies. A voltage-dependent current source is adopted to separate the input and output power for convenient simulation. Simulations show, for example, a 100-GHz integrated RTD oscillator can be excited by a 50-GHz pulse with 1-ns decay time without the dc instability problem, while a voltage ramp of 1-ns rise or fill time is far too slow to initiate such an oscillator.

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A 1-W High-Efficiency Q-Band MMIC Power Amplifier

J.C.L. Chi, J.A. Lester, Y. Hwang, P.D. Chow and M.Y. Huang. "A 1-W High-Efficiency Q-Band MMIC Power Amplifier." 1995 Microwave and Guided Wave Letters 5.1 (Jan. 1995 [MGWL]): 21-23.

Recent development on MMIC power amplifier has pushed the power-added efficiency (PAE) of 1-W amplifier to 29.4%. The power amplifier, using 0.15- μm InGaAs T-gate PHEMT devices, can deliver 1.2 W with 25% efficiency at 40 GHz when the drain is biased at 5 V. When the drain voltage drops to 4 V the output power is 1 W with 9-db associated gain and 29.4% PAE. The measured linear gain is averaged to be 12.5 db from 38-44 GHz.

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Aperture Coupling Between Adjacent Layers Using a New Stripline Geometry

N.I. Herscovici, N.K. Das, S. Papatheodorou and D.M. Pozar. "Aperture Coupling Between Adjacent Layers Using a New Stripline Geometry." 1995 Microwave and Guided Wave Letters 5.1 (Jan. 1995 [MGWL]): 24-25.

The excitation of the parallel plate mode in stripline configurations is a serious concern in the design of multilayer feeding networks. Using either probes or slots as means of power transfer between adjacent layers, the parallel-plate is always excited, and to insure its suppression a considerable effort has to be made. This letter presents a new method to solve this problem by using striplines with two different dielectric substrates on the two sides of its center strip. By inserting a dielectric plug of a high dielectric constant, only in the vicinity of the source, the excitation of the parallel-plate mode is significantly suppressed. A microstrip-to-stripline-to-microstrip coupler was designed with the new plug configuration and tested to demonstrate this concept.

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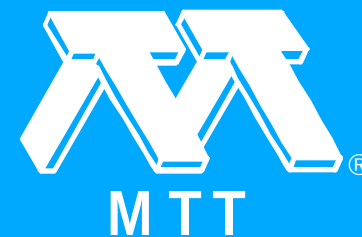
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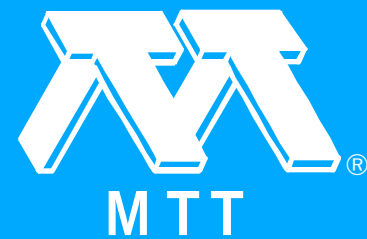


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A Transverse Slot in the Broad Wall of Inhomogeneously Loaded Rectangular Waveguide for Array Applications

J. Joubert. "A Transverse Slot in the Broad Wall of Inhomogeneously Loaded Rectangular Waveguide for Array Applications." 1995 Microwave and Guided Wave Letters 5.2 (Feb. 1995 [MGWL]): 37-39.

The self-properties of transverse slots in the broad wall of inhomogeneously loaded rectangular waveguide are computed using an integral equation moment method formulation, and compared to measured values. Results are also presented which show that transverse slots in inhomogeneously loaded rectangular waveguide can be used for antenna arrays which will not have grating lobes in their radiation patterns, and will not suffer from the same distribution taper limitations as similar arrays of homogeneous waveguide transverse slots.



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Slit-Coupled Ridge Waveguide T-Junctions

A. Abdelmonem and K.A. Zaki. "Slit-Coupled Ridge Waveguide T-Junctions." 1995 Microwave and Guided Wave Letters 5.2 (Feb. 1995 [MGWL]): 40-41.

The slit-coupled ridge waveguide T-junction is introduced and modeled using the single-port mode matching technique. The three-port scattering matrix of the T-junction is obtained from nine reflection coefficient computations at the perpendicular arm. Dependence of S-parameters on the slit thickness and width is given. Ridge T-junctions are analyzed as a special case of slit-coupled ridge T-junction and the computed S-parameters are in good agreement with available results.

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Beam Propagation Analysis of the Nonlinear Tapered Optical Waveguide

H.-Y. Liu and W.-S. Wang. "Beam Propagation Analysis of the Nonlinear Tapered Optical Waveguide." 1995 Microwave and Guided Wave Letters 5.2 (Feb. 1995 [MGWL]): 42-44.

A study of the transient behavior of nonlinear tapered optical waveguide is presented. The Fresnel equation with an input Gaussian field distribution is solved numerically using a combination of the semivectorial-polarized finite difference method and the Runge-Kutta method. The calculated results show that the tapered nonlinear waveguides have better waveguiding characteristics in potential applications.

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How Invariant is the Measured Equation of Invariance?

J.O. Jevtic and R. Lee. "How Invariant is the Measured Equation of Invariance?." 1995 Microwave and Guided Wave Letters 5.2 (Feb. 1995 [MGWL]): 45-47.

We prove that the measured equation of invariance (MEI) is not invariant to the excitation. The proof is based on the fact that different sets of sinusoidal metrons produce different boundary equations, even when the nodal separation is infinitely small. These results follow from the rigorous analytical derivations which are also verified numerically. The noninvariance of the MEI emphasizes the importance of the proper choice of metrons and indicates that this choice should be influenced by the excitation and geometry in question.

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A V-Band, High Gain, Low Noise, Monolithic PHEMT Amplifier Mounted on a Small Hermetically Sealed Metal Package

Y. Itoh, Y. Horiie, K. Nakahara, N. Yoshida, T. Katoh and T. Takagi. "A V-Band, High Gain, Low Noise, Monolithic PHEMT Amplifier Mounted on a Small Hermetically Sealed Metal Package." 1995 Microwave and Guided Wave Letters 5.2 (Feb. 1995 [MGWL]): 48-49.

V-band, high gain, low noise, monolithic amplifiers based on 0.15- μm AlGaAs/InGaAs/GaAs pseudomorphic HEMT's have been developed. The four-stage amplifier has been assembled on a small hermetically sealed metal package and has achieved a noise figure of 3 dB with a small signal gain of 42.2 dB at 51 GHz. The overall amplifier measured 14.2 x 20.0 x 2.3 mm³. The two-stage amplifier has been mounted on a carrier-type fixture and has achieved a noise figure of 2.5 dB with a small signal gain of 20.4 dB at 51.5 GHz. These results represent the best noise figure and the highest gain ever achieved by a monolithic amplifier using GaAs- or InP-based HEMT devices at these frequencies.

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DC-725 GHz Sampling Circuits and Subpicosecond Nonlinear Transmission Lines Using Elevated Coplanar Waveguide

U. Bhattacharya, S.T. Allen and M.J.W. Rodwell. "DC-725 GHz Sampling Circuits and Subpicosecond Nonlinear Transmission Lines Using Elevated Coplanar Waveguide." 1995 Microwave and Guided Wave Letters 5.2 (Feb. 1995 [MGWL]): 50-52.

Nonlinear transmission lines (NLTL's) fabricated with Schottky diodes on GaAs were used to electrically generate 3.7-V step functions that had a measured 10%-90% fall time of 0.68 ps. These NLTL's were integrated on wafer with sampling circuits that had a measured 3-dB bandwidth of 725 GHz. Key to circuit performance are the use of low-loss, high-wave-velocity elevated coplanar waveguide transmission lines and the elimination of active device pad parasitic by contacting devices above the plane of the wafer.

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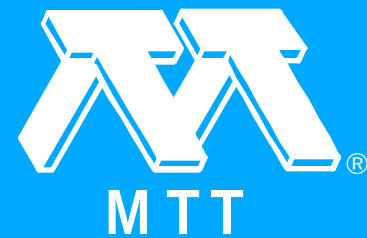


Abstracts

Higher Order Approximation for the Difference Operators in the Method of Lines

R. Pregla. "Higher Order Approximation for the Difference Operators in the Method of Lines." 1995 Microwave and Guided Wave Letters 5.2 (Feb. 1995 [MGWL]): 53-55.

In this paper a new general formalism for improving the convergence of the Method of Lines (MoL) is presented. The procedure reduces the discretization error to an order of higher than $O(h/\sup 4)$. The convergence behaviour is demonstrated for a rib waveguide for optical frequencies.



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A 50 MHz-30 GHz Broadband Co-Planar Waveguide SPDT PIN Diode Switch with 45-dB Isolation

K.W. Kobayashi, L. Tran, A.K. Oki and D.C. Streit. "A 50 MHz-30 GHz Broadband Co-Planar Waveguide SPDT PIN Diode Switch with 45-dB Isolation." 1995 Microwave and Guided Wave Letters 5.2 (Feb. 1995 [MGWL]): 56-58.

This paper reports on a GaAs PIN diode SPDT switch design which achieves 45 dB of isolation up to 30 GHz. The switch design uses 2- μ m-thick i-region PIN's, a shunt-shunt-series switch topology in each arm, and a quasi-coplanar waveguide (CPW) design environment to achieve its superior isolation performance. By employing CPW ground isolation with a microstrip design, as much as 10-dB improvement in isolation performance was observed at the upper band frequencies. The switch achieves 1.02-dB insertion loss and > 15-dB input and output return-loss across the band. In comparison to previously reported GaAs MMIC PIN diode switches at millimeter-wave frequencies, this design achieves state-of-the-art isolation performance.

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W-Band Monolithic Low Noise Amplifiers for Advanced Microwave Scanning Radiometer

Y. Itoh, K. Nakahara, T. Sakura, N. Yoshida, T. Katoh, T. Takagi and Y. Ito. "W-Band Monolithic Low Noise Amplifiers for Advanced Microwave Scanning Radiometer." 1995 Microwave and Guided Wave Letters 5.2 (Feb. 1995 [MGWL]): 59-61.

Monolithic low noise amplifiers using 0.15- μm AlGaAs/InGaAs/GaAs pseudomorphic HEMTs with a passivation film have been developed at W-band for the Advanced Microwave Scanning Radiometer. A two-stage monolithic amplifier has achieved a noise figure of 3.4 dB with a small signal gain of 8.7 dB at 91 GHz. A six-stage amplifier cascading three two-stage monolithic amplifier chips has achieved a noise figure of 4.2 dB with a small signal gain of 29.7 dB at 91 GHz. Taking into account the minimum noise figure of 2.5 dB with an associated gain of 4.3 dB of 0.15 x 60 μm^2 PHEMTs at 90 GHz, these results demonstrate that a good noise matching has been successfully achieved.

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Abstracts

Heterostructure Barrier Varactor Simulation Using an Integrated Hydrodynamic Device/Harmonic-Balance Circuit Analysis Technique (Correction)

J.R. Jones, S.H. Jones, G.B. Tait and M.F. Zybura. "Heterostructure Barrier Varactor Simulation Using an Integrated Hydrodynamic Device/Harmonic-Balance Circuit Analysis Technique (Correction)." 1995 Microwave and Guided Wave Letters 5.2 (Feb. 1995 [MGWL]): 62-62.

In addition to reporting on the integration of a hydrodynamic device simulator for Heterostructure Barrier Varactors (HBV's) with a novel harmonic-balance circuit simulation technique, the letter of reference was intended to illustrate the importance of representing active devices with physics-based numerical device models rather than typical analytical device models based on lumped quasi-static equivalent circuits.



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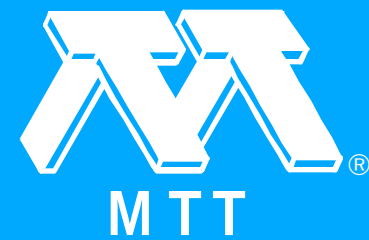
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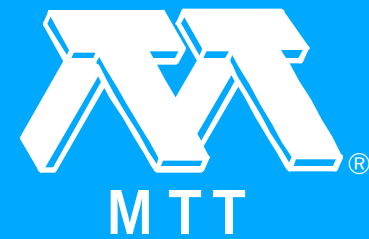
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Prepaid Order Plan (Advertisement) (Feb. 1995 [MGWL])

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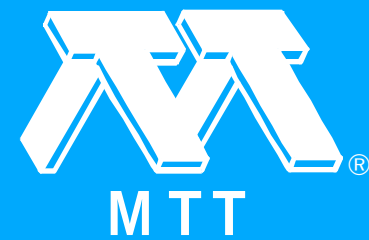
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IEEE Financial Advantage Program (Advertisement) (Feb. 1995 [MGWL])

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Millimeter Wave Tripler Evaluation of a Metal/2-DEG Schottky Diode Varactor

P.J. Koh, W.C.B. Peatman and T.W. Crowe. "Millimeter Wave Tripler Evaluation of a Metal/2-DEG Schottky Diode Varactor." 1995 Microwave and Guided Wave Letters 5.3 (Mar. 1995 [MGWL]): 73-75.

A new Schottky diode, based on a contact at the edge of a 2-dimensional electron gas (2-DEG) is investigated for use as a multiplier element in the millimeter and submillimeter wavelength regions. As a negative voltage is applied to the Schottky contact, the depletion layer between the Schottky contact and the 2-DEG expands and the junction capacitance decreases, resulting in a non-linear reactance. Device results are presented which demonstrate low series resistance, large capacitance modulation, and significantly higher tripler efficiency (75-225 GHz) than previously reported multiplier results of this type of structure.

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An HEMT with an Integrated On-Drain Capacitor as Basis of an Hybrid Mixer

R. Allam, C. Kolanowski, D. Theron and Y. Crosnier. "An HEMT with an Integrated On-Drain Capacitor as Basis of an Hybrid Mixer." 1995 Microwave and Guided Wave Letters 5.3 (Mar. 1995 [MGWL]): 76-78.

This paper reports the study of an HEMT, the characteristic of which is to have a decoupling capacitor directly integrated between its drain and source electrodes. It is shown that, with an appropriate design of this basic filtering element, such a device proves to be efficient as for the realization of hybrid gate mixers. An experimental demonstration of this property is given by the comparing a HEMT without capacitor with a HEMT with an integrated capacitor. For the latter, the gate length of which is 0.3 μm , it is shown that, at 18 GHz, a 5-dB improvement of conversion gain is provided by the integrated capacitor.





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Dispersion Analysis of a TLM Mesh Using a New Scattering Matrix Formulation

V. Trenkic, T.M. Benson and C. Christopoulos. "Dispersion Analysis of a TLM Mesh Using a New Scattering Matrix Formulation." 1995 Microwave and Guided Wave Letters 5.3 (Mar. 1995 [MGWL]): 79-80.

An equivalent scattering matrix for the TLM symmetrical condensed node is derived by rearranging the order of node ports. The new matrix is given in a partitioned form with zero blocks on the main diagonal. It enables a transformation of the general dispersion relation from a 12th- to a 6th-order eigenvalue equation, thus significantly simplifying the problem of finding a closed algebraic form of the dispersion relation for the symmetrical condensed node.

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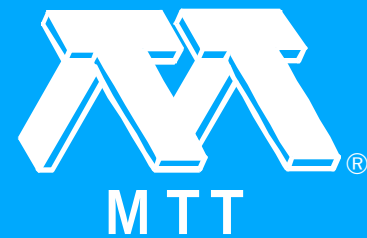


Abstracts

Optically Controlled Microwave Switching and Phase Shifting Using GaAs FET's

S.J. Rossek and C.E. Free. "Optically Controlled Microwave Switching and Phase Shifting Using GaAs FET's." 1995 Microwave and Guided Wave Letters 5.3 (Mar. 1995 [MGWL]): 81-83.

Theoretical and experimental results relating to a novel method for achieving direct optical control of a microwave phase shifter are presented, based upon a microwave reflective switch in which on- and off-states are controlled by direct optical illumination of a GaAs FET. Results, hitherto unavailable in the literature, verify previously published models for the GaAs FET as a microwave switch while under electrical control and establish the use of this model to predict the response of the switch under direct optical control over the frequency range 8 to 12 GHz.



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A New Look at the Perfectly Matched Layer (PML) Concept for the Reflectionless Absorption of Electromagnetic Waves

R. Mittra and U. Pekel. "A New Look at the Perfectly Matched Layer (PML) Concept for the Reflectionless Absorption of Electromagnetic Waves." 1995 Microwave and Guided Wave Letters 5.3 (Mar. 1995 [MGWL]): 84-86.

The Perfectly Matched Layer (PML) concept has been introduced recently by Berenger with the objective of developing an absorbing boundary condition for the Finite Difference Time Domain (FDTD) method. In its original formulation, the PML approach is based on the splitting of the field components into two sub-components which are weighted with different constituent parameters. The objectives of this paper are to take a critical look at the PML concept with a view to providing some interpretations of the same; to examine the Maxwellian nature of the PML layer; to present a version of the PML approach that does not involve the "splitting" and the resulting six components for each of the electric and magnetic fields in the PML layer; and, finally, to compare it with other approaches, e.g., co-ordinate scaling.

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Abstracts

Edge-Coupled Microstrip Loop Resonators with Capacitive Loading

J.S. Hong and M.J. Lancaster. "Edge-Coupled Microstrip Loop Resonators with Capacitive Loading." 1995 Microwave and Guided Wave Letters 5.3 (Mar. 1995 [MGWL]): 87-89.

Novel edge-coupled microstrip loop resonators with capacitive loading have been developed. A preliminary investigation has shown that the novel coupled resonators have a smaller size and similar frequency responses as compared with the conventional coupled microstrip line resonators. This makes them attractive to the monolithic microwave integrated circuits (MMIC) and the microwave superconductive circuits where size reduction is of primary importance.



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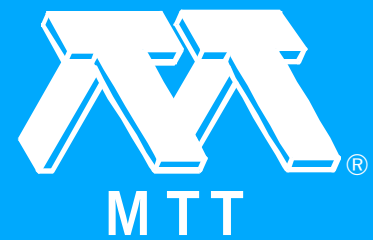
Perfectly Matched Absorbing Boundary Conditions Based on Anisotropic Lossy Mapping of Space

C.M. Rappaport. "Perfectly Matched Absorbing Boundary Conditions Based on Anisotropic Lossy Mapping of Space." 1995 Microwave and Guided Wave Letters 5.3 (Mar. 1995 [MGWL]): 90-92.

An absorbing boundary condition (ABC), based on the PML ABC of Berenger, used in the frequency domain to terminate the computational grid in electromagnetic scattering simulations is presented. Making use of an impedance-matched lossy layer, with directionally-dependent electric and magnetic conductivity, this ABC is independent of frequency and almost independent of incident angle. Thus it can be placed very close to a scatterer, minimizing the usual buffer of required, uninteresting computational space, and so reduce computer storage and CPU time. With this novel formulation, the ABC can be specified in three dimensions in almost the same manner as the standard FDTD equations, with only a small percentage of increased software overhead.

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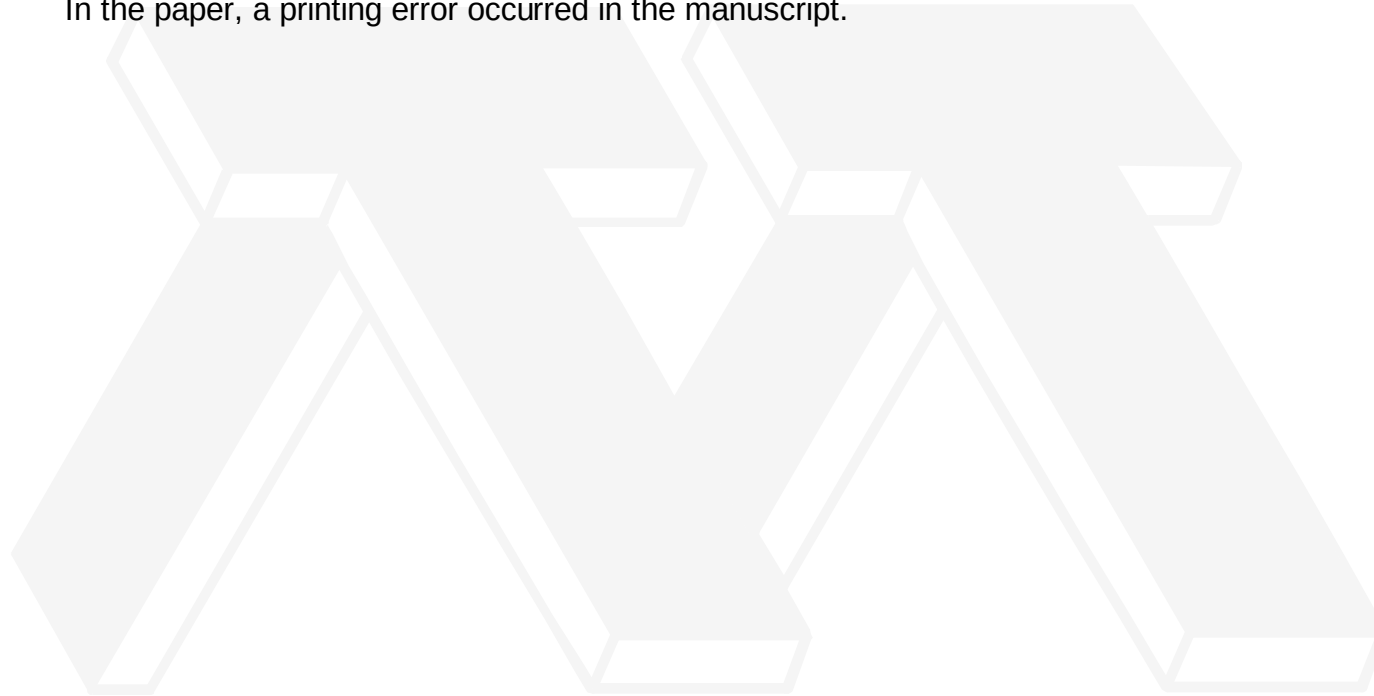
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Oscillator Design for Maximum Added Power (Correction)

B.K. Kormanyos and G.M. Rebeiz. "Oscillator Design for Maximum Added Power (Correction)." 1995 Microwave and Guided Wave Letters 5.3 (Mar. 1995 [MGWL]): 93-93.

In the paper, a printing error occurred in the manuscript.



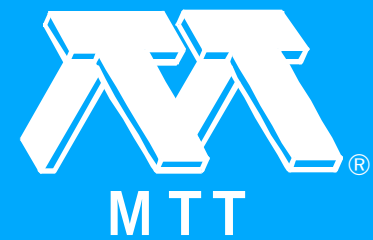
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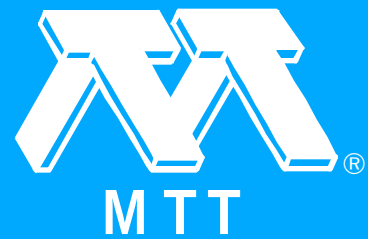
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Call for Papers - Transmission Line Matrix (TLM) Modeling - Theory and Applications (Mar. 1995 [MGWL])

"Call for Papers - Transmission Line Matrix (TLM) Modeling - Theory and Applications (Mar. 1995 [MGWL])." 1995 Microwave and Guided Wave Letters 5.3 (Mar. 1995 [MGWL]): 101-101.



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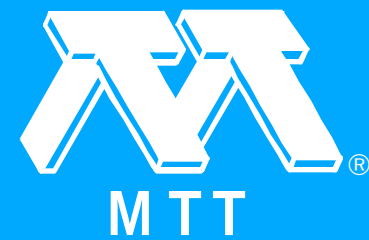
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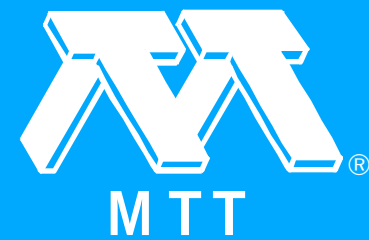
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Neurocomputed Model of Open-Circuited Coaxial Probes

D. Tuck and S. Coad. "Neurocomputed Model of Open-Circuited Coaxial Probes." 1995 Microwave and Guided Wave Letters 5.4 (Apr. 1995 [MGWL]): 105-107.

An artificial multi-layered feedforward neural network has been developed which transforms reflection coefficient data measured using a coaxial probe and network analyser, into the permittivity values of the fluid the probe touches. This eliminates the need for de-embedding of data from the measurement plane via empirical models of the physical cable. Back propagation training and testing was performed on a 0.25 in. diameter coaxial probe, using data spanning the frequency range 200 MHz-16 GHz taken on nine fluids. The successful results indicate that a new nonparametric technique can join the other permittivity measurement schemes for coaxial probes.

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Low Noise 9-GHz Sapphire Resonator-Oscillator with Thermoelectric Temperature Stabilization at 300 Kelvin

M.E. Tobar, E.N. Ivanov, R.A. Woode, J.H. Searls and A.G. Mann. "Low Noise 9-GHz Sapphire Resonator-Oscillator with Thermoelectric Temperature Stabilization at 300 Kelvin." 1995 Microwave and Guided Wave Letters 5.4 (Apr. 1995 [MGWL]): 108-110.

This letter reports on an X-band microwave oscillator incorporating a room temperature thermoelectric stabilized sapphire resonator operating at 9.00000 GHz. With a Galani type stabilization scheme we have measured a reduced single sideband phase noise of about -124 dBc/Hz at 1 kHz with a $f/\text{sup } -3/$ dependence. The measurement was limited by the flicker noise of the phase detector in the feedback electronics. The frequency stability was also measured; at an integration time of 0.1 seconds a $\Delta f/f$ of about $10/\text{sup } -11/$ with a $\tau/\text{sup } 0.7/$ dependence was measured. The frequency drift strongly correlated with ambient temperature fluctuations.

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Scattering from Ferrite Bodies of Revolution Using a Hybrid Approach

L.W. Epp, D.J. Hoppe and G.C. Chinn. "Scattering from Ferrite Bodies of Revolution Using a Hybrid Approach." 1995 Microwave and Guided Wave Letters 5.4 (Apr. 1995 [MGWL]): 111-113.

The scattered fields from axisymmetric problems containing anisotropic media are found by a Hybrid Finite Element method. In particular a symmetric formulation for bodies of revolution that incorporates a Finite Element formulation for axially magnetized ferrite materials is presented. The method is applied to a ferrite cylinder with quartz matching layers. A Gaussian beam input is used to predict the Faraday rotation through the ferrite cylinder and display it visually.

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A 60-GHz MMIC-Compatible TED-Oscillator

A.L. Springer, C.G. Diskus, K. Lubke and H.W. Thim. "A 60-GHz MMIC-Compatible TED-Oscillator." 1995 Microwave and Guided Wave Letters 5.4 (Apr. 1995 [MGWL]): 114-116.

Experimental results achieved with planar GaAs transferred electron oscillators at V-band frequencies are reported in this contribution. The active devices are MESFET-like structures with a Schottky-gate controlling the electron injection into the drift region. The electron injection is adjusted to a level yielding a frequency independent negative differential resistance which is exploited for millimeter-wave power generation. The highest measured CW output power and efficiency are 6.72 mW and 1.3 % at 60.33 GHz, respectively. These results are comparable to those obtained with transistor oscillators which are much more difficult to fabricate due to their extremely small dimensions in the 0.1 μm range.

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Abstracts

An Efficient Analysis Approach for Inset Dielectric Guide (IDG) Structures and its Variations

Z. Ma, T. Ishikawa and E. Yamashita. "An Efficient Analysis Approach for Inset Dielectric Guide (IDG) Structures and its Variations." 1995 Microwave and Guided Wave Letters 5.4 (Apr. 1995 [MGWL]): 117-118.

Based on a simplified analysis model of the inset dielectric guide (IDG), an efficient mode-matching approach is proposed for the accurate characterization of IDG structures. Formulations of the approach are easy to understand and to perform, and are proved to be accurate, fast convergent, and versatile by a variety of numerical examples.



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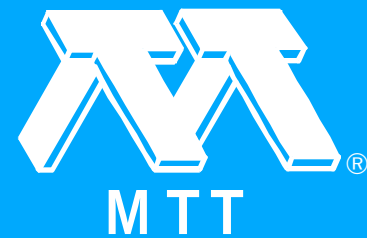


Abstracts

A Simplified Algorithm for Leaky Network Analyzer Calibration

A. Ferrero and F. Sanpietro. "A Simplified Algorithm for Leaky Network Analyzer Calibration." 1995 Microwave and Guided Wave Letters 5.4 (Apr. 1995 [MGWL]): 119-121.

A new algorithm for Network Analyzer Calibration is presented. The error model includes leakage effects and can be applied to a general n-port NWA. The 2-port 16-term model becomes a special case of this new technique which is also hopefully suitable for the calibration problems of multiport on-wafer probing systems. Experimental results testify the effectiveness of the new approach.



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Subharmonic Gate Mixer Based on a Multichannel HEMT

R. Allam, C. Kolanowski, D. Theron and Y. Crosnier. "Subharmonic Gate Mixer Based on a Multichannel HEMT." 1995 Microwave and Guided Wave Letters 5.4 (Apr. 1995 [MGWL]): 122-123.

This paper presents the realization and simulation of a new subharmonic gate mixer based on a multichannel HEMT. This device gives the possibility of tailoring the transconductance profile. Two peaks separated by a valley can be obtained. Biasing the device at the bottom of the valley, the IF signal comes from the mixing of the RF signal and the second LO harmonic. This mixer uses half the normal LO frequency and has a minimum conversion loss of 10 dB.

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A Monolithic HBT-Regulated HEMT LNA by Selective MBE

D.C. Streit, K.W. Kobayashi, A.K. Oki and D.K. Umemoto. "A Monolithic HBT-Regulated HEMT LNA by Selective MBE." 1995 Microwave and Guided Wave Letters 5.4 (Apr. 1995 [MGWL]): 124-126.

We demonstrate here the monolithic integration of an HBT operational amplifier and a HEMT low-noise amplifier to achieve an elegant single-chip solution to the problem of HEMT current regulation. We have developed a novel method of achieving monolithic HEMT-HBT integration by selective MBE and a unique merged-processing technology. Pseudomorphic 0.2 μm gate-length InGaAs-GaAs-AlGaAs HEMT's and $2 \times 10 \mu\text{m}^2$ GaAs-AlGaAs-InGaAs HBT devices have been incorporated into the same microwave circuit for the first time with no degradation in the intrinsic device performance of either device technology.

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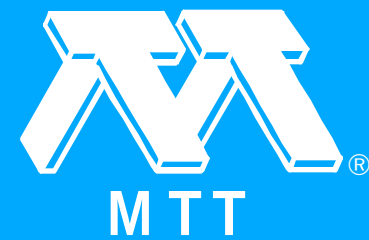
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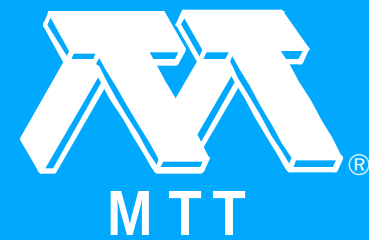
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Frequently Asked Questions and Answers (Advertisement) (Apr. 1995 [MGWL])

*"Frequently Asked Questions and Answers (Advertisement) (Apr. 1995 [MGWL])." 1995
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FD-TLM Modeling of Josephson Junction Circuits

R.H. Voelker and C.G. Sentelle. "FD-TLM Modeling of Josephson Junction Circuits." 1995 Microwave and Guided Wave Letters 5.5 (May 1995 [MGWL]): 137-138.

Josephson junction circuits are capable of operating at high frequencies where a full-wave field simulation is needed to completely analyze the circuits. The FD-TLM time-domain full-wave electromagnetic field calculation method is extended to modeling high-speed Josephson junction (JJ) circuits by the incorporation of a model for the JJ. The JJ model implementation is described and is validated by excellent agreement between FD-TLM and conventional circuit simulations of the transient response of a JJ circuit having short interconnections.

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



New Cross-T Junction for CPW Stub-Filters on MMIC's

F. Mernyei, I. Aoki and H. Matsuura. "New Cross-T Junction for CPW Stub-Filters on MMIC's." 1995 Microwave and Guided Wave Letters 5.5 (May 1995 [MGWL]): 139-141.

This letter reports on a new Cross-T junction for CPW stub-type filters. We analyzed the structure by full 3D structure simulations and corrected its equivalent circuit based on measurement data. Using the equivalent circuit of the Cross-T we optimized filters by compensating for their discontinuities. We found good agreement between the measured and simulated characteristics, which confirms the validity of the equivalent circuit.

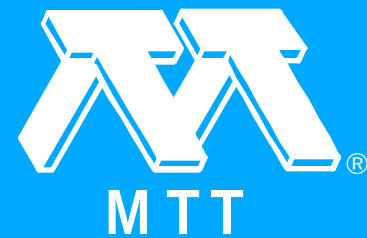


Abstracts

Enhanced Thin-Slot Formalism for the FDTD Analysis of Thin-Slot Penetration

B.-Z. Wang. "Enhanced Thin-Slot Formalism for the FDTD Analysis of Thin-Slot Penetration." 1995 Microwave and Guided Wave Letters 5.5 (May 1995 [MGWL]): 142-143.

The inclusion of the singularities of the field variation near a thin-slot is validated to be a useful enhancement of the standard thin-slot formalism for the finite-difference time-domain analysis of thin-slot penetration.



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Notable Features of Hybrid Modes in a Chiral-Filled Rectangular Waveguide

A.R. Samant and K.W. Whites. "Notable Features of Hybrid Modes in a Chiral-Filled Rectangular Waveguide." 1995 Microwave and Guided Wave Letters 5.5 (May 1995 [MGWL]): 144-146.

An analysis of hybrid modes in a rectangular waveguide filled with chiral material is presented in this paper. The modal wavenumbers are computed using the finite difference method together with Mullers root-finding algorithm. A novel scheme is presented whereby the validity of the numerical solution is established with analytical results. Using this numerical methodology, the existence of complex modes for a rectangular chiral waveguide is confirmed. Other notable features such as mode bifurcation and low frequency effects of chirality are also discussed.

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



Cylindrical Post with Gap in a Rectangular Waveguide

R. Keam. "Cylindrical Post with Gap in a Rectangular Waveguide." 1995 Microwave and Guided Wave Letters 5.5 (May 1995 [MGWL]): 147-149.

The problem of a thin hollow post, of the type often used for semiconductor mounting structures, in a rectangular waveguide is considered for the case where the post has a variable gap located at some position on it. The solution for the reflection coefficient in the waveguide for the case where there is only one propagating mode in the waveguide. A comparison of theoretical results and experimental measurements of the reflection coefficient as a function of gap size, shows the theory yields a high degree of accuracy.





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A 140-GHz Monolithic Low Noise Amplifier

H. Wang, R. Lai, D.C.W. Lo, D.C. Streit, P.H. Liu, R.M. Dia, M.W. Pospieszalski and J. Berenz.
"A 140-GHz Monolithic Low Noise Amplifier." 1995 Microwave and Guided Wave Letters 5.5
(May 1995 [MGWL]): 150-150.

This paper presents the development of a 140-GHz monolithic low noise amplifier (LNA) using 0.1- μm pseudomorphic InAlAs/InGaAs/InP low noise HEMT technology. A two-stage single-ended 140-GHz monolithic LNA has been designed, fabricated and tested. It exhibits a measured small signal gain of 9 dB at 142 GHz, and more than 5-dB gain from 138-145 GHz. This is the highest frequency monolithic amplifier ever reported using three terminal devices.

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A 250-GHz Microshield Bandpass Filter

T.M. Weller, L.P. Katehi and G.M. Rebeiz. "A 250-GHz Microshield Bandpass Filter." 1995 Microwave and Guided Wave Letters 5.5 (May 1995 [MGWL]): 153-155.

A four-section, planar bandpass filter has been designed, fabricated and tested at 130-360 GHz. The filter is based on the microshield line, a half-shielded transmission line in which the conducting lines are supported on a 1.4- μm -thick dielectric membrane. The insertion loss of the filter is less than 1.5 dB with a 58% relative bandwidth at 250 GHz, demonstrating the excellent performance of the microshield geometry. Also, a Monte Carlo routine was developed in conjunction with a semi-empirical/semi-analytical model to allow the S-parameters of the filter to be derived from scalar power measurements.

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Ka-Band Monolithic Low-Noise Amplifier Using Direct Ion-Implanted GaAs MESFET's

M. Feng, D.R. Scherrer, P.J. Apostolakis, J.R. Middleton, M.J. McPartlin, B.D. Lauterwasser and J.D. Oliver, Jr.. "Ka-Band Monolithic Low-Noise Amplifier Using Direct Ion-Implanted GaAs MESFET's." 1995 Microwave and Guided Wave Letters 5.5 (May 1995 [MGWL]): 156-158.

Ka-band monolithic low-noise amplifiers using low cost direct ion-implanted GaAs MESFET's with 0.25 μm "T"-gates have been developed for use at 27 to 34 GHz. The five stage MMIC amplifier is designed based on 50% loss self-biasing using a single power supply. These amplifiers achieved 2-3 dB noise figure with 30 dB associated gain at 33 GHz. These results, using low cost ion implantation techniques, rival the best GaAs p-HEMT MMIC results to date.

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Piecewise Stability Analysis in Microwave Circuits

S. Basu, S.A. Maas and T. Itoh. "Piecewise Stability Analysis in Microwave Circuits." 1995 Microwave and Guided Wave Letters 5.5 (May 1995 [MGWL]): 159-160.

A novel method for analyzing the global stability of microwave circuits under multi-parameter variation is presented. In this method, an arbitrary linear circuit is divided up into subcircuits containing parametric elements and a fixed linear circuit. This approach improves the computational efficiency by eliminating the need for recalculation of the Y-parameters of the fixed part of the linear circuit.

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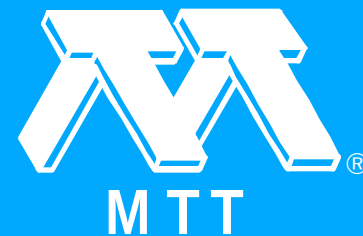


Abstracts

On the Measurement of the Complex Permittivity of Materials by an Open-Ended Coaxial Probe

D. Misra. "On the Measurement of the Complex Permittivity of Materials by an Open-Ended Coaxial Probe." 1995 Microwave and Guided Wave Letters 5.5 (May 1995 [MGWL]): 161-163.

A number of papers have appeared on the characterization of materials using a coaxial probe, In most cases, approximate admittance models have been used for this purpose. The present work compares two rigorous mathematical models for the aperture admittance. One of these relations is based on the variational principle while the other utilizes the method of moments. Muller's method is then used to determine the complex permittivity of materials. The two procedures have been tested in the frequency range of 1-18 GHz.



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Plane Wave Excitation of an Infinite Dielectric Rod (Comments) (May 1995 [MGWL])

J.-G. Ma. "Plane Wave Excitation of an Infinite Dielectric Rod (Comments) (May 1995 [MGWL])." 1995 Microwave and Guided Wave Letters 5.5 (May 1995 [MGWL]): 164-164.

In the above paper, the author finds that there are some mistakes in (3), (5), (7), (9), and (10).



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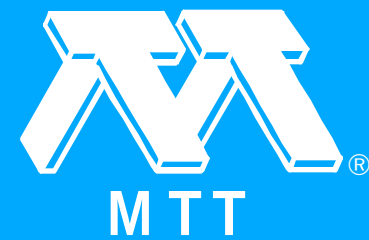
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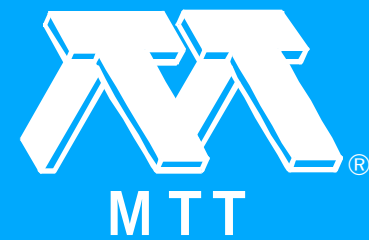
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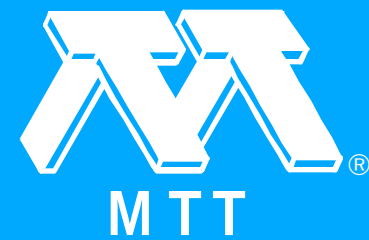
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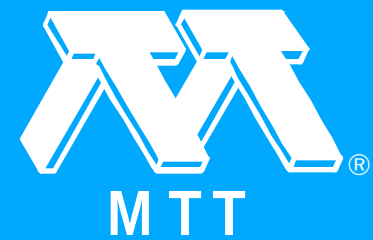
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Performance and Optimization of Gunn Self-Oscillating Mixer

J. Krasavin and H. Hinrikus. "Performance and Optimization of Gunn Self-Oscillating Mixer." 1995 Microwave and Guided Wave Letters 5.6 (Jun. 1995 [MGWL]): 177-179.

Dependence of performance of a Gunn Doppler self-oscillating mixer on the oscillator loaded quality factor, bias voltage and bias circuit resistance is investigated theoretically and experimentally. The analysis is based on consideration of stability principle and average voltage-current characteristic of a Gunn oscillator. Location of the operating point of the best performance of a Gunn Doppler self-oscillating mixer is defined. Results of the work can be used for tuning a Gunn Doppler self-oscillating mixer.

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Multi-Slot 50-Omega Antennas for Quasi-Optical Circuits

H.S. Tsai and R.A. York. "Multi-Slot 50-Omega Antennas for Quasi-Optical Circuits." 1995 Microwave and Guided Wave Letters 5.6 (Jun. 1995 [MGWL]): 180-182.

CPW-fed multiple-slot antennas have been developed for active arrays and integrated antennas. This letter describes how the antenna can be engineered for a self-resonant 50-Omega input impedance for a various substrate parameters, and the concepts are verified using a three-slot antenna on $\epsilon_r = 2.2$ substrate and a five-slot antenna on $\epsilon_r = 9.8$ substrate. These antennas have been integrated directly with commercial MMIC gain block chips without any matching networks to create a quasi-optical amplifier array.

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Abstracts

A Fast Recursive Highly Dispersive Absorbing Boundary Condition Using Time Domain Diakoptics and Laguerre Polynomials

M. Mrozowski, M. Niedzwiecki and P. Suchomski. "A Fast Recursive Highly Dispersive Absorbing Boundary Condition Using Time Domain Diakoptics and Laguerre Polynomials." 1995 Microwave and Guided Wave Letters 5.6 (Jun. 1995 [MGWL]): 183-185.

The contribution presents a new implementation of the absorbing boundary condition for structures where traditional ABC's perform poorly because of high dispersion. The proposed approach consists in the application of time domain diakoptics combined with the expansion of the impulse response into series of Laguerre polynomials. The application of Laguerre polynomials allows fast recursive calculation of the convolutions required by diakoptics. The numerical cost associated with this approach is significantly lower than in currently used time diakoptics schemes.



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Cutoff Frequencies of Guiding Structures with Circular and Planar Boundaries

B.N. Das, S.B. Chakrabarty and A.K. Mallick. "Cutoff Frequencies of Guiding Structures with Circular and Planar Boundaries." 1995 Microwave and Guided Wave Letters 5.6 (Jun. 1995 [MGWL]): 186-188.

The paper presents a method of evaluation of cut-off frequencies of a guiding structure consisting of two eccentric circular arcs with edges shorted by conducting planes. Combination of conformal transformation and method of finite difference is used for the analysis. The general formulation is applied to the limiting cases of lunar guide and also the guiding structure of semicircular cross section with a semi-circular dent along its diameter. Numerical data for TE and TM modes are presented for different angular separation between the shorting planes, distance between the centers and ratio of radii.





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Third-Order Intermodulation Distortion in Cascaded Stages

S.A. Maas. "Third-Order Intermodulation Distortion in Cascaded Stages." 1995 Microwave and Guided Wave Letters 5.6 (Jun. 1995 [MGWL]): 189-191.

The relation for intermodulation distortion (IM) levels in cascaded stages is based on the worst-case assumption that intermodulation products at the output of each stage combine in phase. However, because there is no apparent reason why IM products should always combine in phase, efforts are customarily made to discard this assumption. Using Volterra analysis, we show that in certain cases, the IM products do indeed combine in phase, and the cascade relation gives an accurate, not worst-case, prediction of distortion.

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A Comparison of the Berenger Perfectly Matched Layer and the Lindman Higher-Order ABC's for the FDTD Method

W.V. Andrew, C.A. Balanis and P.A. Tirkas. "A Comparison of the Berenger Perfectly Matched Layer and the Lindman Higher-Order ABC's for the FDTD Method." 1995 Microwave and Guided Wave Letters 5.6 (Jun. 1995 [MGWL]): 192-194.

Higher-order absorbing boundary conditions are compared to the recently introduced Berenger perfectly matched layer (PML) absorbing boundary conditions (ABC). Reflections caused by the ABC's are examined in both the time and frequency domains for the case of a line source radiating in a finite computational domain. It is shown that the PML ABC significantly reduces reflections from the truncation of the computational grid when compared to 7th order Lindman ABC's. Also, except for at low frequencies, higher-order absorbing boundary conditions are no better than 2nd order Mur absorbing boundaries.

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Theoretical and Experimental Evidence of Nonreciprocal Effects on Magnetostatic Forward Volume Wave Resonators

I. Huynen, G. Verstraeten and A. Vander Vorst. "Theoretical and Experimental Evidence of Nonreciprocal Effects on Magnetostatic Forward Volume Wave Resonators." 1995 Microwave and Guided Wave Letters 5.6 (Jun. 1995 [MGWL]): 195-197.

An unexpected nonreciprocal behavior is observed on Magnetostatic Forward Volume Waves (MSFVW) Straight Edge Resonators (SER's) using YIG films. The nonreciprocal effect is theoretically predicted by taking into account the demagnetizing effect of the dc biasing magnetic field when calculating the forward and reverse propagation constants of MSFVW inside the YIG film. Hence, a nonreciprocal scattering matrix of the MSFVW-YIG-SER coupled to its transducers is calculated. The measured values of the transmission coefficients agree extremely well with the predicted ones. They both present an important nonreciprocal phase behavior.

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Optically Controlled Spatial Modulation of (Sub-)Millimeter Waves Using nipi-Doped Semiconductors

G. Delgado, J. Johansson, A. Larsson and T. Andersson. "Optically Controlled Spatial Modulation of (Sub-)Millimeter Waves Using nipi-Doped Semiconductors." 1995 Microwave and Guided Wave Letters 5.6 (Jun. 1995 [MGWL]): 198-200.

The use of a molecular beam epitaxy engineered semiconductor structure to quasioptically modulate a millimeter wave Gaussian beam using an optical control signal has been demonstrated. The RF transmission is modulated spatially by the optically generated excess carrier density. Low optical intensities are sufficient due to the long recombination lifetime achieved in the nipi-doped structure used. A modulation depth of more than 15 dB in transmission mode has been obtained at 100 GHz. Modulation has been measured up to 5 THz using a Fourier transform spectrometer.



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A 60-GHz High Efficiency Monolithic Power Amplifier Using 0.1- μ m PHEMT's

S.-W. Chen, P.M. Smith, S.-M.J. Liu, W.F. Kopp and T.J. Rogers. "A 60-GHz High Efficiency Monolithic Power Amplifier Using 0.1- μ m PHEMT's." 1995 Microwave and Guided Wave Letters 5.6 (Jun. 1995 [MGWL]): 201-203.

We report the development of a V-band monolithic power amplifier based on 0.1 μ m gate-length pseudomorphic HEMT's. The two-stage amplifier has demonstrated record performance at 60 GHz on the first design pass: 272 mW output power with 9.4 dB power gain and 24% power-added efficiency. The amplifier was designed for high-reliability communications applications, with passivation, good linearity and excellent thermal properties, and has been fabricated on 3-in. wafers with high yield and excellent uniformity--on one typical wafer, consistency of MMIC output power is better than ± 0.5 dB with an associated total yield through RF test of 58%.

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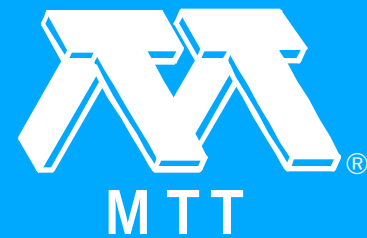
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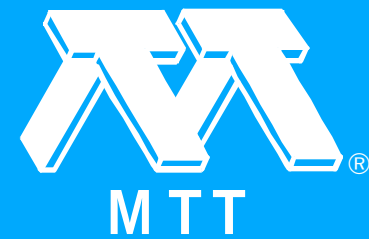
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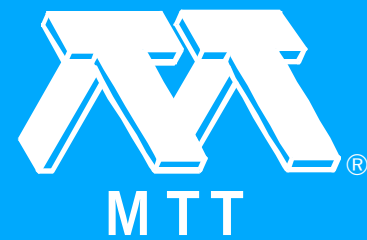
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A Mode Locked Array of Coupled Phase Locked Loops

J.J. Lynch and R.A. York. "A Mode Locked Array of Coupled Phase Locked Loops." 1995 Microwave and Guided Wave Letters 5.7 (Jul. 1995 [MGWL]): 213-215.

An array of coupled phase locked loops is configured to produce a comb spectrum, and therefore pulsed microwave power, using a frequency locking technique analogous to the mode locked optical laser. The basic principles of operation are derived and measurements of an 11-GHz system, built from commercially available microwave components, demonstrate the frequency and time domain characteristics.

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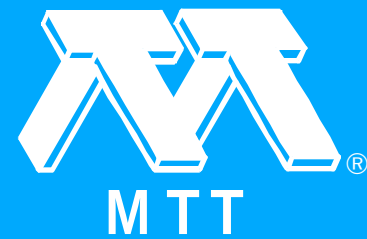


Abstracts

Small Signal Analysis of Active Circuits Using FDTD Algorithm

C.-N. Kuo, V.A. Thomas, S.T. Chew, B. Houshmand and T. Itoh. "Small Signal Analysis of Active Circuits Using FDTD Algorithm." 1995 Microwave and Guided Wave Letters 5.7 (Jul. 1995 [MGWL]): 216-218.

The FDTD method is extended to analyze a microwave amplifier. This amplifier includes matching circuits, DC bias circuits, and an active device. Equivalent current sources are used to model the active element. With the small signal model of the active element, the FDTD full-wave simulations show good agreement with measured results.



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Bias Stabilization for Resonant Tunnel Diode Oscillators

M. Reddy, R.Y. Yu, H. Kroemer, M.J.W. Rodwell, S.C. Martin, R.E. Muller and R.P. Smith.
"Bias Stabilization for Resonant Tunnel Diode Oscillators." 1995 Microwave and Guided Wave Letters 5.7 (Jul. 1995 [MGWL]): 219-221.

While Resonant tunnel diodes (RTD's) are useful as submillimeter-wave oscillators, circuit design constraints imposed to suppress parasitic bias circuit oscillations have limited output powers to well below 1 mW. We report a 7.5GHz RTD oscillator with a shunt regulator for bias circuit stabilization. With regulation, oscillator power is not limited by stability constraints. Regulation elements are readily integrated with RTD's to construct monolithic RTD oscillator arrays.



Edge Elements and the Inclusion Condition

S. Caorsi, P. Fernandes and M. Raffetto. "Edge Elements and the Inclusion Condition." 1995 Microwave and Guided Wave Letters 5.7 (Jul. 1995 [MGWL]): 222-223.

For many years the finite element solution of electro- magnetic eigenproblems has been corrupted by spurious modes. This work proves that the inclusion condition is sufficient but not necessary for the absence of nonzero frequency spurious modes. This is done by showing through a simple example that edge elements, a well known spurious-free technique, do not satisfy the inclusion condition.



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Quasi-Periodic Route to Chaos in a Microwave Doubler

S. Basu, S.A. Maas and T. Itoh. "Quasi-Periodic Route to Chaos in a Microwave Doubler." 1995 Microwave and Guided Wave Letters 5.7 (Jul. 1995 [MGWL]): 224-226.

Quasi-periodic route to chaos was observed as the bias level was increased in a 5-10 GHz frequency doubler. The appearance of spurious oscillations is a consequence of the dynamical negative resistance manifested by the pn junction diode in the doubler. This phenomenon is caused by the long minority carrier recombination time of the junction diode compared to the period of the input signal.

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Combination of the Source Method with Absorbing Boundary Conditions in the Method of Lines

R. Pregla and L. Vietzorreck. "Combination of the Source Method with Absorbing Boundary Conditions in the Method of Lines." 1995 Microwave and Guided Wave Letters 5.7 (Jul. 1995 [MGWL]): 227-229.

The Method of Lines (MoL) is extended to improve the analysis of discontinuities in microstrip lines and antennas. Therefore the source method is developed by integrating absorbing boundary conditions in the reference plane. With the new approach a higher accuracy is reached by using fewer discretization points. This reduction of the numerical effort becomes necessary to develop effective software to analyze complex structures. The new procedure is demonstrated by calculating the end effect of an open-end. A comparison is then made between the results obtained by former and other methods. The improvement over the former procedure is made obvious.

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Abstracts

W-Band High Efficiency InP-Based Power HEMT with 600 GHz $f_{\text{sub max/}}$

P.M. Smith, S.-M.J. Liu, M.-Y. Kao, P. Ho, S.C. Wang, K.H.G. Duh, S.T. Fu and P.C. Chao. "W-Band High Efficiency InP-Based Power HEMT with 600 GHz $f_{\text{sub max/}}$." 1995 Microwave and Guided Wave Letters 5.7 (Jul. 1995 [MGWL]): 230-232.

We have developed 0.1- μm gate-length InAlAs/InGaAs/ InP power HEMT's with record efficiency and power gain at 94 GHz. A 200 μm gate-width device has produced 58 mW output power with 6.4 dB power gain and 33% power-added efficiency. The extrapolated $f_{\text{sub max/}}$ of 600 GHz is the highest reported to date for any transistor, and smaller 30- μm devices fabricated on the same wafer exhibit excellent noise figure (1.4 dB at 94 GHz), demonstrating the applicability of this technology to multifunction MMIC's.



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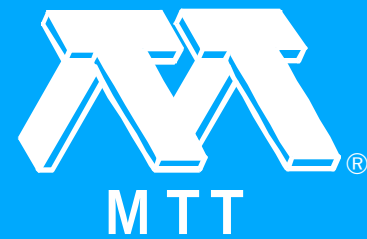


Abstracts

Plane Wave Excitation of an Infinite Dielectric Rod (Comments) (Jul. 1995 [MGWL])

M. Le Blanc and G.Y. Delisle. "Plane Wave Excitation of an Infinite Dielectric Rod (Comments) (Jul. 1995 [MGWL])." 1995 Microwave and Guided Wave Letters 5.7 (Jul. 1995 [MGWL]): 233-234.

In the above letter, Keam provides analytical expressions for the fields inside and outside a lossy, circular cylindrical dielectric rod illuminated by a normally incident plane wave. The author is to be commended for noting the usefulness of analytical methods in studying such problems. However, it appears that a number of important references have been left out and, more seriously, that the computational results are in error. It is the purpose of this letter to correct these deficiencies.



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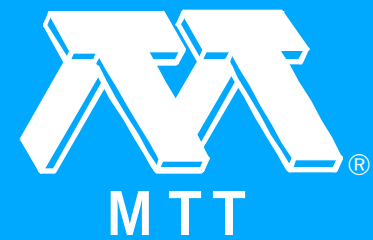
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Absorbing Boundary Conditions for the Modeling of Scatterers in Parallel-Plate Transmission Media

C. Spillard, S.R. Pennock and P.R. Shepherd. "Absorbing Boundary Conditions for the Modeling of Scatterers in Parallel-Plate Transmission Media." 1995 Microwave and Guided Wave Letters 5.8 (Aug. 1995 [MGWL]): 241-242.

In modeling wave propagation using the Finite Difference Time Domain (FDTD) method, the field gradients at each point are calculated using central difference approximation. For points on the edge of the model volume a separate algorithm to simulate absorbing boundaries has to be used. Most of these absorbing boundary conditions assume normal wave incidence at the boundary, but at the sides of stripline or microstrip this is not the case. This letter proposes a variant of dispersive boundary conditions with one phase velocity given an infinite value to represent a wave traveling parallel to the boundary. When applied to uniform stripline, these boundary conditions gave better results than the original version of the dispersive boundary condition with two finite phase velocities. These boundary conditions enable the use of a smaller calculation volume, thus saving computing memory and time.

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Abstracts

Analysis of the Source Inductance Effect on the Power Performance of High Development HEMT's in the Ka-Band

C. Gaquiere, B. Bonte, D. Theron, Y. Crosnier and J. Favre. "Analysis of the Source Inductance Effect on the Power Performance of High Development HEMT's in the Ka-Band." 1995 Microwave and Guided Wave Letters 5.8 (Aug. 1995 [MGWL]): 243-245.

This paper provides an analysis of the power performance degradations of interdigitated HEMT's in millimeter wave range as the total gate width increases. It investigates the possibility of optimizing the device topologie by combining a limited number of via holes and airbridge source connections in order to offer a good cost-performance trade-off.



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Waveguide Input Method for Time-Domain Wave Propagation Algorithms

R.Y. Chan and J.M. Liu. "Waveguide Input Method for Time-Domain Wave Propagation Algorithms." 1995 Microwave and Guided Wave Letters 5.8 (Aug. 1995 [MGWL]): 246-248.

A waveguide feed method is constructed for time-domain wave propagation algorithms. The concept is to connect a region of homogeneous index of refraction to the waveguide region by a refractive index taper. The first example of this method finds the coupling efficiency for a given input into a waveguide of a parabolic index geometry. The second example of this method reveals the evolution of the propagation constant through a horn geometry.

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Quarter-Wave Fresnel Zone Planar Lens and Antenna

H.D. Hristov and M.H.A.J. Herben. "Quarter-Wave Fresnel Zone Planar Lens and Antenna." 1995 Microwave and Guided Wave Letters 5.8 (Aug. 1995 [MGWL]): 249-251.

A new variety of the Fresnel zone planar lens with enhanced focusing quality is proposed. Each full-wave zone is divided into four quarter-wave subzones, which are covered by dielectric rings having equal thickness but different permittivities. Based on this planar lens configuration, a transmissive-type Fresnel-zone antenna for DBS-reception with more than 50% aperture efficiency is developed and examined theoretically.

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Abstracts

Finite Element Solution of Open Region Electrostatic Problems Incorporating the Measured Equation of Invariance

G.K. Gothard, S.M. Rao, T.K. Sarkar and M.S. Palma. "Finite Element Solution of Open Region Electrostatic Problems Incorporating the Measured Equation of Invariance." 1995 Microwave and Guided Wave Letters 5.8 (Aug. 1995 [MGWL]): 252-254.

In this work, we utilize the finite element technique to open region problems in conjunction with the truncation condition based on the measured equation of invariance (MEI) concept. The major advantage of the present scheme is a significant reduction in the number of unknowns while retaining the sparsity of the generating matrix. Typical numerical results are presented for the solution of Laplace's equation to illustrate the accuracy of the technique.



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Prediction of Surface Wave Radiation Coupling on Microwave Planar Circuits

D. Vanhoenacker and I. Huynen. "Prediction of Surface Wave Radiation Coupling on Microwave Planar Circuits." 1995 Microwave and Guided Wave Letters 5.8 (Aug. 1995 [MGWL]): 255-257.

A theoretical and experimental study is presented for spurious radiation coupling induced by radiated surface waves on planar circuits, at frequencies up to 20 GHz. The radiation coupling phenomenon generated by a planar line containing a discontinuity is modelled by an equivalent E-field planar radiation pattern associated with the current waveform along this line in the presence of the discontinuity. It is observed that the direction of the main and side lobes of this pattern varies with frequency. The model is validated by measurements of radiation coupling obtained on microstrip configurations, up to 20 GHz. Theory and measurements agree very well. The model yields for instance the directions of maximum spurious radiation coupling on a planar line in the vicinity of a radiating line.

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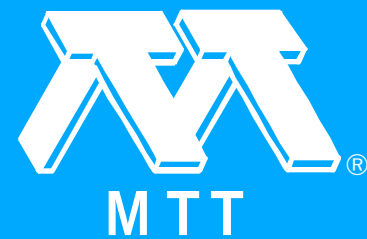


Abstracts

An Application of the Perfectly Matched Layer (PML) Concept to the Finite Element Method Frequency Domain Analysis of Scattering Problems

U. Pekel and R. Mittra. "An Application of the Perfectly Matched Layer (PML) Concept to the Finite Element Method Frequency Domain Analysis of Scattering Problems." 1995 Microwave and Guided Wave Letters 5.8 (Aug. 1995 [MGWL]): 258-260.

The Perfectly Matched Layer (PML) concept, introduced by Berenger with the aim of synthesizing an absorbing boundary condition (ABC) for the Finite Difference Time Domain (FDTD) method, was recently modified and extended to Finite Element Frequency Domain (FEFD) applications. The modified equations, which neither require the splitting of the field components of interest nor involve negative conductivity parameters, are employed, in this paper, in conjunction with analytic ABC's to obtain a boundary condition (BC) for scattering problems. This BC exhibits an improved performance over a PML medium terminated by a perfect conductor, or an ABC termination alone.



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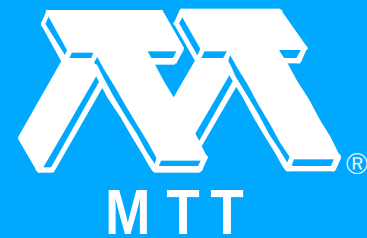


Abstracts

Development of New Microstrip Pseudo-Interdigital Bandpass Filters

J.S. Hong and M.J. Lancaster. "Development of New Microstrip Pseudo-Interdigital Bandpass Filters." 1995 Microwave and Guided Wave Letters 5.8 (Aug. 1995 [MGWL]): 261-263.

A new type of miniaturized microstrip bandpass filters with pseudo-interdigital structure without via hole grounded resonators is described. A, very compact filter of this type, having a size smaller than quarter-wavelength by quarter-wavelength at a midband frequency of 1.1 GHz was designed and fabricated. The measured and simulated results are presented.



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A New Type of Active Antenna for Coupled Gunn Oscillator Driven Spatial Power Combining Arrays

Z. Ding, L. Fan and K. Chang. "A New Type of Active Antenna for Coupled Gunn Oscillator Driven Spatial Power Combining Arrays." 1995 Microwave and Guided Wave Letters 5.8 (Aug. 1995 [MGWL]): 264-266.

A new type of active antenna appropriate for coupled Gunn oscillator driven spatial power combining arrays was developed. The active antenna uses a ring stabilized oscillator coupled to a slot antenna. The circuit should be useful in communications, radar, and sensor systems.



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A Simple Way to Model Curved Metal Boundaries in FDTD Algorithm Avoiding Staircase Approximation

P. Mezzanotte, L. Roselli and R. Sorrentino. "A Simple Way to Model Curved Metal Boundaries in FDTD Algorithm Avoiding Staircase Approximation." 1995 Microwave and Guided Wave Letters 5.8 (Aug. 1995 [MGWL]): 267-269.

The conventional FDTD algorithm in Cartesian coordinates uses staircase approximation to treat curvilinear surfaces. This approximation causes loss of accuracy often unacceptable. An extremely simple and more accurate polygonal approximation of curved surfaces is proposed in this paper. The method improves significantly the accuracy of the original FDTD algorithm, without increasing its complexity.



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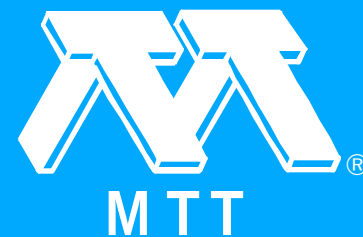
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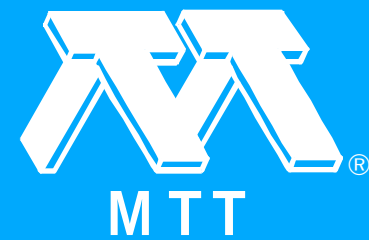
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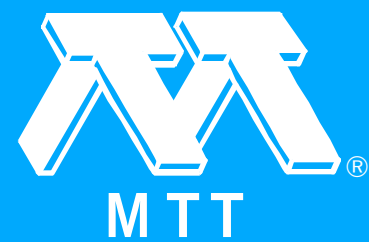
Cryogenically Cooled Performance of a Monolithic 44-GHz InP-Based HEMT Low-Noise Amplifier

H. Wang, D.C.W. Lo, R. Lai, C.-C. Yang and J. Berenz. "Cryogenically Cooled Performance of a Monolithic 44-GHz InP-Based HEMT Low-Noise Amplifier." 1995 Microwave and Guided Wave Letters 5.9 (Sep. 1995 [MGWL]): 281-283.

A monolithic 44-GHz low-noise amplifier using 0.1 μ m pseudomorphic InAlAs/InGaAs/InP HEMT technology and its cryogenically cooled performance are reported. This single-stage MMIC amplifier has a measured noise figure of 2.5 dB with an associated gain of 8 dB at 44.5 GHz with 5-mW dc power consumption at room temperature. The noise temperature of this MMIC LNA decreases to 29 K (0.4-dB noise figure) and the associated gain increases to 10.3 dB when it is cooled down to 80 K under the same bias condition, which correspond to an average noise temperature reduction slope of 0.9 and a gain increase slope of 0.01 dB/°K. To our knowledge, this is the first reported cryogenically cooled noise performance of a monolithic amplifier at this frequency.

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Interfacing Unstructured Tetrahedron Grids to Structured-Grid FDTD

D.J. Riley and C.D. Turner. "Interfacing Unstructured Tetrahedron Grids to Structured-Grid FDTD." 1995 Microwave and Guided Wave Letters 5.9 (Sep. 1995 [MGWL]): 284-286.

Finite-element unstructured tetrahedron grids provide considerable modeling flexibility but can give rise to an extremely large number of cells when solving open-region problems. The finite-volume hybrid-grid (FVHG) algorithm enables unstructured grids to be combined with traditional structured-grid, rectangular-cell, finite-difference time-domain (FDTD), thereby considerably reducing the unstructured-mesh overhead in surrounding space. In this letter, a simple technique to interface free-meshed, tetrahedron grids with FDTD is described. The two grids are directly coupled without the need for spatial interpolation. The tetrahedron mesh is defined to terminate on a rectangular surface that may be located very close to the geometry under study. Absorbing boundary conditions are easily applied in the surrounding FDTD grid. This technique provides finite-element modeling flexibility with the benefits of explicit time differencing and limited unstructured-mesh overhead. Multimaterial regions can be solved. The FVHG algorithm has been found to be accurate and generally stable for the long-term, even with complex free meshes generated by advanced solid-modeling software.

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Hybrid Transversal Filter Utilizing MMIC and Optical Fiber Delay Lines

T.A. Yost, P.R. Herczfeld, A. Rosen and S. Singh. "Hybrid Transversal Filter Utilizing MMIC and Optical Fiber Delay Lines." 1995 Microwave and Guided Wave Letters 5.9 (Sep. 1995 [MGWL]): 287-289.

Conventional microwave transversal filters are hindered by bandwidth limitations and cannot provide long-time delays due to excessive propagation losses. Optical transversal filters lack the means to provide negative weighting coefficients. Therefore, a hybrid transversal filter that utilizes low loss, wide bandwidth optical fibers for the delays and microwave monolithic integrated circuits (MMIC's) for accurate weighting is investigated. Theoretical analysis of the noise performance, bandwidth, and delay line dispersion of a completed MMIC advanced transversal filter and the novel hybrid transversal filter are presented.

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The Transmission-Line High-Efficiency Class-E Amplifier

T.B. Mader and Z.B. Popovic. "The Transmission-Line High-Efficiency Class-E Amplifier." 1995 Microwave and Guided Wave Letters 5.9 (Sep. 1995 [MGWL]): 290-292.

High-efficiency switched-mode (heavily saturated) circuits such as the class-E amplifier are well-known in the MHz frequency range. Here, a microwave transmission-line class-E amplifier is presented. Design equations for the output circuit line lengths and impedances are derived, along with approximate equations predicting power and efficiency for the class-E amplifier. Microstrip circuits using the Siemens CLY5 MESFET demonstrate 80% power-added efficiency (PAE) at 0.5 GHz with 0.55 W of output power and 73% PAE at 1.0 GHz with 0.94 W. Experimental results compare favorably to a simplified design-oriented analysis.

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Experimental and Numerical Verification of the Cause of Hopf Bifurcation in a Microwave Doubler

S. Basu, S.A. Maas and T. Itoh. "Experimental and Numerical Verification of the Cause of Hopf Bifurcation in a Microwave Doubler." 1995 Microwave and Guided Wave Letters 5.9 (Sep. 1995 [MGWL]): 293-295.

The appearance of Hopf bifurcation in a microwave doubler is due to the relative speed of the recombination delay of the junction diode with the input RF signal, which results in a dynamical negative resistance. This is verified here experimentally by using a back-to-back diode structure that quenches Hopf bifurcation numerically through stability analysis in the frequency domain.

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Parasitic Impedance Analysis of Double Bonding Wires for High-Frequency Integrated Circuit Packaging

S.-K. Yun and H.-Y. Lee. "Parasitic Impedance Analysis of Double Bonding Wires for High-Frequency Integrated Circuit Packaging." 1995 Microwave and Guided Wave Letters 5.9 (Sep. 1995 [MGWL]): 296-298.

Double bonding wires separated by an internal angle have been characterized in a wide range of frequencies using the Method of Moments with the incorporation of the ohmic resistance. For a 30° internal angle, the calculated total reactance is more than 35% less than that of a single bonding wire due to the negative mutual coupling effect of different current directions. The radiation effect at high frequencies has been observed decreasing the mutual inductance between the angled bonding wires, whereas for parallel bonding wires it greatly increases the mutual inductance.

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Super Absorption Boundary Condition for Guided Waves in the 3-D TLM Simulation

N. Kukutsu and R. Konno. "Super Absorption Boundary Condition for Guided Waves in the 3-D TLM Simulation." 1995 Microwave and Guided Wave Letters 5.9 (Sep. 1995 [MGWL]): 299-301.

A super absorption boundary condition (SABC) for the 3-D symmetrical condensed node transmission line matrix (3D SCN TLM) method is presented. As both an electric field and a magnetic field exist at the same time and position, SABC may be more suitable for the 3-D SCN TLM method than for the finite difference time domain (FD-TD) method. To illustrate the effectiveness of the boundary condition, SABC is used to truncate the computational domain of an open microstrip line. It performs better than the Higdon first- and second-order conditions and the Higdon second-order condition with spurious mode suppressed.

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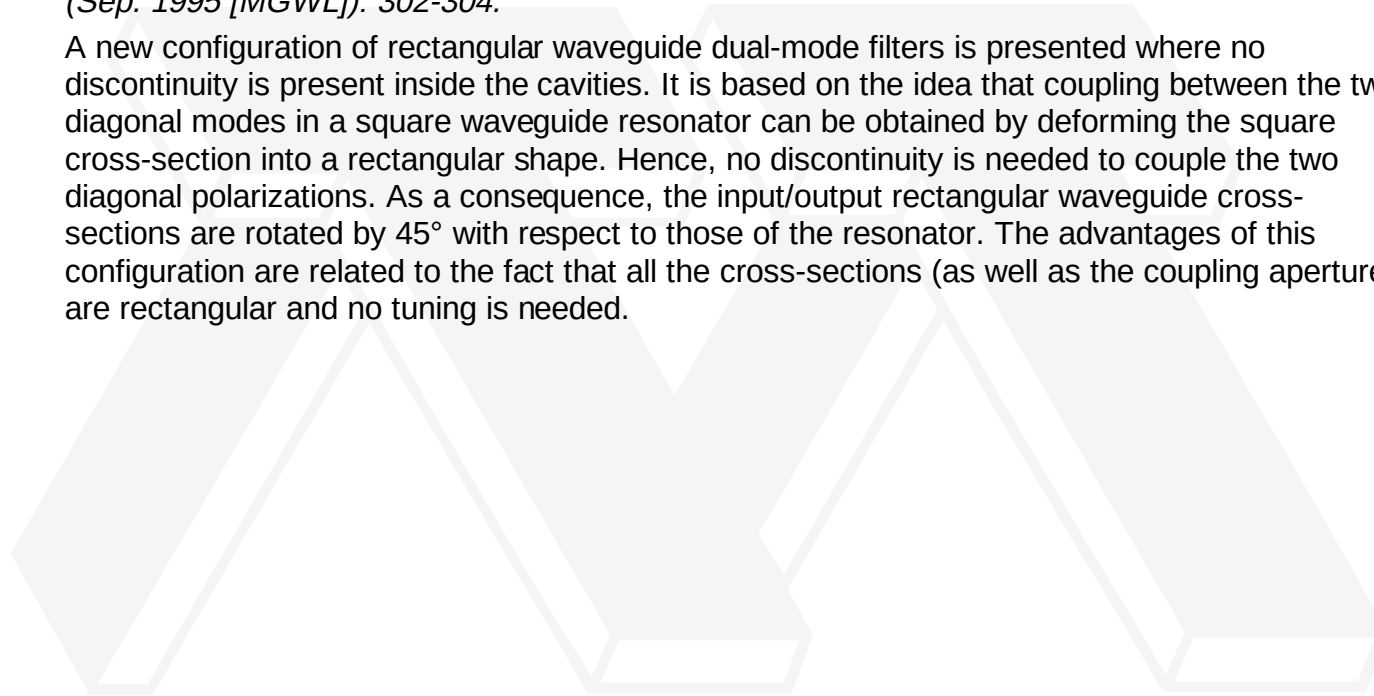
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Rectangular Waveguide Dual-Mode Filters without Discontinuities Inside the Resonators

R. Orta, P. Savi, R. Tascone and D. Trinchero. "Rectangular Waveguide Dual-Mode Filters without Discontinuities Inside the Resonators." 1995 Microwave and Guided Wave Letters 5.9 (Sep. 1995 [MGWL]): 302-304.

A new configuration of rectangular waveguide dual-mode filters is presented where no discontinuity is present inside the cavities. It is based on the idea that coupling between the two diagonal modes in a square waveguide resonator can be obtained by deforming the square cross-section into a rectangular shape. Hence, no discontinuity is needed to couple the two diagonal polarizations. As a consequence, the input/output rectangular waveguide cross-sections are rotated by 45° with respect to those of the resonator. The advantages of this configuration are related to the fact that all the cross-sections (as well as the coupling apertures) are rectangular and no tuning is needed.



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Efficient Method for the Capacitance Calculation of Circularly Symmetric via in Multilayered Media

F. Tefiku and E. Yamashita. "Efficient Method for the Capacitance Calculation of Circularly Symmetric via in Multilayered Media." 1995 Microwave and Guided Wave Letters 5.9 (Sep. 1995 [MGWL]): 305-307.

The equivalent capacitance produced by a circularly symmetric via connecting two microstrip lines on different planes is efficiently calculated by using the rectangular boundary division method. The calculation is carried out considering effects of inhomogeneous media within the line structures as well as the ground conductor thickness on the capacitance produced by a microstrip via. Computational results for various via geometries are presented and compared with presently available data.

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A DC-10 GHz High Gain-Low Noise GaAs HBT Direct-Coupled Amplifier

K.W. Kobayashi and A.K. Oki. "A DC-10 GHz High Gain-Low Noise GaAs HBT Direct-Coupled Amplifier." 1995 Microwave and Guided Wave Letters 5.9 (Sep. 1995 [MGWL]): 308-310.

An AlGaAs/GaAs HBT wide-band low noise amplifier has been achieved using a direct-coupled amplifier topology. A nominal gain of 22.5 dB and a noise figure of 3.0-3.65 dB has been achieved over a dc-10 GHz band, while consuming less than 55 mW of dc power through a 5 V supply. This result benchmarks the lowest noise figure so far reported for a direct-coupled HBT amplifier at X-band frequencies. In addition, an approximate expression for the amplifier noise figure is given that predicts the noise figure to within 0.3 dB over bias and frequency. The amplifier can be compacted into a 0.3 x 0.3 mm² area and can yield as many as 30 000 die per 3-in. GaAs wafer. The broadband gain and noise figure, low dc power, and miniature die size makes this design attractive as a standard off-the-shelf microwave product for high volume commercial applications.

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A Coplanar Waveguide InAlAs/InGaAs HBT Monolithic Ku-Band VCO

K.W. Kobayashi, L.T. Tran, A.K. Oki, T. Block and D.C. Streit. "A Coplanar Waveguide InAlAs/InGaAs HBT Monolithic Ku-Band VCO." 1995 Microwave and Guided Wave Letters 5.9 (Sep. 1995 [MGWL]): 311-312.

An 18 GHz coplanar waveguide (CPW) monolithic voltage controlled oscillator (VCO) has been demonstrated using InAlAs/InGaAs HBT technology. The VCO achieves 6% frequency tuning range using a varactor diode constructed from the HBT base-emitter junction. A CPW design was employed to increase the Q-factor of the monolithic resonator as well as reduce the chip size. The VCO obtains an output power of $+10 \pm 0.5$ dBm over the tuning range and a collector efficiency of 11.5%. A SSB phase noise of -72 and -96 dBc/Hz at 100 kHz and 1 MHz offset frequency from the carrier were achieved, respectively. This represents the first reported phase noise results of an InAlAs/InGaAs-based HBT VCO with a monolithic integrated varactor and are comparable to other MMIC HBT varactor-tuned VCO's reported in this frequency band.

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Abstracts

Patent Abstracts (Sep. 1995 [MGWL])

"Patent Abstracts (Sep. 1995 [MGWL])." 1995 Microwave and Guided Wave Letters 5.9 (Sep. 1995 [MGWL]): 313-318.



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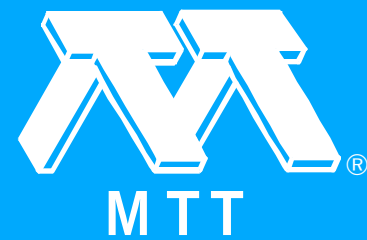
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Call for Papers - Bridging the Spectrum (Sep. 1995 [MGWL])

"Call for Papers - Bridging the Spectrum (Sep. 1995 [MGWL])." 1995 Microwave and Guided Wave Letters 5.9 (Sep. 1995 [MGWL]): 319-319.



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Call for Papers - Revolutionary Developments in Phased Arrays (Sep. 1995 [MGWL])

"Call for Papers - Revolutionary Developments in Phased Arrays (Sep. 1995 [MGWL])." 1995 Microwave and Guided Wave Letters 5.9 (Sep. 1995 [MGWL]): 320-320.



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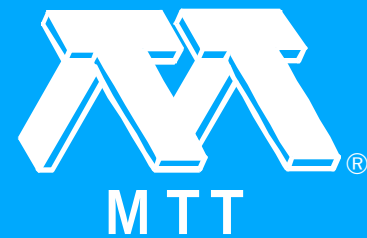


Abstracts

The Design of Active Floating Positive and Negative Inductors in MMIC Technology

S. El Khoury. "The Design of Active Floating Positive and Negative Inductors in MMIC Technology." 1995 Microwave and Guided Wave Letters 5.10 (Oct. 1995 [MGWL]): 321-323.

An original method for the determination of all possible inductive circuits as a function of the number of FET's used is described in this paper. The method is of general use in monolithic microwave integrated circuits. Circuits with large inductance, either positive or negative in value, can be obtained along with low loss or even negative resistance.



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Removing the Angular Sensitivity of FSS Structures Using Novel Double-Layer Structures

J. Shaker and L. Shafai. "Removing the Angular Sensitivity of FSS Structures Using Novel Double-Layer Structures." 1995 Microwave and Guided Wave Letters 5.10 (Oct. 1995 [MGWL]): 324-325.

A double-layered periodic structure composed of shorted rings is employed to reduce the angular sensitivity of the reflection coefficient of a frequency selective surface (FSS). The angular sensitivity appears to vanish altogether for certain separation of the two layers. The configuration of the proposed cell element makes it suitable for dual orthogonal or circular polarized applications.

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Why the DFT is Faster Than the FFT for FDTD Time-to-Frequency Domain Conversions

C.M. Furse and O.P. Gandhi. "Why the DFT is Faster Than the FFT for FDTD Time-to-Frequency Domain Conversions." 1995 Microwave and Guided Wave Letters 5.10 (Oct. 1995 [MGWL]): 326-328.

Although it is a time-domain method, the finite-difference time-domain (FDTD) method has been used extensively for calculating frequency domain parameters such as specific absorption rate, radar cross-section, and S-parameters. When a broad frequency band is of interest, using a broad-band pulsed excitation can provide this frequency response with a single FDTD simulation. The frequency domain data can be calculated from the time domain data using either a discrete Fourier transform (DFT) or a fast Fourier transform (FFT). This letter examines both methods and analyzes why the DFT is generally more efficient and easier to use than the FFT for FDTD time-to-frequency domain conversions.

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A Power Amplifier Based on an Extended Resonance Technique

A. Martin, A. Mortazawi and B.C. De Loach, Jr.. "A Power Amplifier Based on an Extended Resonance Technique." 1995 Microwave and Guided Wave Letters 5.10 (Oct. 1995 [MGWL]): 329-331.

A new power amplifier based on an extended resonance technique is presented. This technique produces high power through multiplying the power handling capability of a single device by the number of devices employed while maintaining the gain of a single-device amplifier. An X-band power combining amplifier employing four 100 mW MESFET's was designed and constructed. The small signal gain was measured at 11.5 dB, and a maximum of 480 mW was obtained at 9.57 GHz with a power-added efficiency of 30.8%.

Click on title for a complete paper.



Abstracts

An Unconditionally Stable Finite Element Time-Domain Solution of the Vector Wave Equation

S.D. Gedney and U. Navsariwala. "An Unconditionally Stable Finite Element Time-Domain Solution of the Vector Wave Equation." 1995 Microwave and Guided Wave Letters 5.10 (Oct. 1995 [MGWL]): 332-334.

This paper presents an implicit finite element time-domain (FETD) solution of the time-dependent vector wave equation. The time-dependent formulation employs a time-integration method based on the Newmark-Beta method. A stability analysis is presented demonstrating that this leads to an unconditionally stable solution of the time-dependent vector wave equation. The advantage of this formulation is that the time step is no longer governed by the spatial discretization of the mesh, but rather by the spectral content of the time-dependent signal. A numerical example of a three-dimensional cavity resonator is presented studying the effects of the Newmark-beta parameters on the solution error. Optimal choices of parameters are derived based on this example.



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Laser-Diode-Based Optoelectronic Subharmonic Phase-Locked Loop

G.-R. Lin, C.-R. Yang and C.-L. Pan. "Laser-Diode-Based Optoelectronic Subharmonic Phase-Locked Loop." 1995 Microwave and Guided Wave Letters 5.10 (Oct. 1995 [MGWL]): 335-337.

An optoelectronic technique for synthesis of frequency versatile electrical signals phase-locked to the optical clock is proposed. The key component is an integrated-optic modulator (IOM) operated in the nonlinear regime. With a photodetector, the IOM functions as an optoelectronic subharmonic mixer for intermixing microwave signals that are subharmonics of the optical clock. As a first demonstration, phase-locked subharmonic and fractional harmonics of the optical clock at $f^\circ = 500$ MHz, with frequency equal to f°/n or $(m/n) f^\circ$, where $n=2,3,4\dots$ and $m/n = 2/5, 2/3, 4/3, 3/2$ and $5/3$ etc., are generated and characterized.

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Analysis of Coupling Between a Curved FSS and an Enclosed Planar Dipole Array

E.A. Parker, B. Philips and R.J. Langley. "Analysis of Coupling Between a Curved FSS and an Enclosed Planar Dipole Array." 1995 Microwave and Guided Wave Letters 5.10 (Oct. 1995 [MGWL]): 338-340.

Interaction between an antenna and an enclosing FSS is investigated using the Pocklington equation approach from an earlier study of arbitrarily curved free-standing arrays of dipoles. Part of such a collection of elements can be regarded as a receiving antenna, and the rest can be distributed around it to form a dichroic enclosure. It is then possible to analyse this structure with and without mutual coupling between the two sets of dipoles, to give an indication of antenna-radome coupling in a simple case.

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A Fast and Efficient FDTD Algorithm for the Analysis of Planar Microstrip Discontinuities by Using a Simple Source Excitation Scheme

A.P. Zhao, A.V. Raisanen and S.R. Cvetkovic. "A Fast and Efficient FDTD Algorithm for the Analysis of Planar Microstrip Discontinuities by Using a Simple Source Excitation Scheme." 1995 Microwave and Guided Wave Letters 5.10 (Oct. 1995 [MGWL]): 341-343.

A fast solution FDTD algorithm with a simple and efficient excitation scheme for the analysis of microstrip circuits is introduced. In this algorithm, the source plane is located several nodes inside the near-end terminal plane and absorbing boundary conditions (ABC's) can be applied on the terminal plane directly, without any special treatment. In addition, with this excitation scheme, no dc source distortions are induced on the source plane and nearby. Consequently, the terminal plane can be moved very close to the discontinuity, even at one-cell beyond the input/output reference planes. Hence, very significant computational savings can be achieved. To demonstrate the validity and efficiency of this algorithm, numerical results for a typical discontinuous microstrip structure are given and compared with those obtained by conventional FDTD method.

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Behavior of Berenger's ABC for Evanescent Waves

J. De Moerloose and M.A. Stuchly. "Behavior of Berenger's ABC for Evanescent Waves." 1995 Microwave and Guided Wave Letters 5.10 (Oct. 1995 [MGWL]): 344-346.

A recently published ABC by Berenger has been shown to outperform all previous ABC's by several orders of magnitude. The cornerstone of this ABC is the so called Perfectly Matched Layer (PML). This layer absorbs electromagnetic waves incident at all angles without any reflection. In this letter we evaluate basic properties of the PML-medium for incident evanescent or inhomogeneous plane waves. We show that the evanescent wave is phase-shifted upon entering the PML-medium but retains its natural damping. Moreover, a substantial numerical reflection error must be taken into account, especially in the low frequency range. These results may be important in determining the number of PML-layers needed to obtain a given accuracy.

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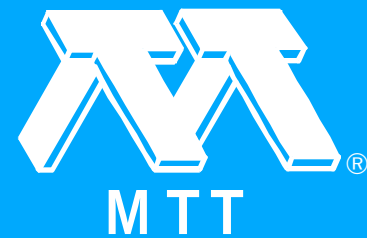


Abstracts

44-GHz Monolithic Plane Wave Amplifiers

J.A. Higgins, E.A. Sovero and W.J. Ho. "44-GHz Monolithic Plane Wave Amplifiers." 1995 Microwave and Guided Wave Letters 5.10 (Oct. 1995 [MGWL]): 347-348.

A Plane Wave Amplifier is an array of small power amplifiers that accept input signals via input antennas and radiate amplified output signals from an output antenna. Such array amplifiers promise a method of efficient power at EHF. This concept has been experimentally explored in the 40-50 GHz band and gain over acceptable bandwidths has been measured.



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Reconstruction of the S-Matrix for a 3-Port Using Measurements at Only Two Ports

M. Davidovitz. "Reconstruction of the S-Matrix for a 3-Port Using Measurements at Only Two Ports." 1995 Microwave and Guided Wave Letters 5.10 (Oct. 1995 [MGWL]): 349-350.

A complete S-parameter characterization of a 3-port device is extracted from vector network analyzer measurements made on only two of its ports. The third port is terminated with three known standards, appropriate to the associated transmission medium. Unique extraction of the 3-port matrix from the measured data sets is shown to be possible. This method is particularly useful for devices having incompatible ports, some of which cannot be directly connected to the analyzer.

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Abstracts

Efficient Analysis of Waveguide Components by FDTD Combined with Time Domain Modal Expansion

F. Alimenti, P. Mezzanotte, L. Roselli and R. Sorrentino. "Efficient Analysis of Waveguide Components by FDTD Combined with Time Domain Modal Expansion." 1995 Microwave and Guided Wave Letters 5.10 (Oct. 1995 [MGWL]): 351-353.

A novel Finite Difference Time Domain (FDTD) scheme is proposed for the analysis of waveguide components. The method consists of combining the conventional 3D with the ID-FDTD algorithm resulting from the time domain modal expansion in uniform waveguides. The new algorithm has been validated on a simple test example showing that the same accuracy can be obtained with a substantial improvement in the numerical efficiency.



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Numerical Errors in the Computation of Impedances by FDTD Method and Ways to Eliminate Them (Comments)

N. Dib, M. Krumpholz, E. Tentzeris and L.P.B. Katehi. "Numerical Errors in the Computation of Impedances by FDTD Method and Ways to Eliminate Them (Comments)." 1995 Microwave and Guided Wave Letters 5.10 (Oct. 1995 [MGWL]): 354-355.

In the above paper, a new formula for the calculation of the characteristic impedance of transmission lines, Z_0 , using the FDTD method has been given. This formula eliminates the numerical errors due to the offset of voltages and currents in space and time. We have recalculated the two examples given in the above paper and confirmed the presented results.

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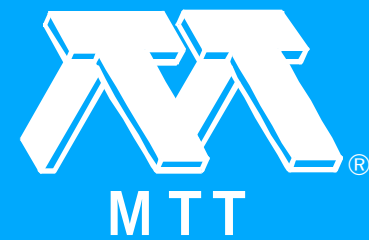
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Simplified 8-Port S-Matrix of the General Reciprocal Lossless Matched 4-Way Divider with Output Port Isolation

G.P. Riblet. "Simplified 8-Port S-Matrix of the General Reciprocal Lossless Matched 4-Way Divider with Output Port Isolation." 1995 Microwave and Guided Wave Letters 5.11 (Nov. 1995 [MGWL]): 365-367.

Matched reciprocal lossless 8-port circuits that provide equal power division between two sets of 4 input and 4 output ports have been found to be useful in various microwave applications. In this paper it is shown that if the 4 input ports as well as the 4 output ports are mutually isolated from each other, then the S-matrix can be reduced to a very simple form depending on only one angular parameter theta.

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A W-Band Medium Power Multi-Stack Quantum Barrier Varactor Frequency Tripler

A. Rahal, R.G. Bosisio, C. Rogers, J. Ovey, M. Sawan and M. Missous. "A W-Band Medium Power Multi-Stack Quantum Barrier Varactor Frequency Tripler." 1995 Microwave and Guided Wave Letters 5.11 (Nov. 1995 [MGWL]): 368-370.

Conventional multi-stack quantum barrier varactor (MSQBV) diodes on GaAs suffer from leaky barriers and low breakdown voltage, which limits their performance in high-power applications. Using a lattice-matched InGaAs/InAlAs/InGaAs barriers on InP we have grown a new 10-stack device. Measurement results are presented that demonstrate low series resistance, large capacitance modulation, and significantly higher breakdown voltage than previously reported devices. The power capability of this new device has been investigated by simulations and measurements. An experiment in a waveguide tripler circuit shows a 19.6 dBm output power at 93 GHz. This is the highest output power reported from a single QBV device at W-band.



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Microstrip Bandpass Filter Using Degenerate Modes of a Novel Meander Loop Resonator

J.S. Hong and M.J. Lancaster. "Microstrip Bandpass Filter Using Degenerate Modes of a Novel Meander Loop Resonator." 1995 Microwave and Guided Wave Letters 5.11 (Nov. 1995 [MGWL]): 371-372.

A novel type of dual-mode microstrip bandpass filter using degenerate modes of a meander loop resonator has been developed for miniaturization of high selectivity narrow-band microwave bandpass filters. A filter of this type having a 2.5% bandwidth at 1.58 GHz was designed and fabricated. The measured filter performance is presented.

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Novel HBT with Reduced Thermal Impedance

D. Hill, A. Khatibzadeh, W. Liu, T. Kim and P. Ikalainen. "Novel HBT with Reduced Thermal Impedance." 1995 Microwave and Guided Wave Letters 5.11 (Nov. 1995 [MGWL]): 373-375.

Heterojunction bipolar transistors have been fabricated using a novel process in which the majority of the front side of the chip is metallized to serve as the groundplane. The completed chip is assembled inverted so that the emitters are next to the heat sink; base and collector are contacted using through-wafer vias and microstrip lines on the back side of the chip. These devices show a 50% reduction in thermal impedance compared to conventionally fabricated devices and have achieved power densities of 10 W/mm of emitter length. Such devices are expected to have substantially lower emitter inductance as well, which may lead to improved gain at higher frequencies.

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Active Aperture-Coupled Rectangular Dielectric Resonator Antenna

M.G. Keller, D.J. Roscoe, M.B. Oliver, R.K. Mongia, Y.M.M. Antar and A. Ittipiboon. "Active Aperture-Coupled Rectangular Dielectric Resonator Antenna." 1995 Microwave and Guided Wave Letters 5.11 (Nov. 1995 [MGWL]): 376-378.

A novel configuration of an active aperture-coupled dielectric resonator antenna is reported, The design methodology is discussed and experimental results in the frequency range 4-6 GHz are presented. A comparison between an active aperture-coupled dielectric resonator antenna and an active aperture-coupled microstrip patch antenna is presented. The results presented should have useful potential applications in phased arrays and communication systems.

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Ka-Band Monolithic InGaAs/InP HBT VCO's in CPW Structure

J. Lin, Y.K. Chen, D.A. Humphrey, R.A. Hamm, R.J. Malik, A. Tate, R.F. Kopf and R.W. Ryan. "Ka-Band Monolithic InGaAs/InP HBT VCO's in CPW Structure." 1995 Microwave and Guided Wave Letters 5.11 (Nov. 1995 [MGWL]): 379-381.

Two Ka-Band monolithic voltage controlled oscillators (VCO's) designed in coplanar waveguide (CPW) structure are described in this letter. Each VCO utilizes a InGaAs/InP heterojunction bipolar transistor (HBT) as the active device and a HBT base-collector junction as the tuning varactor. These two VCO's are biased at a very low voltage of $V_{CE} = 1.5$ V and the emitter current is less than 10 mA. Under this low dc power dissipation, the VCO's with, center frequencies of 26.5 and 33.5 GHz show high dc-to-rf conversion efficiencies over 10% and 5% within the frequency tuning ranges of 1.6 and 1.2 GHz, respectively. The measured phase noise at 1 MHz offset frequency is -110 dBc/Hz.

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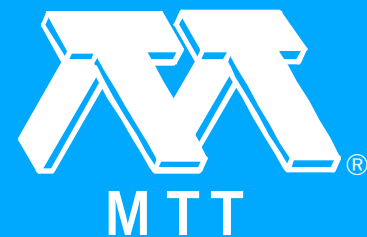


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New Prospects for Time Domain Analysis

M. Krumpholz and L.P.B. Katehi. "New Prospects for Time Domain Analysis." 1995 Microwave and Guided Wave Letters 5.11 (Nov. 1995 [MGWL]): 382-385.

The method of moments with scaling functions is applied directly to Maxwell's equations. As a result, we obtain a new three-dimensional time domain scheme with highly linear dispersion characteristics that allows one to incorporate the advantages of multiresolution analysis. First examples suggest significant reductions with respect to computer resources.



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High-Performance InP Gunn Devices for Fundamental-Mode Operation in D-Band (110-170 GHz)

H. Eisele and G.I. Haddad. "High-Performance InP Gunn Devices for Fundamental-Mode Operation in D-Band (110-170 GHz)." 1995 Microwave and Guided Wave Letters 5.11 (Nov. 1995 [MGWL]): 385-387.

InP Gunn devices with an n^+nn^+ structure and a graded doping profile in the active region were designed, fabricated, and tested for fundamental-mode operation at D-band frequencies. Improved heat dissipation significantly increased the available RF output power and power levels of more than 90 mW up to frequencies around 135 GHz, more than 130 mW at 131.7 GHz, and more than 60 mW at 151 GHz in fundamental-mode operation. These are the highest RF power levels reported to date from any Gunn devices. These InP Gunn devices with de-to-RF conversion efficiencies up to 2.5% around 132 GHz also exhibit excellent noise performance and the typical phase noise up to the highest RF power levels is well below -100 dBc/Hz, measured at a frequency off-carrier of 500 kHz.

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A 62-GHz Monolithic InP-Based HBT VCO

H. Wang, K.-W. Chang, D.C.W. Lo, L.T. Tran, J.C. Cowles, T.R. Block, G.S. Dow, A. Oki, D.C. Streit and B.R. Allen. "A 62-GHz Monolithic InP-Based HBT VCO." 1995 Microwave and Guided Wave Letters 5.11 (Nov. 1995 [MGWL]): 388-390.

A monolithic V-band VCO using InP-based HBT technology has been designed, fabricated, and tested. This VCO delivers a peak output power of 4 dBm at a center frequency of 62.4 GHz with a tuning range of 300 MHz. The measured phase noise shows -78 dBc/Hz at 100 kHz offset and -104 dBc/Hz at 1 MHz offset. To our knowledge, this is the highest frequency fundamental-mode oscillator ever reported using bipolar transistors.

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Impedance Characteristics of Microstrip Antennas Excited by Coplanar Waveguides with Inductive or Capacitive Coupling Slots

S.-M. Deng, M.-D. Wu and P. Hsu. "Impedance Characteristics of Microstrip Antennas Excited by Coplanar Waveguides with Inductive or Capacitive Coupling Slots." 1995 Microwave and Guided Wave Letters 5.11 (Nov. 1995 [MGWL]): 391-393.

A rectangular microstrip antenna fed by a coplanar waveguide with an inductive or a capacitive coupling end slot is analyzed by using the moment method. Numerical calculations for the input impedances are shown to agree well with those of the measurements. For the purpose of design, a parameter study for the variations of input impedance with length and width of the coupling slot is presented. Differences in the input impedance characteristics between the inductive and capacitive coupling cases are also discussed.

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A Monolithically Integrated F-Band Resistive InAlAs/InGaAs/InP HFET Mixer

C. Karlsson, N. Rorsman and H. Zirath. "A Monolithically Integrated F-Band Resistive InAlAs/InGaAs/InP HFET Mixer." 1995 Microwave and Guided Wave Letters 5.11 (Nov. 1995 [MGWL]): 394-395.

A monolithically integrated F-band resistive HFET mixer has been designed, simulated, fabricated, and characterized. The mixer is based on an InAlAs/InGaAs/InP HFET with 0.15 μm gate length. The measured minimum conversion loss is 9 dB at 112.5 GHz and an LO power of 4 dBm, which is the lowest conversion loss reported for resistive HFET mixers in this frequency range.

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Analysis of Double Groove Guide Coupling Structures Using Domain Bases EW--BIEM

J. Ma, B. Li and H. Yang. "Analysis of Double Groove Guide Coupling Structures Using Domain Bases EW--BIEM." 1995 Microwave and Guided Wave Letters 5.11 (Nov. 1995 [MGWL]): 396-398.

Double groove guide structures can be used to realize the coupling between groove guides of different kinds. In this letter, a novel method for studying these structures is introduced. The calculation model developed from eigen-weighted boundary integral equation method is given and applied to analyze double circular groove guide and circular-rectangular double groove guide. The numerical results are obtained and discussed.

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Modified Berenger PML Absorbing Boundary Condition for FD-TD Meshes

B. Chen, D.G. Fang and B.H. Zhou. "Modified Berenger PML Absorbing Boundary Condition for FD-TD Meshes." 1995 Microwave and Guided Wave Letters 5.11 (Nov. 1995 [MGWL]): 399-401.

A new modified, perfectly matched layer absorbing boundary condition (MPML ABC) is presented. In the MPML, the introducing of extra degrees of freedom provides the possibility of adjusting the parameters of nonphysical material absorber (PML) for the purpose of enhancing the attenuation rate of the evanescent modes. Compared to Berenger PML, the MPML is more efficient in absorbing the evanescent energy and keeps the same performance for propagation modes. The sophisticated properties of MPML ABC result in the reduction of the thickness of the matched layers and their closer allocation, leading to better accuracy simulations and less computer burdens in FD-TD modeling.

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A 12-GHz, 12-W HJFET Amplifier with 48% Peak Power-Added Efficiency

K. Matsunaga, Y. Okamoto and M. Kuzuhara. "A 12-GHz, 12-W HJFET Amplifier with 48% Peak Power-Added Efficiency." 1995 Microwave and Guided Wave Letters 5.11 (Nov. 1995 [MGWL]): 402-404.

This letter describes a Ku-band power amplifier fabricated with a one-chip $0.45\text{ }\mu\text{m} \times 16.8\text{ mm}$ GaAs-based heterojunction FET (HJFET), in which a 40.9 dBm (12.3 W) output power with 48% power-added efficiency (PAE) and 10.1 dB linear gain was achieved at 12 GHz. To our knowledge, this is the highest PAE, gain and output power combination achieved by a single FET power amplifier at this frequency.

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A 19-Pole Cellular Bandpass Filter Using 75-mm-Diameter High-Temperature Superconducting Thin Films

D. Zhang, G.-C. Liang, C.F. Shih, Z.H. Lu and M.E. Johansson. "A 19-Pole Cellular Bandpass Filter Using 75-mm-Diameter High-Temperature Superconducting Thin Films." 1995 Microwave and Guided Wave Letters 5.11 (Nov. 1995 [MGWL]): 405-407.

A 19-pole bandpass filter designed for the 900MHz cellular communication band with 25-MHz bandwidth is reported using a compact forward-coupled approach in microstrip configuration. The filter was fabricated using 75-mm-diameter, double-side-coated YBa/sub 2/Cu/sub 3/O/sub 7/ (YBCO) high-temperature superconducting (HTS) thin films grown by a single-source MOCVD technique on a LaAlO/sub 3/ substrate. Measurement of the filter at 77 K showed a dissipation loss of 0.5 dB, corresponding to an average unloaded Q-factor of 10000 in 75-mm-diameter microstrip resonators. A minimum return loss of 15 dB was obtained from measurements at 77 K.

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Abstracts

New Aspects of the Method of Lines

A. Dreher and T. Rother. "New Aspects of the Method of Lines." 1995 Microwave and Guided Wave Letters 5.11 (Nov. 1995 [MGWL]): 408-410.

A re-examination of the fundamentals of the Method of Lines (MoL) shows its close relation to the mode-matching technique, on which it is merely a variant with further approximations. It is obvious that the discretization of the differential operators should be avoided, because it has no advantage, and in fact only leads, to additional errors. This effect is demonstrated for a partially filled waveguide.



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Three-Dimensional MMIC Technology: A Possible Solution to Masterslice MMIC's on GaAs and Si

T. Tokumitsu, M. Aikawa and K. Kohiyama. "Three-Dimensional MMIC Technology: A Possible Solution to Masterslice MMIC's on GaAs and Si." 1995 Microwave and Guided Wave Letters 5.11 (Nov. 1995 [MGWL]): 411-413.

A novel masterslice MMIC is presented that expands the possibilities for three-dimensional (or multilayer) MMIC technology. This MMIC incorporates two levels of ground metals, resulting in an effective selection of master-array elements on the wafer surface by using the lower-level metal and a circuit-stacking effect by the upper one. X-band amplifier and receiver MMIC's on 3 x 1 and 6 x 3 array-units, respectively, are also demonstrated in very small areas.

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Optically Controlled Phased Array Radar Receiver Using SLM Switched Real Time Delays

H.R. Fetterman, Y. Chang, D.C. Scott, S.R. Forrest, F.M. Espiau, M. Wu, D.V. Plant, J.R. Kelly, A. Mather, W.H. Steier, R.M. Osgood, Jr., H.A. Haus and G.J. Simonis. "Optically Controlled Phased Array Radar Receiver Using SLM Switched Real Time Delays." 1995 Microwave and Guided Wave Letters 5.11 (Nov. 1995 [MGWL]): 414-416.

We report the results of a demonstration of a real time delay, optically controlled phased array radar receiver. This implementation employed a free space configuration based upon an optical switching network using liquid crystal spatial light modulators (SLM's). A three-delay unit, two-antenna array receiver was implemented at an optical wavelength of $1.3\ \mu\text{m}$ and demonstrated "squint-free" operation over the entire X-band (8-12 GHz) with an angular accuracy of 1.4° . Finally, a novel configuration for the two-antenna element SLM architecture was proposed and demonstrated equivalent system performance with a reduction in the number of components.

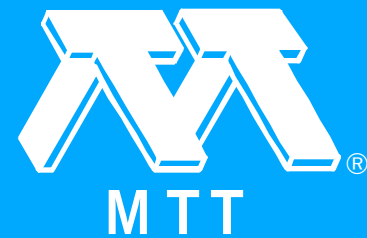


Abstracts

How Invariant is the Measured Equation of Invariance? (Comments)

K.K. Mei. "How Invariant is the Measured Equation of Invariance? (Comments)." 1995 Microwave and Guided Wave Letters 5.11 (Nov. 1995 [MGWL]): 417-417.

In their paper appeared in the Feb. 1995 issue of this journal, the authors Jevtit and Lee claimed that they proved the measured equation of invariance (MEI) to be not invariant to excitation. This letter points out the defect of their proof.



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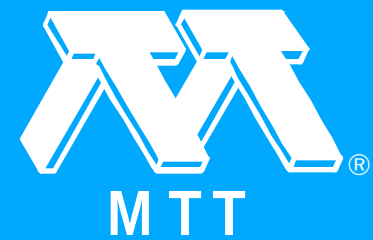
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A Comparison of Numerical Techniques for Modeling Electromagnetic Dispersive Media

R. Siushansian and J. LoVetri. "A Comparison of Numerical Techniques for Modeling Electromagnetic Dispersive Media." 1995 Microwave and Guided Wave Letters 5.12 (Dec. 1995 [MGWL]): 426-428.

A comparison of various time domain numerical techniques to model material dispersion is presented. Methods that model the material dispersion via a convolution integral as well as those that use a differential equation representation are considered. We have shown how the convolution integral arising in the electromagnetic constitutive relation can be approximated by the trapezoidal rule of numerical integration and implemented using a newly derived one-time-step recursion relation. The superiority of the new method, in terms of accuracy and computer resources, over four previously published techniques is demonstrated on the problem of a transient electromagnetic plane wave propagating in a dispersive media. All of the methods considered are easily incorporated into 3-D codes where the requirement for efficiency is very important.

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W-Band MMIC Characterization in an Isothermal Environment

H. Wang and M. Sayed. "W-Band MMIC Characterization in an Isothermal Environment." 1995 Microwave and Guided Wave Letters 5.12 (Dec. 1995 [MGWL]): 429-431.

A W-band pulsed network analyzer has been developed to emulate an isothermal environment for on-wafer characterization of MMIC's. Testing results of a W-band monolithic power amplifier with a dc power consumption of 728 mW show an increase of 0.9 dB for small signal gain at 94 GHz in the isothermal environment. The measurement system and the MMIC testing are described in this letter. To our knowledge, this is the first demonstration of the on-wafer isothermal MMIC measurement at this frequency.

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Perturbation Method for Sinusoidally Excited FDTD Analysis

O.P.M. Pekonen, P. Alinikula and K.I. Nikoskinen. "Perturbation Method for Sinusoidally Excited FDTD Analysis." 1995 Microwave and Guided Wave Letters 5.12 (Dec. 1995 [MGWL]): 432-434.

A method for perturbing a sinusoidally excited FD-TD simulation is introduced. In this scheme, desired simulation output data is read after the first steady state is reached. Simulated structure is altered slightly as the simulation runs, and thus a perturbation is created into the steady state. A new steady state emerges faster than the initial one and computational efficiency is gained. The new steady state can be perturbed again with similar efficiency. The method is applicable for fast optimization of various microwave applications in FDTD analysis.

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Class-A SiGe HBT Power Amplifiers at C-Band Frequencies

U. Erben, M. Wahl, A. Schuppen and H. Schumacher. "Class-A SiGe HBT Power Amplifiers at C-Band Frequencies." 1995 Microwave and Guided Wave Letters 5.12 (Dec. 1995 [MGWL]): 435-436.

In this letter we report on the first experimental investigations of the power-handling capabilities of SiGe heterojunction bipolar transistors (HBT's) at C-band frequencies. Multifinger HBT's in common-emitter (CE) and common-base (CB) configuration were matched using high Q matching net-works, At a frequency of 5.7 GHz the CE and the CB class A amplifier exhibit a 1-dB compression output power of 18 and 20 dBm, respectively. A power-added efficiency (PAE) of more than 30% and a output power density of 1 mW/ μm^2 at 4 V V/sub CB/ were observed.



Abstracts

Experimental Results on Buried Microstrip Lines for Constructing High-Density Microwave Integrated Circuits

T. Ishikawa and E. Yamashita. "Experimental Results on Buried Microstrip Lines for Constructing High-Density Microwave Integrated Circuits." 1995 Microwave and Guided Wave Letters 5.12 (Dec. 1995 [MGWL]): 437-438.

This letter describes the characterization and some experimental results of a buried microstrip line (BMSL), a guided-wave structure considered to be promising for constructing high-density microwave and millimeter-wave integrated circuits because of its high isolation characteristics. The BMSL structure is characterized practically by the rectangular boundary division (RBD) method and rigorously by the finite difference time domain (FDTD) method. The analyzed results reveal that the BMSL structure possesses much lower coupling level than the conventional microstrip line does, from -15 to -100 dB depending on their burial depth. Experimental data show good agreement with numerical results.



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A Frequency-Hopping Approach for Microwave Imaging of Large Inhomogeneous Bodies

W.C. Chew and J.H. Lin. "A Frequency-Hopping Approach for Microwave Imaging of Large Inhomogeneous Bodies." 1995 Microwave and Guided Wave Letters 5.12 (Dec. 1995 [MGWL]): 439-441.

A frequency-hopping approach is proposed to process multifrequency CW microwave measurement data so that larger dielectric bodies for microwave imaging can be reconstructed with higher fidelity compared to a single-frequency reconstruction. The frequency hopping approach uses only data at a few frequencies, and hence can reduce data acquisition time in a practical system. Moreover, the frequency-hopping approach overcomes the effect of nonlinearity in the optimization procedure so that an algorithm is not being trapped in local minima. In this manner, larger objects with higher contrasts could be reconstructed without a priori information. We demonstrate the reconstruction of an object 10 wavelengths in diameter with permittivity profile contrast larger than 1:2 without using a priori information.

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A Novel Monolithic LNA Integrating a Common-Source HEMT with an HBT Darlington Amplifier

K.W. Kobayashi, D.K. Umemoto, T.R. Block, A.K. Oki and D.C. Streit. "A Novel Monolithic LNA Integrating a Common-Source HEMT with an HBT Darlington Amplifier." 1995 Microwave and Guided Wave Letters 5.12 (Dec. 1995 [MGWL]): 442-444.

Here we report on the results of a novel HEMT-HBT LNA MMIC fabricated using selective molecular beam epitaxy (MBE) techniques. This unique circuit monolithically integrates a low-noise common-source HEMT with an HBT Darlington feedback amplifier to achieve high gain, low noise figure, and wide bandwidth utilizing a compact direct-coupled topology. The miniature direct-coupled MMIC is $0.9 \times 0.7 \text{ mm}^2$ in size and obtains 1-8 GHz bandwidth, greater than 17.5 dB gain, and a minimum noise figure of 2.5 dB. The maximum IP3 is 18 dBm with a saturated output power (P_{sat}) $> 12 \text{ dBm}$. The HEMT-HBT amplifier achieves comparable P_{sat} performance to the conventional HBT-only Darlington amplifier while achieving over 2-dB reduction in noise figure across the band. This work benchmarks the first HEMT-HBT MMIC that illustrates microwave performance advantages when compared to an HBT-only design.

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On the Measured Equation of Invariance for an Electrically Large Cylinder

K.M. Luk, E.K.N. Yung, K.W. Leung and Y.W. Liu. "On the Measured Equation of Invariance for an Electrically Large Cylinder." 1995 Microwave and Guided Wave Letters 5.12 (Dec. 1995 [MGWL]): 445-447.

By considering the electromagnetic scattering of a circular conducting cylinder, the accuracy of the measured equation of invariance (MEI) is examined analytically. Using the asymptotic expansions of the Hankel's functions of second kind, $H_n^{(2)}(kp)$ as measuring functions, the case of an electrically large cylinder is studied. It is shown that the MEI coefficients are invariant to the field of excitation.

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Optically Controlled Photoconductive N-Bit Switched Microwave Signal Attenuator

N.A. Riza and S.E. Saddow. "Optically Controlled Photoconductive N-Bit Switched Microwave Signal Attenuator." 1995 Microwave and Guided Wave Letters 5.12 (Dec. 1995 [MGWL]): 448-450.

An optical architecture for N-bit digital control of microwave signals is introduced that uses the photoconductive effect in microwave waveguides for variable rf attenuation control. A 2-bit optically controlled microwave attenuator based on a transmission line fabricated on a silicon photoconductive substrate is experimentally demonstrated at 990 MHz. This attenuator provided 0, 5.8, 11.2, and 15.6 dB of independent optically switched attenuation levels.

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Generalized Perfectly Matched Layer--An Extension of Berenger's Perfectly Matched Layer Boundary Condition

J. Fang and Z. Wu. "Generalized Perfectly Matched Layer--An Extension of Berenger's Perfectly Matched Layer Boundary Condition." 1995 Microwave and Guided Wave Letters 5.12 (Dec. 1995 [MGWL]): 451-453.

Berenger's perfectly matched layer (PML) has been found very effective in absorbing propagating waves, but it is ineffective in absorbing evanescent waves. Also, since the impedance of PML does not match those of most of lossy media, the PML technique can generally not be applied to terminate lossy media. Derived from the modified Maxwell's equations in the stretched coordinates, the absorber, which we call the generalized perfectly matched layer (GPML), presented in this letter cannot only absorb propagating waves, but also accelerate the attenuation of evanescent waves and perfectly match arbitrary lossy media. Verifications of GPML are provided with numerical examples.

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A 5-10 GHz 15-W GaAs MESFET Amplifier with Flat Gain and Power Responses

Y. Itoh, M. Mochizuki, M. Kohno, H. Masuno, T. Takagi and Y. Mitsui. "A 5-10 GHz 15-W GaAs MESFET Amplifier with Flat Gain and Power Responses." 1995 Microwave and Guided Wave Letters 5.12 (Dec. 1995 [MGWL]): 454-456.

A 5-10 GHz 15-W GaAs MESFET amplifier has been developed. It utilizes a multisection maximally flat impedance transformer whose length is designed to become a quarter wavelength at the highest frequency of the design band to achieve flat gain and flat power responses over a wide bandwidth. With the use of this transformer, the amplifier has achieved a linear gain of 9 ± 1 dB, a P1 dB of 41.8 ± 1 dBm, and a power-added efficiency of 27.5 ± 7.5 over 5-10 GHz, which demonstrate the highest power-bandwidth product ever achieved by high-power amplifiers using GaAs MESFET's, PHEMT's or HBT's.

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A Wideband HEMT Cascode Low-Noise Amplifier with HBT Bias Regulation

K.W. Kobayashi, D.K. Umemoto, T.R. Block, A.K. Oki and D.C. Streit. "A Wideband HEMT Cascode Low-Noise Amplifier with HBT Bias Regulation." 1995 Microwave and Guided Wave Letters 5.12 (Dec. 1995 [MGWL]): 457-459.

We have achieved broadband low-noise performance and dc bias regulation in a single compact HEMT-HBT MMIC. The self-biased MMIC achieves greater than 13 dB gain from 1-8 GHz with a noise figure of less than 1.9 dB across the band and a minimum noise figure of 1.6 dB. The MMIC consists of a HEMT cascode first stage and a source-follower output stage, with shunt feedback between the stages to obtain good broadband noise figure and gain performance. Bias regulation is realized by monolithically integrating an HBT current regulator with the HEMT LNA using selective MBE. This is the first microwave demonstration of key monolithic HEMT-HBT circuit functionality combined with state-of-the-art low-noise figure performance, realized in a miniature 0.9 x 1.0 mm² MMIC.

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Distortion of Pulsed Signals in Microstrip Transmission Lines Using Short-Time Fourier Transform

S.R. Kunasani and C. Nguyenj. "Distortion of Pulsed Signals in Microstrip Transmission Lines Using Short-Time Fourier Transform." 1996 Microwave and Guided Wave Letters 6.1 (Jan. 1996 [MGWL]): 1-3.

Short-time Fourier transform (STFT) is used to window the propagation of pulses traveling in microstrip lines. Characteristics of dc and Gaussian pulses are studied based on their zoom-in time-amplitude windows, fast Fourier transforms, and time-frequency results. Behaviors of dc and Gaussian pulses at a certain time along the length of a microstrip line are also examined. The STFT technique can be used to observe the distortion locally at any time and at any point in the microstrip lines and is especially attractive when the microstrip lines are subjected to complex signals, which vary substantially over a short duration.

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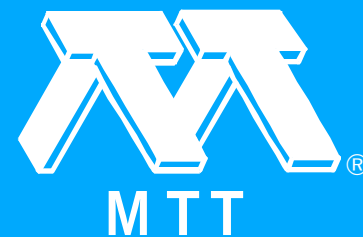


Abstracts

Bridging the Gap Between TLM and FDTD

C. Eswarappa and W.J.R. Hoefer. "Bridging the Gap Between TLM and FDTD." 1996 Microwave and Guided Wave Letters 6.1 (Jan. 1996 [MGWL]): 4-6.

A real-time interface between transmission line modeling (TLM) and finite difference time domain (FDTD) algorithms has been developed and validated. A structure can be subdivided in an arbitrary manner into connected TLM and FDTD subdomains that are updated simultaneously. In this way the specific advantages of both methods can be exploited when solving a given problem. The interface procedure has been validated by solving identical structures, first with TLM, then FDTD, and finally with a combination of both. All three methods yield identical numerical results for equal excitation, space, and time resolution.



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Low-Noise Distributed Amplifier with Active Load

P.K. Ikalainen. "Low-Noise Distributed Amplifier with Active Load." 1996 Microwave and Guided Wave Letters 6.1 (Jan. 1996 [MGWL]): 7-9.

Conventional distributed amplifiers show a marked increase in noise figure at frequencies below 2--6 GHz, depending on the design, because of noise emanating from a resistor that terminates the input line. It is shown in this letter that a low-noise device can be configured to emulate a one-port resistor, but with lower apparent noise temperature than the physical ambient temperature. The use of such an "electronically cold" resistor in the design of a low-noise distributed amplifier is discussed together with simulated results. The new distributed amplifier shows improved noise performance.

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Extraction of Waveguide Scattering Features Using Joint Time-Frequency ISAR

L.C. Trintinalia and H. Ling. "Extraction of Waveguide Scattering Features Using Joint Time-Frequency ISAR." 1996 Microwave and Guided Wave Letters 6.1 (Jan. 1996 [MGWL]): 10-12.

A new joint time-frequency ISAR algorithm that combines the conventional ISAR processing with the joint time-frequency signal representation is presented. The adaptive spectrogram, applied to the range axis of the ISAR image, is used as the time-frequency processing engine. The algorithm is tested using the chamber measurement data from a scale model airplane. The results show that the nonpoint scattering mechanisms due to the waveguide-like engine inlet can be seamlessly removed, leading to an enhanced ISAR image consisting only of point scatterers. Furthermore, the extracted inlet features are displayed in the frequency-aspect plane and show distinct waveguide cutoff features.

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Wide-Band Waveguide-to-Microstrip Transition and Power Divider

M. Davidovitz. "Wide-Band Waveguide-to-Microstrip Transition and Power Divider." 1996 Microwave and Guided Wave Letters 6.1 (Jan. 1996 [MGWL]): 13-15.

A waveguide-to-microstrip transition is proposed, modeled, and validated through a prototypical design. The transition is shown to possess characteristics required in many high-frequency systems, namely wide-band response, ease of construction and hermetic isolation of the two transmission media. Implementation in a waveguide-to-microstrip power divider (three-port) form is detailed here, but other feasible variants are mentioned. Favorable agreement between the proposed model and measured results is observed.

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FDTD Analysis of Plane-Wave Diffraction from Microwave Devices on an Infinite Dielectric Slab

T.-T. Hsu and L. Carin. "FDTD Analysis of Plane-Wave Diffraction from Microwave Devices on an Infinite Dielectric Slab." 1996 Microwave and Guided Wave Letters 6.1 (Jan. 1996 [MGWL]): 16-18.

A 2-D (two-dimensional) Huygens surface is developed for the finite difference time domain (FDTD) algorithm, allowing the investigation of pulsed plane-wave scattering from arbitrary 2-D structures placed on or in an infinite dielectric slab. Example results are presented for scattering from a perfectly conducting strip on an infinite dielectric slab, and the results are compared with data computed via the method of moments. Additionally, the diffraction from a finite, saw-tooth dielectric grating on an infinite dielectric slab is investigated.



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A Study of Dielectric Resonators Based on Two-Dimensional Fast Wavelet Algorithm

K.F. Sabet and L.P.B. Katehi. "A Study of Dielectric Resonators Based on Two-Dimensional Fast Wavelet Algorithm." 1996 Microwave and Guided Wave Letters 6.1 (Jan. 1996 [MGWL]): 19-21.

This letter reports the implementation of orthonormal wavelets for the moment method characterization of three-dimensional dielectric structures. The formulation is based on a 3-D volume integral equation, which is solved numerically using a 2-D multiresolution analysis in conjunction with a sub-domain pulse basis. The use of multiresolution expansions leads to highly sparse linear systems that can be solved very efficiently using the bi-conjugate gradient method. To speed up the numerical evaluation of moment integrals, the fast wavelet algorithm (FWA) has been employed.



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High-Efficiency GaInP/GaAs HBT MMIC Power Amplifier with up to 9 W Output Power at 10 GHz

K. Riepe, H. Leier, U. Seiler, A. Marten and H. Sledzik. "High-Efficiency GaInP/GaAs HBT MMIC Power Amplifier with up to 9 W Output Power at 10 GHz." 1996 Microwave and Guided Wave Letters 6.1 (Jan. 1996 [MGWL]): 22-24.

Monolithic power amplifiers using adequately balasted high-efficiency GaInP/GaAs heterojunction bipolar transistors (HBT's) have been designed, fabricated, and tested. A maximum output power of 9 W with a power-added efficiency (PAE) of 42% and peak power-added efficiencies of 45% have been achieved at 10 GHz under critical long pulse conditions (pulse width = 100 μ s, duty cycle= 10%). To our knowledge these results represent the best performance of any GaInP/GaAs HBT MMIC power amplifier considering efficiency, output power, operation frequency, and pulse conditions.

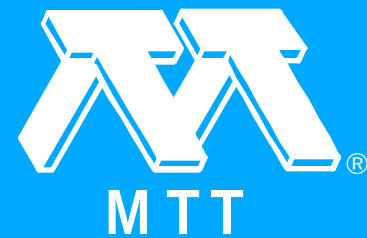
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Abstracts

A Low-Loss Thermal Isolator for Waveguides and Coaxial Transmission Lines

M. Davidovitz. "A Low-Loss Thermal Isolator for Waveguides and Coaxial Transmission Lines." 1996 Microwave and Guided Wave Letters 6.1 (Jan. 1996 [MGWL]): 25-27.

A low-loss element insertable into microwave coaxial transmission lines and waveguides is designed to provide a thermal isolation barrier at the point of insertion.



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Simulation of an Elevated Coplanar Waveguide Using 2-D FDTD

S. Hofschien and I. Wolff. "Simulation of an Elevated Coplanar Waveguide Using 2-D FDTD." 1996 Microwave and Guided Wave Letters 6.1 (Jan. 1996 [MGWL]): 28-30.

Nonlinear transmission lines (NLTL's) are commonly used together with sampling circuits for millimeter-wave instruments. Recently, the use of an elevated coplanar waveguide (CPW) has been proposed to increase the bandwidth of sampling circuits. A full-wave analysis between 10 and 500 GHz of such an elevated CPW using 2-D FDTD will be presented here. The influence of the elevation heights on the capacitance and the loss behavior of the transmission line will be discussed. The analysis shows that the distributed capacitance of the elevated CPW is four times lower and the losses are at least divided by two in comparison to a normal CPW at 300 GHz.

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Model Verification for a High-Power-Efficiency AlGaAs-GaAs HBT

F. Deshours, E. Bergeault, G. Berghoff, C. Pinatel and C. Dubon-Chevallier. "Model Verification for a High-Power-Efficiency AlGaAs-GaAs HBT." 1996 Microwave and Guided Wave Letters 6.1 (Jan. 1996 [MGWL]): 31-33.

Heterojunction bipolar transistors (HBT's) with $2700 \mu\text{m}^2$ of emitter area are characterized for model verification using an active load-pull measurement system. The simulation and measurement results (up to 26 dBm) are reported and compared in terms of output power level and power-added efficiency under variable operating conditions. These measurements are performed with the aim of designing power amplifiers for mobile communication.

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Field Displacement Phenomenon in a Rectangular Waveguide Containing a Thin Plate of Omega Medium

J. Mazur and D. Pietrzak. "Field Displacement Phenomenon in a Rectangular Waveguide Containing a Thin Plate of Omega Medium." 1996 Microwave and Guided Wave Letters 6.1 (Jan. 1996 [MGWL]): 34-36.

An analysis of the wave propagation in a rectangular waveguide containing pseudochiral Omega slab is presented in this letter. Approximate continuity conditions modeling a thin Omega plate are introduced to simplify the analysis. The problem is solved by the mode-matching procedure. A notable field displacement phenomenon appearing in the guide owing the pseudochirality properties is studied. Other feature such as a weak perturbation of the dispersion characteristics of the isotropic guide by pseudochirality introduced into the medium is also discussed.

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De-Embedding Correction for Imperfect Absorbing Boundary Conditions in FDTD

F. Moglie, S. Amara, T. Rozzi and E. Martelli. "De-Embedding Correction for Imperfect Absorbing Boundary Conditions in FDTD." 1996 Microwave and Guided Wave Letters 6.1 (Jan. 1996 [MGWL]): 37-39.

The finite differences in the time domain (FDTD) technique is a very powerful method for field evaluation in complex structures. In many cases knowledge of the field is unnecessary, because that of the scattering parameter suffices. We introduce a very simple, fast, and easy-to-implement method to correct the absorbing boundary condition (ABC) errors in the scattering parameter evaluation arising from any ABC, however imperfect this method allows universal use of any simple ABC for any transmission media, therefore facilitating the development of general purpose codes. The technique is based on the evaluation of the reflection coefficient due to the absorbing boundary condition and a subsequent correction in the frequency domain.

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Derivation and Application of a Passive Equivalent Circuit for the Finite Difference Time Domain Algorithm

I.J. Craddock, C.J. Railton and J.P. McGeehan. "Derivation and Application of a Passive Equivalent Circuit for the Finite Difference Time Domain Algorithm." 1996 Microwave and Guided Wave Letters 6.1 (Jan. 1996 [MGWL]): 40-42.

The widely used finite difference time domain (FDTD) algorithm in its standard form is conditionally stable, the condition being the well-known Courant criterion. Much research has focussed on modifying the standard algorithm to improve its characterisation of geometrical detail and curved surfaces; these modified algorithms, however, may easily be conditionally stable--there is no value of time step that stabilizes the algorithm. This contribution presents a passive electrical circuit that, by virtue of its formal equivalence with FDTD, provides a criterion by which unconditionally unstable algorithms may be avoided. As an example the passive circuit criterion is used to remove the instability from a contour-path FDTD algorithm.





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Degradation of an X-K/sub u/ Band GaAs/AlGaAs Power HBT MMIC Under RF Stress

A. Gupta, F. Ali, D. Dawson and P. Smith. "Degradation of an X-K/sub u/ Band GaAs/AlGaAs Power HBT MMIC Under RF Stress." 1996 Microwave and Guided Wave Letters 6.1 (Jan. 1996 [MGWL]): 43-45.

This paper summarizes the observed degradation in the performance of a high-efficiency X-K/sub u/ band 1-W HBT power MMIC operating under ~2 dB compression for an extended period. The main finding of this study is that no new degradation mechanisms appeared, even under severe RF stress; the device degraded in the same manner as with dc stress only. The only significant change in device characteristics was increased base leakage current that resulted in a monotonic reduction in current gain after an initial period of stability. Output power of the MMIC remained essentially unchanged even after current gain had dropped to 60% of its initial value. RF properties of the device, both small and large signal, showed little change even after severe deterioration of dc characteristics. The results of this study suggest that HBT reliability can be effectively evaluated for most applications by applying only dc stress to the device.

Click on title for a complete paper.



Accurate Determination of Frequency Dividers Operating Bands

J. Morales, A. Suarez and R. Quere. "Accurate Determination of Frequency Dividers Operating Bands." 1996 Microwave and Guided Wave Letters 6.1 (Jan. 1996 [MGWL]): 46-48.

In analog frequency dividers, phenomena such as harmonic synchronization and jumps between coexisting quasiperiodic and frequency divided paths must be taken into account in order to accurately predict their operation ranges. This has been done in this letter by means of a detailed bifurcation analysis. A simple simulation technique is also proposed for determining the second harmonic synchronization locus. A MMIC frequency divider has been thoroughly analyzed, obtaining an excellent agreement with measurements.





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Fabrication and Performance of Planar Schottky Diodes with T-Gate-Like Anodes in 200-GHz Subharmonically Pumped Waveguide Mixers

I. Mehdi, S.C. Martin, R.J. Dengler, R.P. Smith and P.H. Siegel. "Fabrication and Performance of Planar Schottky Diodes with T-Gate-Like Anodes in 200-GHz Subharmonically Pumped Waveguide Mixers." 1996 Microwave and Guided Wave Letters 6.1 (Jan. 1996 [MGWL]): 49-51.

A T-gate-like structure has been developed, fabricated, and tested as the anode for millimeter and submillimeter-wave Schottky diodes. The low parasitic of the T-anode diodes yield extremely high cutoff frequencies, making the diodes useable at frequencies well beyond 1 THz. The diodes were tested as an antiparallel-pair, integrated monolithically with microstrip circuitry on a quartz substrate, in a subharmonically pumped waveguide mixer. A double sideband noise temperature of 600 K with a conversion loss of 4.7 dB were measured at 200 GHz. This is believed to be the lowest noise temperature ever reported for a room-temperature subharmonically pumped Schottky diode mixer at this frequency.

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A Local Mesh Refinement Algorithm for the FDFD Method Using a Polygonal Grid

H. Klingbeil, K. Beilenhoff and H.L. Hartnagel. "A Local Mesh Refinement Algorithm for the FDFD Method Using a Polygonal Grid." 1996 Microwave and Guided Wave Letters 6.1 (Jan. 1996 [MGWL]): 52-54.

A local mesh refinement algorithm for the finite-difference method in the frequency domain (FDFD) is presented that is based on polygonal grids. It is applied to a simple test structure for which the propagation parameters were computed with a mode-matching method as a reference. It is shown that the local mesh refinement realized with this polygonal grid significantly improves the accuracy of the propagation constant compared to the conventional FD method based on rectangular meshes.



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A Monolithic HEMT-HBT Direct-Coupled Amplifier with Active Input Matching

K.W. Kobayashi, D.C. Streit, D.K. Umemoto, T.R. Block and A.K. Oki. "A Monolithic HEMT-HBT Direct-Coupled Amplifier with Active Input Matching." 1996 Microwave and Guided Wave Letters 6.1 (Jan. 1996 [MGWL]): 55-57.

We have achieved the first active input matching of a monolithic microwave integrated circuit through the use of a common-gate (CG) HEMT directly coupled to the input of an HBT Darlington feedback amplifier. The HEMT and HBT devices were monolithically integrated on the same chip using selective MBE. This circuit features an active impedance match technique that eliminates the need for large microstrip matching components. The novel amplifier obtains greater than 10-dB gain over a dc-5 GHz band, a maximum IP3 of 27 dBm, and a minimum noise figure of 3.7 dB. In comparison with a HBT-ONLY Darlington feedback design, the employment of the CG HEMT results in a 6-dB improvement in IP3 and a 1.5-2 dB reduction in noise figure. By adjusting the common-gate HEMT bias, the input return-loss can be tuned for near ideal 50 Ohm match (>20 dB). The actively matched HEMT-HBT amplifier demonstrates an active circuit technique, which can reduce the chip area and cost of HEMT-HBT MMIC's while improving their performance.

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Removing the Angular Sensitivity of FSS Structures Using Novel Double-Layer Structures (Correction)

J. Shaker and L. Shafai. "Removing the Angular Sensitivity of FSS Structures Using Novel Double-Layer Structures (Correction)." 1996 Microwave and Guided Wave Letters 6.1 (Jan. 1996 [MGWL]): 58-58.

In the above letter, the incidence angles in the captions of Figs. 2 and 3 should be corrected as, $\phi_{\text{inc}} = 89^\circ$ and $\theta_{\text{inc}} = 0.1^\circ$, respectively.

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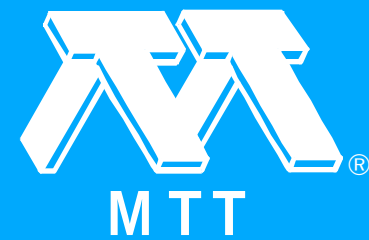
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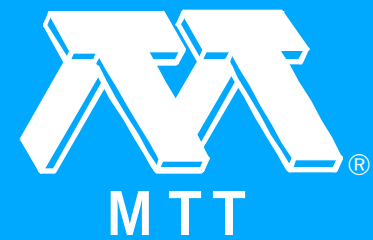
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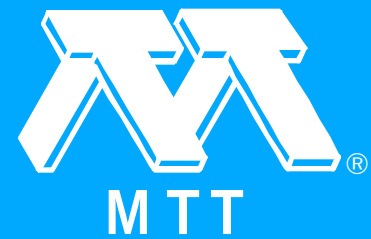
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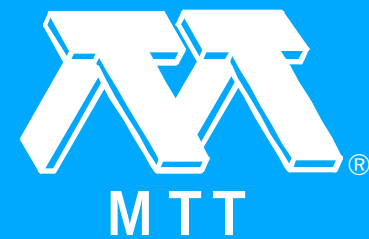
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Frequently Asked Questions and Answers (Advertisement) (Jan. 1996 [MGWL])

*"Frequently Asked Questions and Answers (Advertisement) (Jan. 1996 [MGWL])." 1996
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A Quasi-Optical Dielectric Slab Power Combiner

H.-S. Hwang, T.W. Nuteson, M.B. Steer, J.W. Mink, J. Harvey and A. Paoella. "A Quasi-Optical Dielectric Slab Power Combiner." 1996 Microwave and Guided Wave Letters 6.2 (Feb. 1996 [MGWL]): 73-75.

Real power gain from a quasi-optical power combining dielectric slab waveguide amplifier system is reported for the first time. The system employs four MESFET amplifiers located under the slab, and a small signal gain of 10.5 dB was achieved. Measurements of insertion loss and E-field patterns are presented.



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K/Ka-Band Coplanar Waveguide Directional Couplers Using a Three-Metal-Level MMIC Process

T. Gokdemir, I.D. Robertson, Q.H. Wang and A.A. Rezazadeh. "K/Ka-Band Coplanar Waveguide Directional Couplers Using a Three-Metal-Level MMIC Process." 1996 Microwave and Guided Wave Letters 6.2 (Feb. 1996 [MGWL]): 76-78.

Two novel types of coupled line structures have been realized on GaAs monolithic microwave integrated circuits to obtain 90° couplers operating at a center frequency of 24 GHz. Both of the couplers are made up of either two or three conductive layers to improve the coupling. The aim is to achieve compact couplers with smaller aspect ratios and to decrease the losses due to field crowding on the edges. Both couplers have achieved good matching and coupling. The simulation is carried out on the electromagnetic simulator em (a trademark of Sonnet Software Inc.).

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Millimeter-Wave Time-Resolved Measurement Near a Discontinuity: Separating Temporally Overlapped Incident and Reflected Signals

S.A. Shah, A. Zeng, W.S. Wong, M.K. Jackson, L. Pouliot, A. Lecours and J.F. Currie.

"Millimeter-Wave Time-Resolved Measurement Near a Discontinuity: Separating Temporally Overlapped Incident and Reflected Signals." 1996 Microwave and Guided Wave Letters 6.2 (Feb. 1996 [MGWL]): 79-81.

We report a new measurement approach to recover temporally overlapping incident and reflected signals near a discontinuity using time-resolved electrooptic sampling. The technique involves measurement at two closely spaced locations and enables decomposition of the measured waveforms into components propagating toward and away from a discontinuity. We show experimental results for a simple coplanar structure.

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Velocity-Matched Electrodes for Compound Semiconductor Traveling-Wave Electrooptic Modulators: Experimental Results

N.A.F. Jaeger, F. Rahmatian, H. Kato, R. James, E. Berolo and Z.K.F. Lee. "Velocity-Matched Electrodes for Compound Semiconductor Traveling-Wave Electrooptic Modulators: Experimental Results." 1996 Microwave and Guided Wave Letters 6.2 (Feb. 1996 [MGWL]): 82-84.

Coplanar strips, capacitively loaded with fins and pads and capable of achieving the microwave/optical wave velocity-match condition in GaAs- and InP-based electrooptic modulators, are described. Measurements on electrodes, fabricated to have dimensions appropriate for use in conventional, Mach-Zehnder-type modulators in the 5-40 GHz range, show that these electrode structures can be made to obtain the desired match between the microwave effective index and the effective indexes of AlGaAs and InGaAsP optical waveguides, while having loss coefficients ~ 0.7 Np/cm at 40 GHz.

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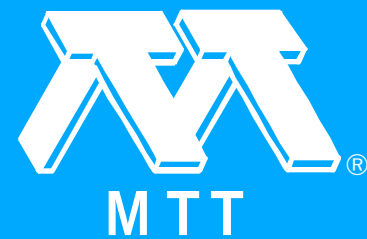


Abstracts

A General Formulation for Connecting Sources and Passive Lumped-Circuit Elements Across Multiple 3-D FDTD Cells

C.H. Durney, W. Sui, D.A. Christensen and J. Zhu. "A General Formulation for Connecting Sources and Passive Lumped-Circuit Elements Across Multiple 3-D FDTD Cells." 1996 Microwave and Guided Wave Letters 6.2 (Feb. 1996 [MGWL]): 85-87.

A previous extension of the finite-difference time-domain (FDTD) method to include lumped-circuit elements is further extended to model lumped-element circuits connected across multiple FDTD cells. This formulation is needed to model many kinds of circuits, like those with a transistor or other active device connected across a transmission line with more than one dielectric. The FDTD analysis of a shielded suspended microstrip transmission line excited by a current source in parallel with a resistance illustrates the usefulness of the formulation.



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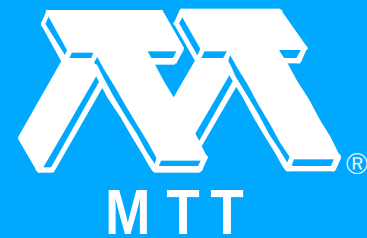


Abstracts

A Two-Stage Spatial Amplifier with Hard Horn Feeds

T. Ivanov and A. Mortazawi. "A Two-Stage Spatial Amplifier with Hard Horn Feeds." 1996 Microwave and Guided Wave Letters 6.2 (Feb. 1996 [MGWL]): 88-90.

A spatial amplifier consisting of two stages, with each stage employing nine HEMT's, has been developed. The coupling to and out of the spatial amplifier is accomplished by placing it in the reactive field of two hard horn antennas. The hard horns' improved aperture field uniformity ensures the simultaneous saturation of most of the active devices across the amplifier array. The amplifier has a small signal gain of 16.2 dB at 9.98 GHz and produces 90 mW at a 2-dB compression point.



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High-Efficiency GaAs-Based pHEMT C-Band Power Amplifier

J.J. Brown, J.A. Pusi, M. Hu, A.E. Schmitz, D.P. Docter, J.B. Shealy, M.G. Case, M.A. Thompson and L.D. Nguyen. "High-Efficiency GaAs-Based pHEMT C-Band Power Amplifier." 1996 Microwave and Guided Wave Letters 6.2 (Feb. 1996 [MGWL]): 91-93.

A high-efficiency C-Band power amplifier design utilizing AlGaAs/InGaAs/GaAs pHEMT's is reported. On-wafer active loadpull power measurements at 4.5 GHz of a $0.25\mu\text{m} \times 1.2\text{mm}$ pHEMT exhibited an output power of 0.35 W and power-added efficiency of 79 %. A single-stage MIC amplifier fabricated with a 2.8-mm-wide pHEMT resulted in $P_{\text{sub out}} = 1.2\text{ W}$ and $\text{PAE} = 74\%$ at 4 GHz. These results demonstrate the potential of pHEMT's to: significantly improve the efficiency performance of microwave solid state power amplifiers compared to present MESFET designs.

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An Efficient Implementation of Berenger's Perfectly Matched Layer (PML) for Finite-Difference Time-Domain Mesh Truncation

J.C. Veihl and R. Mittra. "An Efficient Implementation of Berenger's Perfectly Matched Layer (PML) for Finite-Difference Time-Domain Mesh Truncation." 1996 Microwave and Guided Wave Letters 6.2 (Feb. 1996 [MGWL]): 94-96.

In this letter, an efficient three-dimensional (3-D) implementation of the perfectly matched layer (PML) type of absorbing medium is presented. The technique combines a new eight-unknown time domain formulation in regions in which there is only one nonzero conductivity with the original 12-unknown formulation in the edge and corner regions where nonzero conductivities overlap. Numerical examples of radiation and guided wave problems are included to demonstrate that the modified formulation provides accuracy comparable to the original split field formulation while substantially reducing the memory and CPU requirements of the PML regions.

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Abstracts

A Simplified PML for Use with the FDTD Method

D.M. Sullivan. "A Simplified PML for Use with the FDTD Method." 1996 Microwave and Guided Wave Letters 6.2 (Feb. 1996 [MGWL]): 97-99.

A recent 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. This letter suggests using fictitious magnetic and electric displacement (as opposed to electric field) conductivities in order to better isolate the PML from the rest of the FDTD problem. It further describes the implementation for the PML directly from the FDTD formulation itself. This results in an analysis that is much easier to understand and to program.



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A Radiating Monolithic Integrated Planar Oscillator at 55 GHz

A. Stiller, K.M. Strohm, E. Sasse, E. Biebl and J.-F. Luy. "A Radiating Monolithic Integrated Planar Oscillator at 55 GHz." 1996 Microwave and Guided Wave Letters 6.2 (Feb. 1996 [MGWL]): 100-102.

A planar radiating oscillator consisting of a planar resonant antenna and an IMPATT diode monolithically integrated on a silicon substrate is presented. This oscillator finds various applications in low-cost sensors, e.g., velocity sensors. The design tools are discussed and the calculated results are compared to measurements.

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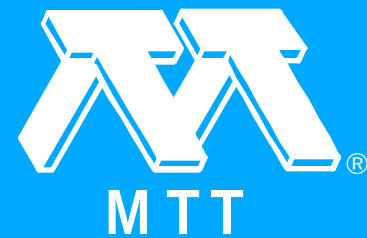


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Microwave Optical Filters Using In-Fiber Bragg Grating Arrays

D.B. Hunter and R.A. Minasian. "Microwave Optical Filters Using In-Fiber Bragg Grating Arrays." 1996 Microwave and Guided Wave Letters 6.2 (Feb. 1996 [MGWL]): 103-105.

A novel multitap optical transversal signal processor based on wavelength multiplexed Bragg grating arrays is presented. This structure enables the realization of a large number of taps for obtaining sharp bandpass filtering with high resolution and also enables arbitrary tap weight profiles to be obtained. Results on a 4-GHz, 29-tap filter demonstrates a sharp bandpass filter response, and windowing techniques on the tap profiles are demonstrated to enhance the sidelobe suppression characteristics.



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A Compact 1.7--2.1 GHz Three-Way Power Combiner Using Microstrip Technology with Better Than 93.8% Combining Efficiency

D. Maurin and K. Wu. "A Compact 1.7--2.1 GHz Three-Way Power Combiner Using Microstrip Technology with Better Than 93.8% Combining Efficiency." 1996 Microwave and Guided Wave Letters 6.2 (Feb. 1996 [MGWL]): 106-108.

This letter presents the design and measured performance of a microstrip three-way power combiner. The combiner is designed using the conventional Wilkinson topology with the extension to three outputs, which has been rarely considered for the design and fabrication of V-way combiners. It is shown that with an appropriate design approach, the main drawback reported with this topology (nonplanarity of the circuit when $N > 2$) can be minimized to have a negligible effect on the circuit performance and still allow an easy MIC or MHMIC fabrication.



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New Aspects of the Method of Lines (Correction)

A. Dreher and T. Rother. "New Aspects of the Method of Lines (Correction)." 1996 Microwave and Guided Wave Letters 6.2 (Feb. 1996 [MGWL]): 109-109.

In Fig. 3 of the above letter, the labels of the abscissa have not been normalized as indicated.



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High-Impedance Coplanar Waveguides with Low Attenuation

F. Schnieder, R. Doerner and W. Heinrich. "High-Impedance Coplanar Waveguides with Low Attenuation." 1996 Microwave and Guided Wave Letters 6.3 (Mar. 1996 [MGWL]): 117-119.

The conventional MMIC coplanar line covers an impedance range from about 30-80 Ω . Values outside this range cannot be fabricated reliably or cause excessive losses. For several applications, however, it is desirable to use high-impedance lines (e.g., for reduced-size couplers and nonlinear transmission lines). This letter reports results from experiment and electromagnetic simulation for a coplanar waveguide (CPW) structure with an elevated center conductor realized by an air-bridge technique. We achieve wave impedances of about 100 Ω at a lower attenuation level as conventional 50- Ω CPW'S of comparable size.

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Abstracts

The Studies of the Stability of FDTD with Mur's Absorbing Boundary Condition of Second Order in 3-D Scattering Problems

Z. Yusheng and W. Wenbing. "The Studies of the Stability of FDTD with Mur's Absorbing Boundary Condition of Second Order in 3-D Scattering Problems." 1996 Microwave and Guided Wave Letters 6.3 (Mar. 1996 [MGWL]): 120-122.

In this letter, the numerical implementation of Mur's absorbing boundary condition (Mur's ABC) of second order in finite-difference time-domain (FDTD) is analyzed and studied in three-dimensional (3-D) scattering problems. Two new stable upwind finite-difference approximations of Mur's ABC are pre-sented and the later-time instability of FDTD with second-order Mur's ABC in 3-D scattering problems is overcome. Numerical results clearly exhibit the availability of the two upwind finite-difference approximations of Mur's ABC.



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Control of Circuit Distortion by the Derivative Superposition Method

D. Webster, J. Scott and D. Haigh. "Control of Circuit Distortion by the Derivative Superposition Method." 1996 Microwave and Guided Wave Letters 6.3 (Mar. 1996 [MGWL]): 123-125.

The derivative structure of the characteristics of GaAs FET's naturally gives rise to changes in magnitude and reversals of phase of intermodulation distortion components. An MMIC design method that exploits the phase reversal to achieve control of distortion in an amplifier is presented. An example circuit is designed and its measured performance is compared with that of a conventional amplifier.

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Mode-Discriminating Electrooptic Sampling for Separating Guided and Unguided Modes on Coplanar Waveguide

N.de B. Baynes, J. Allam and J.R.A. Cleaver. "Mode-Discriminating Electrooptic Sampling for Separating Guided and Unguided Modes on Coplanar Waveguide." 1996 Microwave and Guided Wave Letters 6.3 (Mar. 1996 [MGWL]): 126-128.

Mode-discriminating electrooptic sampling (MEOS) of coplanar waveguides was shown to discriminate between the symmetric quasi-TEM guided mode and asymmetric field distributions including unguided electromagnetic radiation. Radiation generated in a photoconductive switch and reflected from the back of the substrate was unambiguously identified. Ultrafast sampling of devices showed features in the transmitted pulse due to multiple substrate reflections. These features are removed using MEOS, leading to increased accuracy in determination of s-parameters.

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Ka-Band Power Performance of InP/InGaAs/InP Double Heterojunction Bipolar Transistors

H.-F. Chau, H.-Q. Tserng and E.A. Beam, III. "Ka-Band Power Performance of InP/InGaAs/InP Double Heterojunction Bipolar Transistors." 1996 Microwave and Guided Wave Letters 6.3 (Mar. 1996 [MGWL]): 129-131.

We report for the first time the Ka-band power performance of InP/InGaAs/InP DHBT's. A $2 \times 10 \mu\text{m}^2$ common-emitter transistor delivered a continuous wave (CW) output power of 19.1 mW (1.91 W/mm power density), an associated gain of 5.3 dB, and a power-added efficiency (PAE) of 35.5% at 30 GHz. The maximum output power density was 2.34 W/mm and the peak associated gain was 6.6 dB. Under common-base operation, the maximum associated gain increased to 15.2 dB, but the maximum output power density and peak PAE dropped to 1.91 W/mm and 24.5%, respectively, at the same frequency.

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A 90% Power-Added-Efficiency GaInP/GaAs HBT for L-Band Radar and Mobile Communication Systems

A. Mallet, D. Floriot, J.P. Viaud, F. Blache, J.M. Nebus and S. Delage. "A 90% Power-Added-Efficiency GaInP/GaAs HBT for L-Band Radar and Mobile Communication Systems." 1996 *Microwave and Guided Wave Letters* 6.3 (Mar. 1996 [MGWL]): 132-134.

A very high 90% power-added efficiency (PAE) with an output power (P_{out}) of 200 mW and a power gain of 18 dB has been achieved at 1.8 GHz with a $240 \mu\text{m}^2$ GaInP/GaAs HBT (Thomson-CSF/LCR). The transistor (common emitter) was biased in class C mode ($I_{bias} = 0$ mA; $V_{be} = 1$ V; $V_{ce} = 7$ V) and the load termination at the signal harmonics was optimized. First, a heterojunction bipolar transistor (HBT) nonlinear model has been extracted from pulsed I-V and pulsed S parameter measurements. A harmonic balance simulation was performed and suitable collector current/voltage waveforms were determined in order to optimize PAE. Second, a multiharmonic active load-pull system was used in order to measure and optimize the transistor efficiency. Measurement data were found to be in good agreement with simulated results. The main use of this HBT is expected to be in mobile communication systems and T/R modules for active array radars.





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Reflection of a Coaxial Line Radiating Into a Parallel Plate

J.H. Lee, H.J. Eom and K.H. Jun. "Reflection of a Coaxial Line Radiating Into a Parallel Plate." 1996 Microwave and Guided Wave Letters 6.3 (Mar. 1996 [MGWL]): 135-137.

Reflection of a coaxial line radiating into a parallel plate is solved analytically. The Hankel transform and the mode-matching technique are used to represent the reflection coefficient in rapidly converging series. The numerical computations are performed to illustrate the reflection behavior in terms of coaxial geometries and frequency. The presented series solution is an analytic, closed-form that is simple yet efficient for numerical computation.

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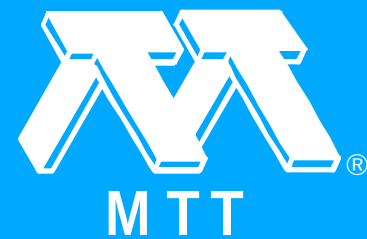


Abstracts

Three-Dimensional FDTD Analysis of Quasi-Optical Arrays Using Floquet Boundary Conditions and Berenger's PML

A. Alexanian, N.J. Koliass, R.C. Compton and R.A. York. "Three-Dimensional FDTD Analysis of Quasi-Optical Arrays Using Floquet Boundary Conditions and Berenger's PML." 1996 Microwave and Guided Wave Letters 6.3 (Mar. 1996 [MGWL]): 138-140.

Infinite periodic grid structures excited by normally incident beams are analyzed using finite-difference time-domain (FDTD), with Berenger's PML (perfectly matched layer) absorbing boundary condition used to terminate the computation domain along the beam axis. Floquet boundary conditions are used to handle arbitrarily shaped unit cells. Restriction to normal incidence permits using a Gaussian pulsed excitation to generate the wideband frequency response. The technique is used to model a previously reported multilayer quasioptical rotator array, with excellent agreement to the measurements obtained in the 26.540 GHz band in a lens-focused test setup.



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Abstracts

TLM Modeling Using Distributed Computing

P.J. Parsons, S.R. Jaques, S.H. Pulko and F.A. Rabhi. "TLM Modeling Using Distributed Computing." 1996 Microwave and Guided Wave Letters 6.3 (Mar. 1996 [MGWL]): 141-142.

Distributed computing techniques offer the potential to significantly reduce the run time of transmission-line-matrix (TLM) calculations. This letter describes the implementation of a TLM model of a two-channel waveguide distributed across a network of workstations using parallel virtual machine (PVM). The methods for distributing the TLM matrix across the work-stations and the effect on performance of different approaches are described and discussed.



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Mode-Matching Analysis of the Step Discontinuity in Elliptical Waveguides

P. Matras, R. Bunger and F. Arndt. "Mode-Matching Analysis of the Step Discontinuity in Elliptical Waveguides." 1996 Microwave and Guided Wave Letters 6.3 (Mar. 1996 [MGWL]): 143-145.

The modal scattering matrix of the step discontinuity of two elliptical waveguides of different cross sections is calculated rigorously by the direct mode-matching method using the Mathieu equation. For the convenient treatment of the Mathieu functions, an efficient trigonometric series expansion technique is used. As examples, the input reflection coefficients are calculated of two step discontinuities, a nearly circular-to-circular waveguide transition and a transition from larger to smaller confocal elliptical waveguide. Excellent agreement with reference results verifies the accuracy of the presented.

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Practical 3-D Contour/Staircase Treatment of Metals in FDTD

J. Anderson, M. Okoniewski and S.S. Stuchly. "Practical 3-D Contour/Staircase Treatment of Metals in FDTD." 1996 Microwave and Guided Wave Letters 6.3 (Mar. 1996 [MGWL]): 146-148.

The standard finite-difference time-domain (FDTD) method incorporates an inaccurate staircase representation of perfect electric conductors. More accurate, contour-type update formulas have been proposed. These approaches suffer from bookkeeping complexity, difficulties in mesh generation, and stability problems. Only simplified special cases have been implemented in three dimensions. A new contour-like FDTD algorithm is presented. Subcell formulas and staircase logic are combined to produce a three-dimensional (3-D) algorithm that is simple, robust, and fully automatic.

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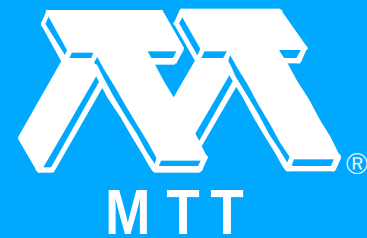


Abstracts

Application of the Complex Integration Path in the Theory of Leaky Modes

F. Wilczewski. "Application of the Complex Integration Path in the Theory of Leaky Modes." 1996 Microwave and Guided Wave Letters 6.3 (Mar. 1996 [MGWL]): 149-150.

A variational expression for the complex core parameter is used to check the validity of the concept of complex integration path in the theory of leaky modes. An numerical example is presented to show the accuracy of the concept.



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Arbitrarily Oriented Microstrip Lines Coupled through an Inclined Slot in the Common Ground Plane

Y.M.M. Antar, Z. Fan and A. Ittipiboon. "Arbitrarily Oriented Microstrip Lines Coupled through an Inclined Slot in the Common Ground Plane." 1996 Microwave and Guided Wave Letters 6.3 (Mar. 1996 [MGWL]): 151-153.

An analysis of arbitrarily oriented microstrip lines coupled through an inclined slot in the common ground plane is presented. The method of analysis is based on the spectral domain approach and reciprocity theorem. Computed scattering parameters are compared with other available measured and computed data for the case of parallel microstrip lines, showing good agreements. It is found that for arbitrarily oriented microstrip lines, by varying slot inclination angle, coupling level can be widely controlled and there exists maximum coupling for a certain value of slot inclination angle. Effects of slot length on coupling and losses are also investigated.

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"Call for Papers - Automated Circuit Design Using Electromagnetic Simulators (Mar. 1996 [MGWL])." 1996 Microwave and Guided Wave Letters 6.3 (Mar. 1996 [MGWL]): 160-160.



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On the Derivation of the Generalized Telegraphist's Equations for Full-Wave Analysis of Chirowaveguides

J.A. Pereda, A. Vegas and A. Prieto. "On the Derivation of the Generalized Telegraphist's Equations for Full-Wave Analysis of Chirowaveguides." 1996 Microwave and Guided Wave Letters 6.4 (Apr. 1996 [MGWL]): 165-167.

This letter discusses a formulation of the generalized telegraphist's equations for the rigorous analysis of chirowaveguides that has recently been reported in the literature. It is found that when a chiral medium is in contact with the perfect electric conducting wall of the waveguide, the boundary conditions are not satisfied on the wall. A new formulation is proposed to overcome this limitation. Both formulations are applied to the calculation of the dispersion diagrams and field distributions of the completely filled parallel-plate chirowaveguide and the results are compared. Our proposed formulation is found to provide satisfactory results when analyzing such a structure.

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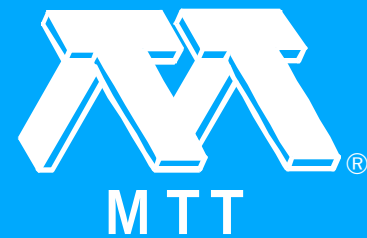


Abstracts

An Accurate Broadband Measurement of Substrate Dielectric Constant

M.-Q. Lee and S. Nam. "An Accurate Broadband Measurement of Substrate Dielectric Constant." 1996 Microwave and Guided Wave Letters 6.4 (Apr. 1996 [MGWL]): 168-170.

An improved two-microstrip line method is proposed for a simple and accurate measurement of the dielectric constants of substrates. The errors due to the transition mismatches and connection repeatability are removed by using the selection algorithm of the best data set in multiple measurements, based on the minimum error cost concept. The measurement data for CGP-500 substrate in broad frequency range (0.5--25.5 GHz) are shown and the result agrees quite well with the theoretical one.



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CAD-Oriented Equivalent Circuit Modeling of Step Discontinuities in Rectangular Waveguides

A. Weisshaar, M. Mongiardo and V.K. Tripathi. "CAD-Oriented Equivalent Circuit Modeling of Step Discontinuities in Rectangular Waveguides." 1996 Microwave and Guided Wave Letters 6.4 (Apr. 1996 [MGWL]): 171-173.

A novel equivalent circuit model for step discontinuities in rectangular waveguides is presented. The equivalent circuit model is based on a modal analysis and enables full-wave characterization of the step-discontinuity by circuit analysis on commercial simulators. The equivalent circuit model of the H-plane step has been implemented on Libra to demonstrate its accuracy. Results of the circuit analysis were found to be in virtually perfect agreement with the conventional mode-matching solution based on incident and reflected wave amplitudes.

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Modeling Dispersive Dielectrics for the 2-D TLM Method

I. Barba, A.C.L. Cabeceira, J. Represa, M. Panizo and C. Pereira. "Modeling Dispersive Dielectrics for the 2-D TLM Method." 1996 Microwave and Guided Wave Letters 6.4 (Apr. 1996 [MGWL]): 174-176.

The transition line matrix (TLM) method, since it is a time-domain method, cannot deal directly with dispersive media. We propose a way for modeling such media, starting from the causality relationship between field vectors D and E , which is discretized over the same space-time mesh as the two-dimensional TLM mesh. This leads to adding a voltage source at each node, its value depending on the previous instants. The method is validated by computing the reflection coefficient at an air-water interface and the cutoff frequencies of a rectangular waveguide containing a Debye dielectric.

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Reflection Analysis of PML ABC's for Low-Frequency Applications

J. De Moerloose and M.A. Stuchly. "Reflection Analysis of PML ABC's for Low-Frequency Applications." 1996 Microwave and Guided Wave Letters 6.4 (Apr. 1996 [MGWL]): 177-179.

A basic numerical reflection analysis is presented for low-frequency applications using a new type of the reflectivity diagram. The retardation effect at low frequencies is explained and use of an exponential profile, as suggested.

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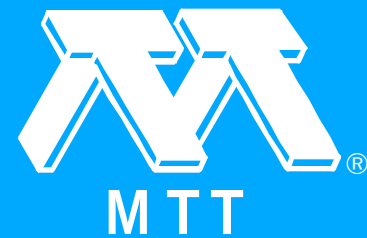


Abstracts

A Q-Band Monolithic Linear Amplifier Using AlGaAs/GaAs HBT's

Y. Kwon, W.-J. Ho and J.A. Higgins. "A Q-Band Monolithic Linear Amplifier Using AlGaAs/GaAs HBT's." 1996 Microwave and Guided Wave Letters 6.4 (Apr. 1996 [MGWL]): 180-182.

This letter reports on a Q-band monolithic hetero-junction bipolar transistor (HBT) amplifier demonstrating high gain, efficiency, excellent linearity, and low added phase noise. The amplifier used $40\text{ }\mu\text{m}^2$ CB-HBT's in a balanced configuration. The monolithic microwave integrated circuit (MMIC) amplifier showed a peak gain of 13.5 dB at 38 GHz and a 3-dB bandwidth of 10 GHz. Under class-A bias conditions, the circuit exhibited P/sub 1 dB/ higher than 15 dBm from 35--41.5 GHz and a peak PAE of 32% at 35 GHz. Two-tone tests showed an IP/sub 3/ of 30 dBm at 44 GHz and IMD/sub 3/ ratios better than 20 dBc at 1-dB gain compression point. Amplifier phase noise measurement showed added phase noise of -148 dBc/Hz at 10 kHz away from the carrier at P/sub 1dB. This circuit demonstrates a great potential for the HBT MMIC's for mm-wave high-efficiency linear applications.



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Reconstruction of the S-Matrix for a 3-Port Using Measurements at Only Two Ports (Comments)

J.C. Rautio. "Reconstruction of the S-Matrix for a 3-Port Using Measurements at Only Two Ports (Comments)." 1996 Microwave and Guided Wave Letters 6.4 (Apr. 1996 [MGWL]): 183-183.

The author of the above letter is to be complemented on finding a closed form solution to the set of bilinear transforms which transform correct S-parameters of a three-port device into the imperfectly terminated two-port S-parameters usually measured. However, readers of his paper might also benefit from work previously published in this area.

Click on title for a complete paper.



A Simple Way to Model Curved Metal Boundaries in FDTD Algorithm Avoiding Staircase Approximation (Comment)

T. Weiland. "A Simple Way to Model Curved Metal Boundaries in FDTD Algorithm Avoiding Staircase Approximation (Comment)." 1996 Microwave and Guided Wave Letters 6.4 (Apr. 1996 [MGWL]): 183-184.

The triangular subdivision of mesh cells as described in the above letter were first published (to the author's knowledge) over 15 years ago in the context of a frequency-domain method. This improvement has been proposed for time-domain computations with particle beams and used in numerous publications for two-dimensional, 2.5-dimensional, and three-dimensional computations for static fields, eddy current fields, high-frequency fields and, last but not least, for time-domain fields.



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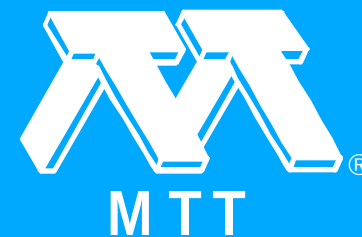
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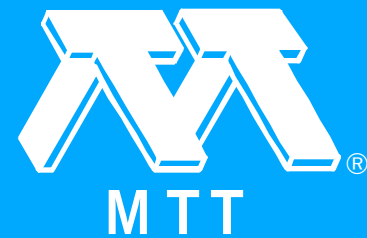


Abstracts

Dispersion Comparison for DSI- and Tensor-Based Nonorthogonal FDTD

H. Shi and J.L. Drewniak. "Dispersion Comparison for DSI- and Tensor-Based Nonorthogonal FDTD." 1996 Microwave and Guided Wave Letters 6.5 (May 1996 [MGWL]): 193-195.

An explicit formulation of the finite-difference time-domain discrete surface integral (FDTD-DSI) technique has allowed a rigorous study of numerical dispersion for the method. The study shows that the DSI- and tensor-based FDTD methods do not have the same numerical dispersion relation. It also clarifies the recently reported discrepancies in the dispersion relation between the two approaches. This study also shows that the tensor-based FDTD algorithm exhibits better dispersion properties for a two-dimensional uniformly skewed mesh.



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Injection-Locked 28-GHz Oscillator Array with Disk-Cylinder Reflector

M.J. Vaughan and R.C. Compton. "Injection-Locked 28-GHz Oscillator Array with Disk-Cylinder Reflector." 1996 Microwave and Guided Wave Letters 6.5 (May 1996 [MGWL]): 196-198.

A 28-GHz endfire (modified Vivaldi) active antenna is described that contains a secondary, circularly polarized patch antenna for reception of an external injection-locking signal. Three of these devices are used to characterize an octagonal cylindrical reflector designed for creating an omni-directional transmitter suitable for use in point-to-multipoint communication systems. The experiments provide data that validates the approach used to simulate the azimuthal radiation patterns. These simulations are then extended to predict the patterns from a full eight-element array.

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Modeling of Microwave Active Devices Using the FDTD Analysis Based on the Voltage-Source Approach

C.-N. Kuo, R.-B. Wu, B. Houshmand and T. Itoh. "Modeling of Microwave Active Devices Using the FDTD Analysis Based on the Voltage-Source Approach." 1996 Microwave and Guided Wave Letters 6.5 (May 1996 [MGWL]): 199-201.

This letter describes a voltage-source-based formulation of the extended finite-difference time-domain algorithm for the purpose of modeling microwave devices. The device-wave interaction is fully characterized by replacing the lumped devices with equivalent voltage sources in the device region, which in turn generate electromagnetic fields according to Faraday's law. This formulation is applied to the analysis of a typical microwave amplifier, which includes a three-terminal active MESFET device. Simulation results are in good agreement with measured data.

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Mutual Coupling Between Microstrips through a Printed Aperture of Arbitrary Shape in Multilayered Media

C. Chen, M.-J. Tsai and N.G. Alexopoulos. "Mutual Coupling Between Microstrips through a Printed Aperture of Arbitrary Shape in Multilayered Media." 1996 Microwave and Guided Wave Letters 6.5 (May 1996 [MGWL]): 202-204.

A concise formulation of mixed-potential integral equation (MPIE) is developed to account for the mutual coupling effects between electric and magnetic current sources in a multi-layered medium. Unlike the electric field integral equation (EFIE) or magnetic field integral equation (MFIE), this expression only requires the less singular vector potential to evaluate the mutual impedance integral. As a result, computational speed and accuracy are enhanced. In addition, this formulation provides a physical insight of how this mutual coupling occurs. Although the odd symmetry of the impedance matrix concluded from reciprocity theorem is not obvious, it is numerically evaluated and justified. Finally, a vertical transition between back-to-back microstrip lines is calculated and compared with published data. Bandwidth improvement of this transition is also demonstrated by introducing a bowtie slot for the vertical coupling.

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A Quasi-Optical Isolator

S. Hollung, W. Shiroma, M. Markovic and Z.B. Popovic. "A Quasi-Optical Isolator." 1996 Microwave and Guided Wave Letters 6.5 (May 1996 [MGWL]): 205-206.

A nonferrite X-band quasi-optical isolator is presented. The isolator consists of six cascaded printed gratings loaded with lumped elements and exhibits less than 2-dB insertion loss. The isolator is designed for protection and stabilization of quasi-optical amplifiers. A linearly polarized output wave from a quasi-optical amplifier becomes circularly polarized in the isolator, which in this case serves as a linear-to-circular polarization converter as well. Isolation of 9 and 19 dB was measured for the co- and cross-polarized waves, respectively.



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Progress Toward Solid-State Local Oscillators at 1 THz

T.W. Crowe, T.C. Grein, R. Zimmermann and P. Zimmermann. "Progress Toward Solid-State Local Oscillators at 1 THz." 1996 Microwave and Guided Wave Letters 6.5 (May 1996 [MGWL]): 207-208.

A varactor tripler to 800 GHz with 250 mW output power is reported. This tripler uses a new GaAs Schottky diode which has been optimized for high frequency applications. It features a smaller anode diameter and higher epitaxial doping density than previous varactor multipliers. The resulting output power is much greater than has been previously reported at such a high frequency.

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A General Approach for the Development of Unsplit-Field Time-Domain Implementations of Perfectly Matched Layers for FDTD Grid Truncation

L. Zhao and A.C. Cangellaris. "A General Approach for the Development of Unsplit-Field Time-Domain Implementations of Perfectly Matched Layers for FDTD Grid Truncation." 1996 Microwave and Guided Wave Letters 6.5 (May 1996 [MGWL]): 209-211.

It is shown that the anisotropic perfectly matched medium, proposed recently for the construction of reflectionless absorbing boundaries for differential equation-based electromagnetic simulations in unbounded domains, can be made equivalent to the Chew-Weedon perfectly matched medium developed from a modified Maxwell's system with coordinate stretching. Consequently, despite the apparently nonphysical coordinate stretching, Chew-Weedon's formulation, with an appropriate definition of the involved electric and magnetic fields, is merely an alternative mathematical form of Maxwell's system in an anisotropic medium. Finally, a more convenient time-domain implementation of the perfectly matched layer without splitting of the field components is derived.

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The Use of Absorbing Boundary Conditions in the Method of Lines

K. Wu and X. Jiang. "The Use of Absorbing Boundary Conditions in the Method of Lines." 1996 Microwave and Guided Wave Letters 6.5 (May 1996 [MGWL]): 212-214.

An artificial lossy absorbing boundary condition is proposed for use in the method of lines for simulating unbounded electromagnetic structures. It is found, through the modeling results of a microstrip line, that the proposed absorbing boundary condition could be effective and a simple rule of application may be established.

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A Differential Method of Reflection Coefficient Extraction from FDTD Simulations

W.K. Gwarek and M. Celuch-Marcysiak. "A Differential Method of Reflection Coefficient Extraction from FDTD Simulations." 1996 Microwave and Guided Wave Letters 6.5 (May 1996 [MGWL]): 215-217.

A novel concept for accurate extraction of the reflection coefficient from electromagnetic simulations is proposed and implemented into the finite-difference time-domain (FDTD) method. It uses only the values of an arbitrary tangential E-field component and its derivative with respect to the longitudinal direction at one selected point, and of an arbitrary tangential H-field component and its derivative with respect to the longitudinal direction at another point. No a priori knowledge of reference impedances is needed, and the reflection coefficient is extracted from a single run of FDTD. The proposed method is directly applicable to arbitrarily shaped and inhomogeneous transmission lines.

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Abstracts

Patent Abstracts (May 1996 [MGWL])

"Patent Abstracts (May 1996 [MGWL])." 1996 Microwave and Guided Wave Letters 6.5 (May 1996 [MGWL]): 218-223.



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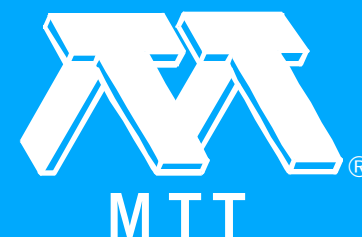
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Call for Papers - 8th Asia Pacific Microwave Conference (May 1996 [MGWL])

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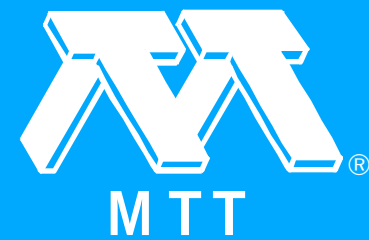
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Call for Papers - Microwave Photonics (May 1996 [MGWL])

"Call for Papers - Microwave Photonics (May 1996 [MGWL])." 1996 Microwave and Guided Wave Letters 6.5 (May 1996 [MGWL]): 227-227.



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Call for Papers - Automated Circuit Design Using Electromagnetic Simulators (May 1996 [MGWL])

"Call for Papers - Automated Circuit Design Using Electromagnetic Simulators (May 1996 [MGWL])." 1996 Microwave and Guided Wave Letters 6.5 (May 1996 [MGWL]): 228-228.



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Mode Coupling Prediction in Whispering Gallery Dielectric Resonators Modes

P. Blondy, V. Madrangeas, D. Cros and P. Guillon. "Mode Coupling Prediction in Whispering Gallery Dielectric Resonators Modes." 1996 Microwave and Guided Wave Letters 6.6 (Jun. 1996 [MGWL]): 229-231.

This letter describes a new method to locate the frequency band in which two whispering gallery modes (WGM's) are likely to be coupled. It is explained why this phenomenon is observed in single-crystal anisotropic dielectric resonators. This method is validated by computations of the resonant frequencies and the electromagnetic field cartography of WGM computed by finite-element method (FEM) for a sapphire resonator and experiments.

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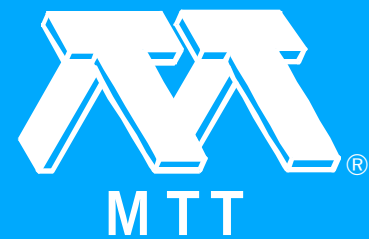


Abstracts

Fast Evaluation of Modal Coupling Coefficients of Waveguide Step Discontinuities

P. Arcioni. "Fast Evaluation of Modal Coupling Coefficients of Waveguide Step Discontinuities." 1996 Microwave and Guided Wave Letters 6.6 (Jun. 1996 [MGWL]): 232-234.

This letter presents a fast method for the determination of a large number of coupling coefficients of a step discontinuity between a rectangular/circular waveguide and a smaller one of arbitrary shape. The mode spectrum of the small waveguide is calculated by a fast algorithm-presented some years ago-and the coupling coefficients are obtained at almost no extra cost by post-processing some of the matrices already used for finding the modes. Tens of modes and hundreds of coefficients are calculated in a few seconds on an ordinary workstation.



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Array of Coupled Phase-Locked Oscillators at 160 GHz

T. Geist and H.-J. Hartfuss. "Array of Coupled Phase-Locked Oscillators at 160 GHz." 1996 Microwave and Guided Wave Letters 6.6 (Jun. 1996 [MGWL]): 235-237.

A ten-channel millimeter-wave heterodyne phase measurement system is currently under construction. This system will be used for electron density measurement at the plasma experiment W7-AS. Main features are: 1) twofold usage of each 160-GHz oscillator to excite both the transmitting signal to the plasma and the local oscillator (LO) signal for downconversion and 2) the phase-locked loops (PLL's) of each oscillator are coupled in a chain. This letter describes the millimeter-wave part and the digital PLL circuits of that system. Test results of the first three channels, which are already running in the laboratory, are presented.

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



Temperature Compensation Circuit for Linear Microwave Amplifiers

V. Alleva and F. Di Paolo. "Temperature Compensation Circuit for Linear Microwave Amplifiers." 1996 Microwave and Guided Wave Letters 6.6 (Jun. 1996 [MGWL]): 238-240.

A hybrid circuit, integrated in a double-stage microwave amplifier, able to compensate for gain variations in the -54.75°C temperature range and 6.18-GHz frequency band, has been designed, realized, and measured. Analytical studies show that cascode configuration for the amplifiers is the best one to solve the problem. Measured results are in good agreement with the analysis.



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Optimization of the Schottky Varactor for Frequency Multiplier Applications at Submillimeter Wavelengths

J.T. Louhi and A.V. Raisanen. "Optimization of the Schottky Varactor for Frequency Multiplier Applications at Submillimeter Wavelengths." 1996 Microwave and Guided Wave Letters 6.6 (Jun. 1996 [MGWL]): 241-242.

Schottky varactor frequency multipliers are used to generate the all-solid-state local oscillator power at submillimeter wavelengths. The aim of this work was to develop a routine that can be used to optimize the electrical and geometrical parameters of the Schottky varactor in order to maximize the output power of the submillimeter wave Schottky varactor frequency multiplier. The optimization of the epitaxial layer thickness and doping density and the anode area significantly increases the maximum theoretical output power at the THz range.

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Patent Abstracts (Jun. 1996 [MGWL])

"Patent Abstracts (Jun. 1996 [MGWL])." 1996 Microwave and Guided Wave Letters 6.6 (Jun. 1996 [MGWL]): 243-248.



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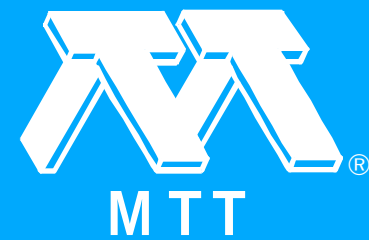
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High-Performance Ka-Band Monolithic Low-Noise Amplifiers Using 0.2- μm Dry-Recessed GaAs PHEMT's

Y. Kwon, D.S. Deakin, E.A. Sovero and J.A. Higgins. "High-Performance Ka-Band Monolithic Low-Noise Amplifiers Using 0.2- μm Dry-Recessed GaAs PHEMT's." 1996 Microwave and Guided Wave Letters 6.7 (Jul. 1996 [MGWL]): 253-255.

Ka-band ultra-low-noise amplifiers fabricated with a manufacturable dry-recess process are presented. Low-damage selective dry etching was used for gate recess to achieve uniform threshold voltage (V_{th}) and saturation current (I_{dss}). Threefold improvement in V_{th} uniformity was achieved in comparison with the wet recess process. Fabricated PHEMT low-noise amplifiers (LNA's) employing 0.2- μm mushroom gates showed an average noise figure of 2.2 dB from 31-36 GHz with an associated gain of 22.5 dB. At the design frequency of 35 GHz, the noise figure was less than 2 dB. This is among the best results ever reported for Ka-band LNA's.

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A DC-to-100-GHz InP HEMT 1:2 Distributor IC Using Distributed Amplification

Y. Imai, S. Kimura, T. Enoki and Y. Umeda. "A DC-to-100-GHz InP HEMT 1:2 Distributor IC Using Distributed Amplification." 1996 Microwave and Guided Wave Letters 6.7 (Jul. 1996 [MGWL]): 256-258.

This letter describes a 1:2 distributor IC for future very-high-speed optical communication systems. Wideband performance is obtained by applying a distributed amplification technique to a differential circuit. This IC uses a 0.μm-gate-length InAlAs/JnGaAs/InP HEMT and a coplanar-waveguide technology. It has a 3-dB bandwidth of 100 GHz with a low-frequency gain of -2.5 dB. Up to 100 GHz, return loss and isolation are better than -10 dB and -20 dB. We believe the bandwidth is the widest ever reported for multi-RF-port wideband IC's.

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Surface-Wave-Like Mode in Slot Line

J.-W. Sheen and Y.D. Lin. "Surface-Wave-Like Mode in Slot Line." 1996 Microwave and Guided Wave Letters 6.7 (Jul. 1996 [MGWL]): 259-261.

Propagation properties of the surface-wave-like mode in slot line are investigated with the spectral domain analysis. This surface-wave-like mode is an odd dominant mode with a magnetic wall symmetric plane placed at the center of the slot. Its field distribution is similar to that of the TMO mode supported by the surrounding structure. It exists in the lower frequency regime and evolves into a nonphysical and nonspectral real mode in the higher frequency regime. Unlike other surface-wave-like modes in planar transmission line, the surface-wave-like mode in slot line does not evolve into a leaky mode.

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Abstracts

A New Technique for Measuring the Permittivity and Loss Tangent of Cylindrical Dielectric Rods

W.R. Humbert and W.R. Scott, Jr.. "A New Technique for Measuring the Permittivity and Loss Tangent of Cylindrical Dielectric Rods." 1996 Microwave and Guided Wave Letters 6.7 (Jul. 1996 [MGWL]): 262-264.

A new technique is presented for measuring the permittivity and loss tangent of cylindrical dielectric rods. It is a resonant technique and exhibits highly accurate results for low-loss dielectrics. The finite-element method is used to model the measurement fixture. Also, a procedure is presented to characterize the surface resistance of the conducting walls. Experimental results are compared to previously reported values and are in excellent agreement.



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A Novel Frequency Divider Configuration for Micro- and Millimeter-Wave Signals

P. Nuchter and W. Menzel. "A Novel Frequency Divider Configuration for Micro- and Millimeter-Wave Signals." 1996 Microwave and Guided Wave Letters 6.7 (Jul. 1996 [MGWL]): 265-267.

A novel frequency divider configuration is presented that is based on the well-known regenerative frequency divider. In addition to a multiplier in the feedback loop--as originally suggested--an auxiliary frequency divider is included in the loop. The maximum operating frequency of the novel configuration can be close to twice the maximum input frequency of the auxiliary divider.



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Comparison of Thermal-Shunt and Flip-Chip HBT Thermal Impedances: Comment on "Novel HBT with Reduced Thermal Impedance" (Comments)

T. Jenkins, C. Bozada, R. Dettmer, J. Sewell, D. Via, J. Barrette, J. Ebel, G. DeSalvo, C. Havasy, L. Liou, T. Quach, J. Gillespie, C. Pettiford, C. Ito, K. Nakano and R. Anholt. "Comparison of Thermal-Shunt and Flip-Chip HBT Thermal Impedances: Comment on "Novel HBT with Reduced Thermal Impedance" (Comments)." 1996 Microwave and Guided Wave Letters 6.7 (Jul. 1996 [MGWL]): 268-269.

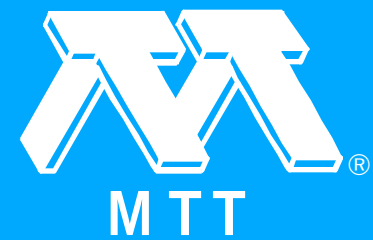
As indicated in the above letter, reducing thermal impedance is a key to increasing heterojunction bipolar transistor (HBT) power densities. Also, as indicated by the above letter and others, several competing technologies are evolving to reduce the thermal impedance of HBT's. This comment specifically addresses the question: Does the flip-chip technology proposed in the above letter offer significantly lower HBT thermal impedance than the thermal-shunt technology?



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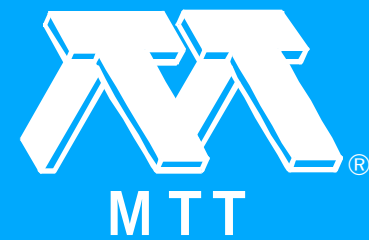
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Call for Papers - Microwave and Millimeter-Wave Photonics II (Jul. 1996 [MGWL])

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Electromagnetic Scattering Solution of Conducting Strips in Layered Media Using the Fast Multipole Method

L. Gurel and M.I. Aksun. "Electromagnetic Scattering Solution of Conducting Strips in Layered Media Using the Fast Multipole Method." 1996 Microwave and Guided Wave Letters 6.8 (Aug. 1996 [MGWL]): 277-279.

The fast multipole method (FMM) is applied to the solution of the electromagnetic scattering problems in layered media for the first time. This is achieved by using closed-form expressions for the spatial-domain Green's functions for layered media. Until now, the FMM has been limited to the homogeneous-medium problems. An integral equation based on the two-dimensional scalar Helmholtz equation is solved to compute the electromagnetic scattering from sample geometries of conducting strips in layered media in order to demonstrate the accuracy and the efficiency of the new method.

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Free-Space RF Triggering of an Active Antenna with Series-Connected Tunneling Diodes

O. Boric-Lubecke, D.-S. Pan and T. Itoh. "Free-Space RF Triggering of an Active Antenna with Series-Connected Tunneling Diodes." 1996 Microwave and Guided Wave Letters 6.8 (Aug. 1996 [MGWL]): 280-282.

Connecting several tunneling diodes--resonant tunneling diodes (RTD's) or tunnel diodes--in series has been shown to be a feasible method for increasing the output power and stability of oscillator circuits using these devices. However, such oscillators require special means of triggering due to biasing difficulties associated with their dc instability. RF triggering was proven to be an effective method of initiating such an oscillation in one-port circuits. An experimental demonstration of free-space RF triggering of an active antenna with a series connection is described here. Active antenna circuits offer excellent isolation between the triggering and oscillation signals and a favorable configuration for spatial power-combining arrays.

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Acoustooptically Controlled True Time Delays: Experimental Results

W.D. Jemison, T. Yost and P.R. Herczfeld. "Acoustooptically Controlled True Time Delays: Experimental Results." 1996 Microwave and Guided Wave Letters 6.8 (Aug. 1996 [MGWL]): 283-285.

A novel microwave true time delay system that uses high-speed optical intensity modulation in conjunction with acoustooptic deflection to address discrete fiber-optic delay lines has been proposed and analyzed. This letter presents experimental results that demonstrate this time delay technique using a typical pulse modulated radar waveform. Ultimately, this technique could be implemented in an integrated optics configuration to provide a small, lightweight, and high-performance time delay unit for modern phased array systems.

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On the Relationship Between Schottky Barrier Capacitance and Mixer Performance at Cryogenic Temperatures

R.R. Romanofsky. "On the Relationship Between Schottky Barrier Capacitance and Mixer Performance at Cryogenic Temperatures." 1996 Microwave and Guided Wave Letters 6.8 (Aug. 1996 [MGWL]): 286-288.

The flat-band voltage is the Schottky junction voltage required to shrink the depletion width to zero. At cryogenic temperatures, mixer diodes are generally biased and/or pumped beyond the flat-band condition to minimize conversion loss and noise figure. This occurs despite the presumed sharp increase in junction capacitance near flat-band, which should instead limit mixer performance. Past moderate forward bias, the diode C-V relationship is difficult to measure. A simple analytic expression for C(V) is usually used to model and predict mixer performance. This letter provides experimental data on C(V) at 77 K based on a microwave measurement and modeling technique. Data is also provided on the conversion loss of a singly balanced mixer optimized for 77 K operation. The connection between junction capacitance, flat-band potential, and conversion loss is examined. It is shown that the analytic expression greatly overestimates the junction capacitance that occurs as flat-band is approached.



Exceeding the Courant Condition with the FDTD Method

D.M. Sullivan. "Exceeding the Courant Condition with the FDTD Method." 1996 Microwave and Guided Wave Letters 6.8 (Aug. 1996 [MGWL]): 289-291.

The finite-difference time-domain (FDTD) method is a time-domain implementation of Maxwell's equations that has found a broad range of applications in electromagnetic simulation. A fundamental stability consideration is the Courant condition, which dictates that the time steps used must be long enough to allow the electromagnetic (EM) field to propagate across a cell at the speed of light. A method is described that, under certain circumstances, allows the Courant condition to be exceeded, resulting in a substantially faster computation.



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High T_c Superconducting CPW Bandstop Filters

S. Wallage, J.L. Tauritz, P. Hadley, L. Lander and J.E. Mooij. "High T_c Superconducting CPW Bandstop Filters." 1996 Microwave and Guided Wave Letters 6.8 (Aug. 1996 [MGWL]): 292-294.

We have designed and tested a superconducting coplanar waveguide bandstop filter. At a center frequency of 2.84 GHz, a 94% bandwidth low-pass Chebychev design resulted in a filter with less than 0.5 dB in the passband and more than 40-dB insertion loss in the stopband at 35 K. The filter was fabricated by dry etching a laser ablated YBa₂Cu₃O₇ layer on a LaAlO₃ substrate. Using a cold-wafer probe, accurate, calibrated measurements on the filter and individual lines sections were carried out.

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



Finite-Difference Analysis of Structures Consisting of Roundly and Rectangularly Shaped Domains

H. Klingbeil, K. Beilenhoff and H.L. Hartnagel. "Finite-Difference Analysis of Structures Consisting of Roundly and Rectangularly Shaped Domains." 1996 Microwave and Guided Wave Letters 6.8 (Aug. 1996 [MGWL]): 295-297.

A new method is presented that allows the analysis of a combination of both circularly and rectangularly shaped subdomains in the same structure. The method is based on the use of polygonal grids in connection with the finite-difference method in the frequency domain. The convergence behavior of this new efficient algorithm is analyzed and compared to conventional stair-case approximations for a circular waveguide. Finally, the dispersion characteristic of a square waveguide with a circular dielectric rod is presented.



Abstracts

Comparison of Thermal-Shunt and Flip-Chip HBT Thermal Impedances: Comment on Novel HBT with Reduced Thermal Impedance (Comment and Reply)

D. Hill, A. Khatibzadeh, W. Liu, T. Kim and P. Ikalainen. "Comparison of Thermal-Shunt and Flip-Chip HBT Thermal Impedances: Comment on Novel HBT with Reduced Thermal Impedance (Comment and Reply)." 1996 Microwave and Guided Wave Letters 6.8 (Aug. 1996 [MGWL]): 298-298.

We would like to take this opportunity to respond to the above comment by Jenkins et al., who raise some good points that we would like to address concerning our letter. However, the primary point of their comment is to question whether flip-chip heterojunction bipolar transistors (HBT's) offer any advantage over the thermal-shunt technology developed by Bayraktaroglu et al. This question has been answered unambiguously in a recent report by Bayraktaroglu et al. that directly compared the thermal resistance of thermal-shunt and flip-chip devices. In this report, flip-chip devices on the average had 37% lower thermal resistance compared to conventional thermally shunted devices of similar size.



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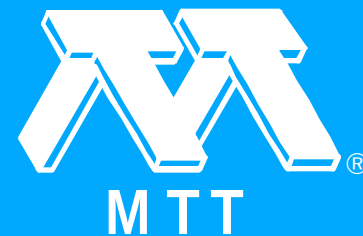


Abstracts

An Accurate Broad-Band Measurement of Substrate Dielectric Constant (Correction)

M.-Q. Lee and S. Nam. "An Accurate Broad-Band Measurement of Substrate Dielectric Constant (Correction)." 1996 Microwave and Guided Wave Letters 6.8 (Aug. 1996 [MGWL]): 299-299.

Since the connector shown in our letter is generally reciprocal, the determinant of the chain matrix of measurements is unity.



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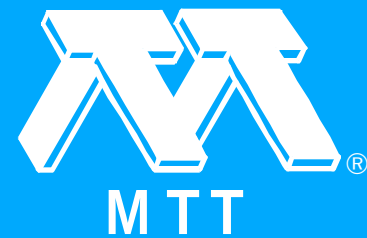
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Directions for the Next Generation of MMIC Devices and Systems (Advertisement) (Aug. 1996 [MGWL])

"Directions for the Next Generation of MMIC Devices and Systems (Advertisement) (Aug. 1996 [MGWL])." 1996 Microwave and Guided Wave Letters 6.8 (Aug. 1996 [MGWL]): 307-307.



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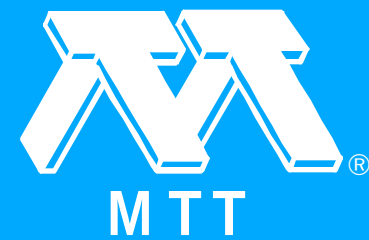
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Call for Papers - Microwave and Millimeter-Wave Photonics II (Aug. 1996 [MGWL])

"Call for Papers - Microwave and Millimeter-Wave Photonics II (Aug. 1996 [MGWL])." 1996 Microwave and Guided Wave Letters 6.8 (Aug. 1996 [MGWL]): 308-308.



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Guided Surface Waves in Photoconductive Excitation

S.A. Shah, A. Zeng, M.K. Jackson, L. Pouliot, A. Lecours and J.F. Currie. "Guided Surface Waves in Photoconductive Excitation." 1996 Microwave and Guided Wave Letters 6.9 (Sep. 1996 [MGWL]): 309-311.

We have used electrooptic sampling to measure photoconductively generated signals on coplanar striplines. We observe a new feature in the measured signal that we attribute to photoconductively-excited surface waves. Measurements at positions laterally displaced from the center of the transmission line show that when the substrate is thin, this signal is confined to the region of the electrodes. We also show that this feature, which can interfere with accurate device characterization, can be eliminated by delaying it out of the time window of interest.

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Ultra-Low-Noise Microwave Oscillator with Advanced Phase Noise Suppression System

E.N. Ivanov, M.E. Tobar and R.A. Woode. "Ultra-Low-Noise Microwave Oscillator with Advanced Phase Noise Suppression System." 1996 Microwave and Guided Wave Letters 6.9 (Sep. 1996 [MGWL]): 312-314.

An advanced phase noise reduction technique has been developed to improve the short-term frequency stability of microwave oscillators. The technique is based upon an ultra-sensitive microwave frequency discriminator with effective noise temperature close to its physical temperature. The phase noise spectral density of a 9 GHz microwave loop oscillator incorporating such a discriminator has been measured as -120 dBc/Hz and -150 dBc/Hz at offset frequencies of 100 Hz and 1 kHz, respectively. This performance is at least 25 dB better than current state of the art. The developed phase noise reduction technique is quite general and can have valuable implications for the design of various low phase noise microwave oscillators.

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W-Band SPST Transistor Switches

H. Takasu, F. Sasaki, H. Kawasaki, H. Tokuda and S. Kamihashi. "W-Band SPST Transistor Switches." 1996 Microwave and Guided Wave Letters 6.9 (Sep. 1996 [MGWL]): 315-316.

A single-pole, single-throw (SPST) transistor switch has been developed. Three types of switches, that is, GaAs MESFET, AlGaAs/GaAs HEMT, and pseudomorphic HEMT (PM-HEMT), have been fabricated, and the performances at W-band are compared. To reduce on-state resistance and off-state capacitance, a gate length was varied as a parameter. Moreover, an inductance for resonance was installed in parallel to the off-state capacitance between source and drain to obtain a high isolation. A relatively low insertion loss of 1.6 dB and a high isolation over 20 dB at W-band have been obtained from the 0.8- μ m gate length PM-HEMT.





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Monolithic Integration of AlGaAs/GaAs HBT and GaAs Junction-Gate Floated Electron Channel Field Effect Transistor Using Selective MOCVD Growth

H. Shin, J.-H. Son and Y.-S. Kwon. "Monolithic Integration of AlGaAs/GaAs HBT and GaAs Junction-Gate Floated Electron Channel Field Effect Transistor Using Selective MOCVD Growth." 1996 Microwave and Guided Wave Letters 6.9 (Sep. 1996 [MGWL]): 317-319.

A novel GaAs BiFET structure based on AlGaAs/GaAs HBT and GaAs junction-gate floated electron channel field effect transistor (J-FECFET) has been developed. Selective metalorganic chemical vapor deposition (MOCVD) growth is extensively used for the BiFET. Structural advantage of the BiFET is that the epitaxial layers of J-FECFET is identical with the lower part of a conventional heterojunction bipolar transistor (HBT). Transconductance of the fabricated J-FECFET with $1 \times 200 \mu\text{m}^2$ gate is 102 mS/mm with $f_{\text{sub T}}$ and $f_{\text{sub MAX}}$ of 10.7 GHz and 27.3 GHz, respectively. DC current gain of HBT is 21 at a collector current density of 50 KA/cm² with emitter area of $3 \times 2 \mu\text{m}^2$. The new integration technology offer a foundation for development of various multifunction monolithic microwave integrated circuits (MMIC's).





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Locking Range of a Hybrid Mode-Locked Monolithic DBR Semiconductor Laser at Millimeter-Wave Frequencies

D. Novak, D.Y. Kim, H.-F. Liu, Z. Ahmed and Y. Ogawa. "Locking Range of a Hybrid Mode-Locked Monolithic DBR Semiconductor Laser at Millimeter-Wave Frequencies." 1996 Microwave and Guided Wave Letters 6.9 (Sep. 1996 [MGWL]): 320-322.

We present the first investigation of the detuning characteristics at 33 GHz of a hybrid mode-locked monolithic distributed Bragg reflector semiconductor laser. Hybrid mode-locking is achieved by applying a radio-frequency (rf) signal, at a frequency corresponding to the fundamental laser repetition frequency, to the saturable absorber of the passively mode-locked laser. Measurements show a 3-dB locking range greater than 40 MHz with an applied external rf signal power of 0 dBm. At this power level, the laser beat signal exhibited phase-noise less than -78 dBc/Hz and -93 dBc/Hz at 10 kHz and 5 MHz offsets, respectively.

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Comparison of Microwave Inductors Fabricated on Silicon-on-Sapphire and Bulk Silicon

R.A. Johnson, C.E. Chang, P.M. Asbeck, M.E. Wood, G.A. Garcia and I. Lagnado.

"Comparison of Microwave Inductors Fabricated on Silicon-on-Sapphire and Bulk Silicon." 1996 Microwave and Guided Wave Letters 6.9 (Sep. 1996 [MGWL]): 323-325.

Inductors are important elements of microwave circuits that frequently require high self-resonant frequencies and high quality factors. In this work, circular spiral inductors fabricated on silicon-on-sapphire (SOS) and bulk silicon are compared. Due to the low-loss dielectric substrate, SOS inductors showed both higher self-resonant frequencies and higher quality factors than those fabricated on bulk silicon. Small-signal models extracted for the inductors confirm that the degradation of the inductor characteristics in bulk silicon stems from losses in the substrate.

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Abstracts

A New Approach to Designing Active MMIC Tuning Elements Using Second-Generation Current Conveyors

J.H. Sinsky and C.R. Westgate. "A New Approach to Designing Active MMIC Tuning Elements Using Second-Generation Current Conveyors." 1996 Microwave and Guided Wave Letters 6.9 (Sep. 1996 [MGWL]): 326-328.

A new method for designing active monolithic microwave integrated circuit (MMIC) tuning elements is proposed. It will be shown that by using a cascade of GaAs FET's, one can closely model a second-generation current conveyor (CCII-) at microwave frequencies and thus synthesize many types of microwave circuit elements, including positive and negative active capacitors and inductors, and gyrators. As a result of this discovery, current conveyor synthesis techniques can now be directly applied to microwave circuit design.



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Integrated Planar NRD Oscillator Suitable for Low-Cost Millimeter-Wave Applications

K. Wu and L. Han. "Integrated Planar NRD Oscillator Suitable for Low-Cost Millimeter-Wave Applications." 1996 Microwave and Guided Wave Letters 6.9 (Sep. 1996 [MGWL]): 329-331.

A class of oscillators are proposed on the basis of a hybrid integration of planar circuits and nonradiative dielectric (NRD) guide. Compared to the existing design procedure and the conventional geometry, the novel oscillator uses an NRD resonator made of low-loss and low-permittivity material coupled to planar oscillator through an aperture. This three-dimensional circuit design allows to have a complete symmetry of circuit and a build-in feedback loop. An HEMT-based experimental prototype shows that the novel scheme of oscillator design is attractive for use in the future low-cost millimeter-wave circuits and systems.

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Closed-Form Expression of Numerical Reflection Coefficient at PML Interfaces and Optimization of PML Performance

J. Fang and Z. Wu. "Closed-Form Expression of Numerical Reflection Coefficient at PML Interfaces and Optimization of PML Performance." 1996 Microwave and Guided Wave Letters 6.9 (Sep. 1996 [MGWL]): 332-334.

This letter presents a derivation of the closed-form expression of numerical reflection at interfaces of perfectly matched layer (PML). Reflection coefficients at single interfaces and of finite-thickness absorbers are presented. The derived closed-form expression is found to match identically with the reflection coefficient obtained directly through finite-difference time-domain computation. The closed-form expression of numerical reflection coefficient can significantly facilitate the optimization of PML performance.

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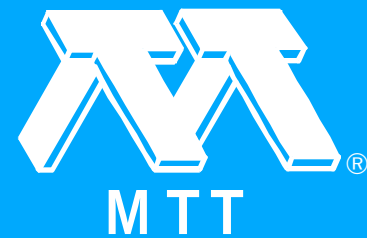


Abstracts

High-Performance PML Algorithms

Z. Wu and J. Fang. "High-Performance PML Algorithms." 1996 Microwave and Guided Wave Letters 6.9 (Sep. 1996 [MGWL]): 335-337.

This letter presents a revised finite-difference equation, applied at perfectly matched layer (PML) interfaces, that can lead to substantial reduction of numerical reflection from PML absorbers. The properties of the reflection coefficient of PML absorbers implemented with the revised finite-difference equation are studied. The effectiveness of the revised finite-difference equation is verified by numerical tests.



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A Two-Dimensional Finite Element Formulation of the Perfectly Matched Layer

A.C. Polycarpou, M.R. Lyons and C.A. Balanis. "A Two-Dimensional Finite Element Formulation of the Perfectly Matched Layer." 1996 Microwave and Guided Wave Letters 6.9 (Sep. 1996 [MGWL]): 338-340.

A perfectly matched layer (PML) is implemented using the finite element method (FEM) to successfully terminate the output port of a parallel-plate waveguide operating over a wide range of frequencies. The PML layer is modeled as a nonphysical anisotropic lossy material backed with a perfect electric conductor (PEC). Numerical results showing the reflection coefficient as a function of frequency, for both TEM and TM/sub 1/ propagation modes, demonstrate the effectiveness and accuracy of the PML concept as applied in the context of the FEM.

Click on title for a complete paper.



1-W SiGe Power HBT's for Mobile Communication

A. Schuppen, S. Gerlach, H. Dietrich, D. Wandrei, U. Seiler and U. Konig. "1-W SiGe Power HBT's for Mobile Communication." 1996 Microwave and Guided Wave Letters 6.9 (Sep. 1996 [MGWL]): 341-343.

Silicon Germanium (SiGe) Power heterobipolar transistors (HBT's) with 10 and 60 x 2.25 x 15 μ m² emitter fingers, respectively, were fabricated in a completely passivated manner by a production-like process. Each emitter stripe of the big transistors includes a ballast resistance of 6 Ω . Class A load pull measurements at 1.9 GHz revealed a power-added efficiency (PAE) of 44% at 1-W rf output power for the 60-stripes transistor. In addition, a ten-finger driver HBT reached a PAE of 72% at 0.9 GHz for class A/B operation.

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Time-Domain Methods for Microwave Structures (Advertisement) (Sep. 1996 [MGWL])

"Time-Domain Methods for Microwave Structures (Advertisement) (Sep. 1996 [MGWL])." 1996 Microwave and Guided Wave Letters 6.9 (Sep. 1996 [MGWL]): 351-351.



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Total Charge Capacitor Model for Short-Channel MESFET's

D. Webster, M. Darvishzadeh and D. Haigh. "Total Charge Capacitor Model for Short-Channel MESFET's." 1996 Microwave and Guided Wave Letters 6.10 (Oct. 1996 [MGWL]): 351-353.

Total charge models for short-channel metal-semiconductor field-effect transistors (MESFET'S) currently available in large-signal simulator packages such as SPICE give a poor description of the bias dependence of the gate capacitance. This letter describes a novel empirical model whose structure is deduced from the reconstructed total charge function derived from measured s-parameters. The new model gives a good overall fit to the observed gate capacitance behavior of a commercial monolithic microwave/millimeter-wave integrated circuit (MMIC) MESFET over a wide range of bias conditions and enables large-signal MESFET models to have a superior fit to measured s-parameters, giving greater confidence in design.

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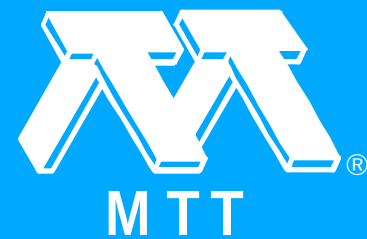


Abstracts

A Perturbation Procedure for Nearly Rectangular, Homogeneously Filled, Cylindrical Waveguides

B.J. McCartin. "A Perturbation Procedure for Nearly Rectangular, Homogeneously Filled, Cylindrical Waveguides." 1996 Microwave and Guided Wave Letters 6.10 (Oct. 1996 [MGWL]): 354-356.

The cut-off frequencies and propagating modes of a hollow cylindrical waveguide may be approximated by conformal mapping to a canonical domain followed by the numerical solution of a Helmholtz-like equation. This letter considers the problem of how these frequencies and modes change under a small perturbation of the bounding metallic walls. A procedure is herein presented that produces a perturbation expansion involving only computations in the unperturbed cross section, thus avoiding costly additional mappings. Moreover, the resulting analytical expressions for these frequencies and modes are then available for optimization of waveguide parameters. An application of this procedure is presented together with comparison to published numerical and experimental results.



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New Distributed Amplifier Design Using Transmission-Gate FET's

Y. Imai, S. Kimura, Y. Umeda and T. Enoki. "New Distributed Amplifier Design Using Transmission-Gate FET's." 1996 Microwave and Guided Wave Letters 6.10 (Oct. 1996 [MGWL]): 357-359.

We propose a new distributed amplifier design using a transmission-gate FET (TGFET) whose gate is embedded in the gate-artificial line. The new technique greatly simplifies the gate-artificial-line design, with no meandering or T-junction lines. The test TGFET distributed amplifier, using 0.1- μ m-gate-length InP HEMT's showed a promising bandwidth performance of 100 GHz.

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Modal Expansion of Dyadic Green's Functions of the Cylindrical Chirowaveguide

H.T. Hui and E.K.N. Yung. "Modal Expansion of Dyadic Green's Functions of the Cylindrical Chirowaveguide." 1996 Microwave and Guided Wave Letters 6.10 (Oct. 1996 [MGWL]): 360-362.

The dyadic Green's functions of the cylindrical chirowaveguide are derived by modal expansion. Bohren's decomposition of the electromagnetic field is used to obtain the vector wave functions. The magnetic dyadic Green's function that is purely solenoidal is first derived and the electric dyadic Green's function is then obtained by manipulating the magnetic dyadic Green's function. The singular term in the expression of the electric dyadic Green's function is reinstated through the manipulation procedure.

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Waveguide-to-Coupled Fin-Line Transition in Ka Band

J. de Mingo, A. Moliner and A. Comeron. "Waveguide-to-Coupled Fin-Line Transition in Ka Band." 1996 Microwave and Guided Wave Letters 6.10 (Oct. 1996 [MGWL]): 363-365.

A new broad-band transition from waveguide-to-coupled fin-line in its quasi-TEM mode is presented. The transition is proposed for low-noise amplifiers or low-noise converters in millimeter-wave bands. Experimental results on the Ka band show a 1 dB insertion loss for a back-to-back double transition over a 10 GHz band.

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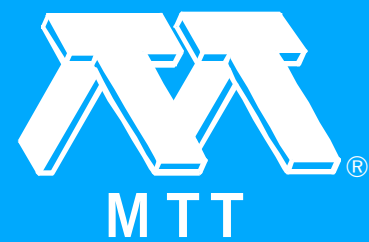
A High-Efficiency 94-GHz 0.15- μ m InGaAs/InAlAs/InP Monolithic Power HEMT Amplifier

R. Lai, G.I. Ng, D.C.W. Lo, T. Block, H. Wang, M. Biedenbender, D.C. Streit, P.H. Liu, R.M. Dia, E.W. Lin and H.C. Yen. "A High-Efficiency 94-GHz 0.15- μ m InGaAs/InAlAs/InP Monolithic Power HEMT Amplifier." 1996 Microwave and Guided Wave Letters 6.10 (Oct. 1996 [MGWL]): 366-368.

We report high efficiency W-band power monolithic microwave integrated circuits (MMIC's) using passivated 0.15 μ m gate length In/sub 0.53/ Ga/sub 0.47/ As/In/sub 0.52/ Al/ sub 0.48/ As/InP HEMT's. A 0.15 μ m x 320 μ m single stage InP power HEMT MMIC amplifier demonstrates a maximum power added efficiency of 23% with 40 mW output power and 4.9 dB power gain at 94 GHz. When biased for higher output power, 54 mW output power with 20% power added efficiency was achieved at 94 GHz. These results represent the best combination of efficiency and output power fixtured data reported to date at this frequency.

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Hybrid Boundary Contour Mode-Matching Analysis of Arbitrarily Shaped Waveguide Structures with Symmetry of Revolution

J.M. Reiter and F. Arndt. "Hybrid Boundary Contour Mode-Matching Analysis of Arbitrarily Shaped Waveguide Structures with Symmetry of Revolution." 1996 Microwave and Guided Wave Letters 6.10 (Oct. 1996 [MGWL]): 369-371.

A combined mode-matching/boundary contour mode-matching (MM/BCMM) technique is described for the rigorous and fast analysis of circular waveguide discontinuities including sections with arbitrarily shaped geometry with symmetry of revolution. The technique involves advantageously the flexibility of both the BCMM method for modeling waveguide regions of more general shape and the efficiency of the proven standard mode-matching (MM) method for circular waveguide step discontinuities. The usefulness of the hybrid method is demonstrated at the design of a spherical two-resonator filter fed by circular waveguides with circular irises. Excellent agreement with reference calculations for circular waveguide tapers verify the accuracy of the proposed method.

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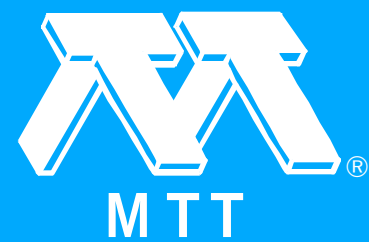
Miniaturized Wilkinson Power Divider Using Three-Dimensional MMIC Technology

K. Nishikawa, T. Tokumitsu and I. Toyoda. "Miniaturized Wilkinson Power Divider Using Three-Dimensional MMIC Technology." 1996 Microwave and Guided Wave Letters 6.10 (Oct. 1996 [MGWL]): 372-373.

A miniaturized Wilkinson power divider using three-dimensional (3-D) monolithic microwave integrated circuit (MMIC) technology is presented. The new power divider utilizes stacked thin film microstrip (TFMS) lines that sandwich a ground plane with a slit between the TFMS lines. The slit effectively widens the upper and lower TFMS-line widths, which makes it possible to stack high-impedance lines with a reasonable conductor strip width and lower loss. The proposed structure also exhibits a coupling between the quarter-wavelength conductor strips of less than -15 dB, simplifying the design for each TFMS line. A fabricated 15-25 GHz Wilkinson power divider, the area of which is only 0.31 mm x 0.52 mm, exhibits a coupling of -4.5 ± 0.5 dB, isolation of greater than 15 dB, and a phase deviation of less than 3 degrees.

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A Monolithic HEMT Passive Switch with Integrated HBT Standard Logic Compatible Driver for Phased-Array Applications

K.W. Kobayashi, A.K. Oki, L.B. Sjogren, D.K. Umemoto, T.R. Block and D.C. Streit. "A Monolithic HEMT Passive Switch with Integrated HBT Standard Logic Compatible Driver for Phased-Array Applications." 1996 Microwave and Guided Wave Letters 6.10 (Oct. 1996 [MGWL]): 375-377.

We have achieved the first demonstration of a monolithically integrated high electron mobility transistor (HEMT) passive switch with a heterojunction bipolar transistor (HBT) switch-driver circuit that represents key integrated mixed-signal functions. The HEMT-HBT monolithic microwave integrated circuit (MMIC) is fabricated using selective molecular beam epitaxy (MBE). The single HEMT series switch is driven by an HBT circuit that provides both level shifting and wide voltage drive swing to adequately turn the passive HEMT switch device on and off. The MMIC can be made compatible for operation from either standard TTL or CMOS control signals. The series $0.2 \times 200 \mu\text{m}^2$ passive HEMT switch achieves 1.6-2.9 dB insertion loss over a 50 MHz to 12 GHz band when the HEMT is turned on. The corresponding return-losses are >10 dB across the band. When the switch is turned off, the isolation ranges from >40 dB at 1 GHz and decreases to 15 dB at 12 GHz. This integrated HEMT switch and HBT switch driver MMIC represents a basic building block that can be applied to programmable phase shifters used in phased-array antenna applications and can result in a dramatic reduction in size and improvement in performance of these systems.





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A 75-110 GHz Automated Tuner with Exceptional Range and Repeatability

R. Drury, R.D. Pollard and C.M. Snowden. "A 75-110 GHz Automated Tuner with Exceptional Range and Repeatability." 1996 Microwave and Guided Wave Letters 6.10 (Oct. 1996 [MGWL]): 378-379.

A 75-110 GHz automated programmable tuner has been constructed displaying maximum reflection coefficients in excess of 0.9 (VSWR ≥ 19) over the majority of the band and typical repeatability of -45 dB. This tuner has been developed for on-wafer noise measurement applications at W-band.

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Micromachined Coplanar Waveguides in CMOS Technology

V. Milanovic, M. Gaitan, E.D. Bowen and M.E. Zaghloul. "Micromachined Coplanar Waveguides in CMOS Technology." 1996 Microwave and Guided Wave Letters 6.10 (Oct. 1996 [MGWL]): 380-382.

Coplanar waveguides were fabricated in standard complimentary metal-oxide semiconductor (CMOS) with post-processing micromachining. IC'S were designed with commercial CAD tools, fabricated through the MOSIS/sup 1/ service, and subsequently suspended by maskless top-side etching. Absence of the lossy silicon substrate after etching results in significantly improved insertion loss characteristics, dispersion characteristics, and phase velocity. Measurements were performed at frequencies from 1 to 40 GHz, before and after micromachining. These show improvement in loss characteristics of orders of magnitude. For the micromachined line, loss does not exceed 4 dB/cm. Before etching, loss as high as 38 dB/cm is measured. Phase velocity $V_{\text{sub P}} / c$ is achieved for the micromachined line,

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Abstracts

Progress Toward Solid-State Local Oscillators at 1 THz (Corrections)

T.W. Crowe, T.C. Grein, R. Zimmermann and P. Zimmermann. "Progress Toward Solid-State Local Oscillators at 1 THz (Corrections)." 1996 Microwave and Guided Wave Letters 6.10 (Oct. 1996 [MGWL]): 383-383.

In the above letter, the phrase "250 mW output," which appears in the first line of the Abstract, should read "250 microwatts output." This error occurred during final production of the letter after review by the authors.



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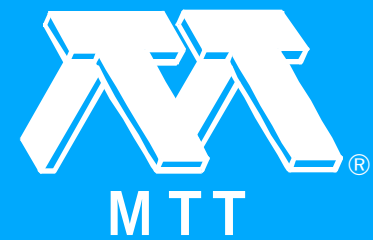
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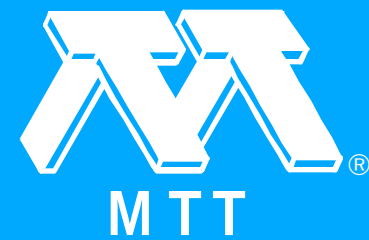
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Special Issue on Time Frequency Analysis (Announcement) (Oct. 1996 [MGWL])

*"Special Issue on Time Frequency Analysis (Announcement) (Oct. 1996 [MGWL])." 1996
Microwave and Guided Wave Letters 6.10 (Oct. 1996 [MGWL]): 394-394.*



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Novel Low-Loss Delay Line for Broadband Phased Antenna Array Applications

W.-M. Zhang, R.P. Hsia, C. Liang, G. Song, C.W. Domier and N.C. Luhmann, Jr.. "Novel Low-Loss Delay Line for Broadband Phased Antenna Array Applications." 1996 Microwave and Guided Wave Letters 6.11 (Nov. 1996 [MGWL]): 395-397.

The microwave propagation velocity along a nonlinear transmission line is a function of dc bias, hence, a nonlinear transmission line (NLTL) can be utilized as a broadband delay line. A hybrid NLTL has been fabricated in a proof-of-principle experimental concept test where a 1.1-ns true time delay with <4-dB insertion loss has been measured in good agreement with theory. A 2 x 2 NLTL-based antenna array has been utilized to demonstrate beam steering at 5 GHz. Using parameters appropriate to varactors tested by our group at 60 GHz, a monolithic NLTL is predicted to exhibit <3.4-dB insertion loss and 200 ps delay at 20 GHz.

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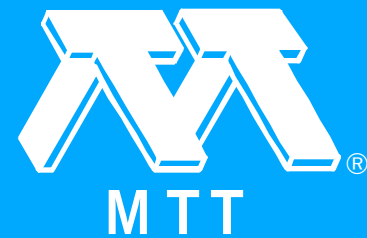


Abstracts

A Coplanar 38-GHz SiGe MMIC Oscillator

C.N. Rheinfelder, F. Beisswanger, J. Gerdes, F.J. Schmuckle, K.M. Strohm, J.-F. Luy and W. Heinrich. "A Coplanar 38-GHz SiGe MMIC Oscillator." 1996 Microwave and Guided Wave Letters 6.11 (Nov. 1996 [MGWL]): 398-400.

Design, technology, and first results of a coplanar Si-SiGe HBT oscillator monolithically integrated on high-resistivity silicon are reported. At 38 GHz, an oscillator output power of 2 dBm with a conversion (dc to rf) efficiency of 6% is measured.



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A Transversal Filter Using CPW Directional Couplers

Y. Ida, N. Imai and E. Ogawa. "A Transversal Filter Using CPW Directional Couplers." 1996 Microwave and Guided Wave Letters 6.11 (Nov. 1996 [MGWL]): 401-403.

A transversal filter using coplanar waveguide (CPW) directional couplers and no active devices has been proposed. It aims to be free from the noise figure problems found in an active transversal filter and also aims to show it can be easily realized with a single-layer structure when the bandwidth is narrower than about 30%. Two types of CPW directional couplers were employed. When using G-S-G-S-G-type directional couplers, connecting section influences between strong and weak couplers were successfully suppressed.





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A 180° Out-of-Phase Power Divider Using Asymmetrical Coplanar Stripline

L. Fan and K. Chang. "A 180° Out-of-Phase Power Divider Using Asymmetrical Coplanar Stripline." 1996 Microwave and Guided Wave Letters 6.11 (Nov. 1996 [MGWL]): 404-406.

This letter presents a new uniplanar 3-dB power divider using an asymmetrical coplanar stripline (ACPS) for microwave integrated circuit (MIC) and microwave and millimeter-wave integrated circuit (MMIC) applications. The circuit having 180° out-of-phase between two output ports provides good performance as compared to conventional microstrip power dividers.

Experimental results for the power divider show an amplitude imbalance of 0.4 dB and a phase difference of $180^\circ \pm 1^\circ$ over a wide bandwidth from 2.5 to 3.5 GHz.

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Specifications for a Linear Network Simultaneously Noise and Available-Power Matched

L. Boglione, R.D. Pollard, V. Postoyalko and T. Alam. "Specifications for a Linear Network Simultaneously Noise and Available-Power Matched." 1996 Microwave and Guided Wave Letters 6.11 (Nov. 1996 [MGWL]): 407-409.

This letter addresses the problem of designing a linear lossy input matching network for low-noise amplifiers so that the source impedance can deliver its available power and correspond to the minimum noise figure of the driven stages. The differences between lossless and lossy networks are highlighted because matching circuits are usually considered to be lossless when designing an amplifier. After stating the assumptions, a solution to the problem of the minimum number of elements fulfilling the requirements is developed. The result explains why the standard distributed approach often fails to cope with minimum noise specifications when practical elements are considered.

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A New TLM Node for Berenger's Perfectly Matched Layer

N. Pena and M.M. Ney. "A New TLM Node for Berenger's Perfectly Matched Layer." 1996 Microwave and Guided Wave Letters 6.11 (Nov. 1996 [MGWL]): 410-412.

A new two-dimensional (2-D) transmission-line matrix (TLM) node for the modeling of perfectly matched layer (PML) media is presented. A rigorous field formulation of the 2-D TLM node allows one to construct a node that has a scattering matrix fully compatible with the standard 2-D hybrid node. This approach avoids the coupling of the TLM algorithm with a finite difference time-domain (FDTD) approximation of PML field differential equations. The simulation of a wideband matched load for a WR-28 rectangular waveguide is presented for validation. A return loss better than 60 dB is obtained over the 25-40 GHz-frequency band.

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Modal Cross Power in Quasi-TEM Transmission Lines

D.F. Williams and F. Olyslager. "Modal Cross Power in Quasi-TEM Transmission Lines." 1996 Microwave and Guided Wave Letters 6.11 (Nov. 1996 [MGWL]): 413-415.

This letter examines modal cross power in electromagnetic transmission lines. It shows that the cross powers of nearly degenerate modes may be large in quasi-TEM multiconductor transmission lines typical of modern electronic circuits at moderate and low microwave frequencies. The letter develops simple expressions to estimate the magnitude of these cross powers from the "power-normalized" conductor impedance and admittance matrices of the lines.

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Wave Propagation in a Periodic Microstrip Line on a Multilayered Anisotropic Substrate

I.S. Nefedov. "Wave Propagation in a Periodic Microstrip Line on a Multilayered Anisotropic Substrate." 1996 Microwave and Guided Wave Letters 6.11 (Nov. 1996 [MGWL]): 416-418.

An efficient spectral domain full-wave algorithm based on 4×4 transfer matrix and integral equation method is developed for the periodic microstrip line on the multilayered anisotropic substrate. The substrate may consists of arbitrary number of layers whose permittivity and permeability are tensors of general form. It is shown, that in some cases, the quasistatic approach for calculations of characteristics of the dominant mode may be invalid even at very small frequencies. The method may be used for simulation of integrated circuits, which include anisotropic layers.

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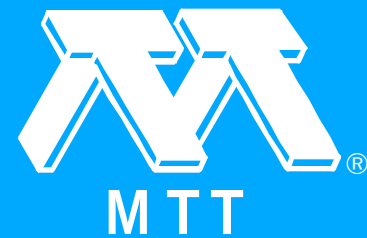


Abstracts

Integrated FDTD and Solid-State Device Simulation

P. Ciampolini, L. Roselli and G. Stopponi. "Integrated FDTD and Solid-State Device Simulation." 1996 Microwave and Guided Wave Letters 6.11 (Nov. 1996 [MGWL]): 419-421.

A mixed-mode circuit simulation technique is presented, based on the lumped-element finite-difference time-domain (FDTD) scheme. The algorithm is extended to incorporate numerical models of lumped devices. This makes the formulation and characterization of analytical, closed-form models for circuit devices unnecessary and allows for directly correlating device behavior and fabrication process parameters. The code is therefore especially suited for high-speed and microwave IC optimization.



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New Prospects for Time Domain Analysis (Comments and Authors' Reply)

W.Y. Tam, M. Krumpholz and L.P.B. Katehi. "New Prospects for Time Domain Analysis (Comments and Authors' Reply)." 1996 Microwave and Guided Wave Letters 6.11 (Nov. 1996 [MGWL]): 422-424.

In the above letter, a new multiresolution time-domain scheme (S-MRTD) was applied to reduce the Maxwell's equations into difference equations using the method of moments with cubic spline Battle-Lemarie scaling functions. Their results showed that a highly linear dispersion characteristic was achieved when it is compared with the Yee's finite-difference time-domain (FDTD) scheme. I would like to point out, however, that the second-order accuracy finite-difference approximation is used in the Yee's scheme and the new scheme employs the form similar to the eighteenth-order accuracy approximation so that we have to compare the new scheme with the higher-order accuracy Yee's FDTD scheme. For simplicity, only the wave propagating in the x-direction with y-directed electric field is considered.

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A Quasi-Optical Isolator (Comment and Authors' Reply)

J.J. Taub, S. Hollung and Z. Popovic. "A Quasi-Optical Isolator (Comment and Authors' Reply)." 1996 Microwave and Guided Wave Letters 6.11 (Nov. 1996 [MGWL]).

In the above letter, the authors describe an interesting design of a linear-to-circular polarizer. Their use of six cascaded printed gratings is indeed a practical way to realize this type of quasioptical isolator. Their use of a resistor loaded grid is a good way to absorb the reflected wave.

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Abstracts

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MEMS Orientational Optomechanical Media for Microwave Nonlinear Applications

B. Tsap, K.S.J. Pister and H.R. Fetterman. "MEMS Orientational Optomechanical Media for Microwave Nonlinear Applications." 1996 Microwave and Guided Wave Letters 6.12 (Dec. 1996 [MGWL]): 432-434.

The fabrication and testing of orientational optomechanical media suitable for microwave phase conjugation is described. It consists of metal-coated dielectric elongated beams $1\text{ mm} \times 100\text{ }\mu\text{m} \times 10\text{ }\mu\text{m}$ suspended by nonconductive torsional springs attached to a microwave transparent frame. Rotation of single elements, in a polarized electromagnetic field at 15 GHz, was measured and found to be in a good agreement with theory. This first experimental implementation of using microelectromechanical structures (MEMS) for nonlinear microwave devices demonstrates the potential of an entirely new class of devices.

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Weighted Haar Wavelet-Like Basis for Scattering Problems

W.Y. Tam. "Weighted Haar Wavelet-Like Basis for Scattering Problems." 1996 Microwave and Guided Wave Letters 6.12 (Dec. 1996 [MGWL]): 435-437.

A class of wavelet-like basis functions orthonormal to the oscillatory functions with spatial frequency near the free space propagation constant is introduced to solve the scattering of a transition matrix (TM)-polarized plane wave due to a metallic strip. The electric field integral equation (EFIE) for the unknown surface current distribution is formulated. The method of moments with rectangular pulse basis functions and point matching is applied to discretize the integral equation into a matrix equation. The dense impedance matrix is transformed to a sparse matrix using compact support wavelet-like basis functions. The effects of the discretization size on the performance of the wavelet-like basis functions are presented.

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A Novel Wavelet Based Time Domain Simulation Approach

M. Werthen and I. Wolff. "A Novel Wavelet Based Time Domain Simulation Approach." 1996 Microwave and Guided Wave Letters 6.12 (Dec. 1996 [MGWL]): 438-440.

A novel time domain simulation approach for analyzing three-dimensional (3-D) passive microwave structures is presented. The electromagnetic fields of the structure under investigation are expanded into a hierarchical system of wavelets and scaling functions for all three dimensions leading to a stable, multiscale algorithm. By neglecting small wavelet coefficients and thereby reducing the computational effort, this method is equivalent to a finite difference scheme with a time dynamic space adaptive grid. A brief overview of the main ideas and advantages of the new method as well as the results of two numerical examples are given.

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Abstracts

A 5-GHz High-Efficiency Class-E Oscillator

E.W. Bryerton, W.A. Shiroma and Z.B. Popovic. "A 5-GHz High-Efficiency Class-E Oscillator." 1996 Microwave and Guided Wave Letters 6.12 (Dec. 1996 [MGWL]): 441-443.

A 5-GHz high-efficiency feedback oscillator using a class-E amplifier is presented. The oscillator is designed at 5.0 GHz for maximum conversion efficiency using only quasilinear simulation techniques. A maximum conversion efficiency of 59% is measured with an output power of 300 mW. The oscillator can also be biased for a maximum power of 600 mW with a conversion efficiency of 48%.



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A 0-to-40-GHz Direct-Coupled Distributed Baseband Amplifier IC with SCFL Interface

S. Kimura, Y. Imai and Y. Miyamoto. "A 0-to-40-GHz Direct-Coupled Distributed Baseband Amplifier IC with SCFL Interface." 1996 Microwave and Guided Wave Letters 6.12 (Dec. 1996 [MGWL]): 444-446.

We have developed a distributed baseband amplifier IC with a distributed source-coupled FET logic (SCFL) level transformer. The amplifier and the SCFL level transformer are directly coupled by a distributed level-shift circuit. The amplifier incorporates our new loss-compensation circuit to improve high-frequency performance. The IC, which was fabricated using commercially-available GaAs MESFET's, has a gain of 5 dB and a 0-to-41-GHz bandwidth. It can also output a 40-Gbit/s pulse waveform on the SCFL logic level, so it can be directly coupled to an SCFL logic circuit. This is the highest performance among all reported GaAs MESFET baseband amplifiers with an SCFL interface.

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Frequency Dependence of the Constitutive Parameters of Causal Perfectly Matched Anisotropic Absorbers

M. Kuzuoglu and R. Mittra. "Frequency Dependence of the Constitutive Parameters of Causal Perfectly Matched Anisotropic Absorbers." 1996 Microwave and Guided Wave Letters 6.12 (Dec. 1996 [MGWL]): 447-449.

Perfectly matched layers (PML's), which are employed for mesh truncation in the finite-difference time-domain (FDTD) or in finite element methods (FEM's), can be realized by artificial anisotropic materials with properly chosen permittivity and permeability tensors. The tensor constitutive parameters must satisfy the Kramers-Kronig relationships, so that the law of causality holds. These relations are used to relate the real and imaginary parts of the constitutive parameters of the PML media to deduce the asymptotic behaviors of these parameters at low and high frequencies.

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Abstracts

Asia-Pacific Abstracts (Dec. 1996 [MGWL])

"Asia-Pacific Abstracts (Dec. 1996 [MGWL])." 1996 Microwave and Guided Wave Letters 6.12 (Dec. 1996 [MGWL]): 450-496.



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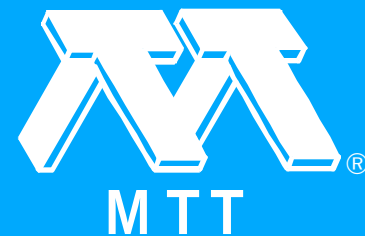


Abstracts

Welcome to the 1995 International Microwave Symposium - Microwaves on the Move

R. Henning and K. Huddleston. "Welcome to the 1995 International Microwave Symposium - Microwaves on the Move." 1995 MTT-S International Microwave Symposium Digest 95.1 (1995 Vol. 1 [MWSYM]): vii-vii.

A warm welcome to all who have come to visit Microwave Week. Your hosts, the IEEE's Microwave Theory and Techniques Society, and particularly its local members, have prepared a Smorgasbord of activities for you in their beautiful city of Orlando. We have striven to provide you with many choices - technical, social and entertaining.



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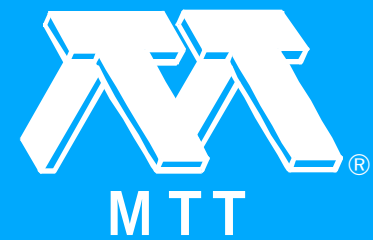
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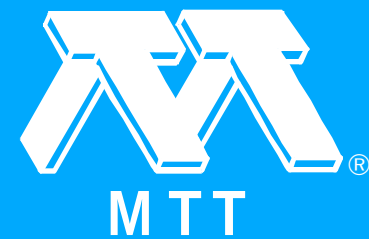
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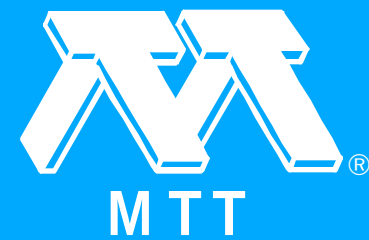
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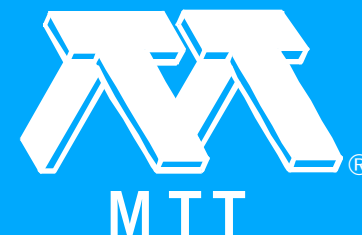
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Abstracts

Microwave Symposium Technical Program Schedule (1995 Vol. I [MWSYM])

"Microwave Symposium Technical Program Schedule (1995 Vol. I [MWSYM])." 1995 MTT-S International Microwave Symposium Digest 95.1 (1995 Vol. I [MWSYM]): xxxvii-lxxi.



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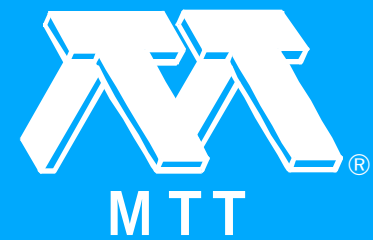
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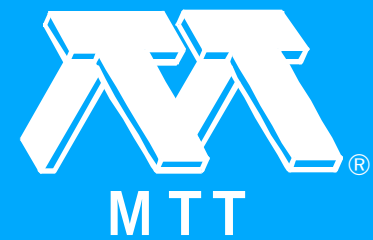
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Session TU1A -- Systems Applications

"Session TU1A -- Systems Applications." 1995 MTT-S International Microwave Symposium Digest 95.1 (1995 Vol. I [MWSYM]): 3-3.



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Abstracts

Performance of a 6 to 18 GHz Frequency Translator Utilizing GaAs MMIC 5-Bit Digital Phase Shifter (1995 Vol. I [MWSYM])

S.R. Mazumder and C.M. Isham. "Performance of a 6 to 18 GHz Frequency Translator Utilizing GaAs MMIC 5-Bit Digital Phase Shifter (1995 Vol. I [MWSYM])." 1995 MTT-S International Microwave Symposium Digest 95.1 (1995 Vol. I [MWSYM]): 5-8.

More than 22 dB of carrier and spurious suppression over 6 to 18 GHz has been achieved for a translator employing MMIC phase shifter. Trade-off of maximum allowed amplitude and phase errors versus number of bits are analyzed. For spurious levels < -29.8 dBc, the amplitude and phase errors must be $< \pm 0.83$ dB Figure and $< \pm 5.65$ degrees respectively.



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A 1.9 GHz-Band Ultra Low Power Consumption Amplifier Chip Set for Personal Communications (1995 Vol. I [MWSYM])

M. Muraguchi, M. Nakatsugawa, H. Hayashi and M. Aikawa. "A 1.9 GHz-Band Ultra Low Power Consumption Amplifier Chip Set for Personal Communications (1995 Vol. I [MWSYM])." 1995 MTT-S International Microwave Symposium Digest 95.1 (1995 Vol. I [MWSYM]): 9-12.

An ultra low power consumption amplifier chip set for the 1.9 GHz Japanese Personal Handy-Phone System (PHS) is presented. The chip set includes a linear power amplifier, a driver amplifier, and an LO switch amplifier. These amplifiers use Cascode FETs that provide low phase distortion, high gain, and low current operation. The power amplifier uses a new concept of a self-phase distortion compensation to achieve a record performance of 45 % power added efficiency with sufficient linearity. The driver amplifier has a gain of 13.5 dB with a low power consumption of 3mW (1mA, 3V). The LO switch amplifier is a new MMIC that has both switch and buffer amplifier functions. The switch amplifier has an output power of 3 dBm, a forward gain of 15 dB, and a reverse isolation of 35 dB with a low power consumption of 6mW (2mA, 3V).

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Miniature GPS Translator Module (1995 Vol. I [MWSYM])

J. Smuk, P. Katzin, V. Aparin and M. Shifrin. "Miniature GPS Translator Module (1995 Vol. I [MWSYM])." 1995 MTT-S International Microwave Symposium Digest 95.1 (1995 Vol. I [MWSYM]): 13-16.

A GaAs MMIC gain/frequency conversion chip set and its integration into a module which frequency translates the C/A-coded L1 GPS signals to the 2200-2290 MHz telemetry band for use in tracking artillery projectiles is demonstrated. The custom downconverter, upconverter and power amplifier MMICs which form the transmission chain as well as the 36 cm³ module which provides over 125dB of gain with 3dB noise figure, survives firing shock (of over 8,000G and operates from 0°C to 70°C are detailed.)

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Abstracts

Session TU1B -- Progress in Time-Domain Techniques

"Session TU1B -- Progress in Time-Domain Techniques." 1995 MTT-S International Microwave Symposium Digest 95.1 (1995 Vol. I [MWSYM]): 17-17.



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The Alternating Transmission Line Matrix (ATLM) Scheme

P. Russer and B. Bader. "The Alternating Transmission Line Matrix (ATLM) Scheme." 1995 MTT-S International Microwave Symposium Digest 95.1 (1995 Vol. I [MWSYM]): 19-22.

A novel alternating transmission line matrix scheme (ATLM) is presented where the TLM cells are subdivided into two subsets of mutually neighboring cells. Within each time step the state of one subset of cells is computed from the states of the neighboring cells at the previous time step. Compared with existing TLM schemes the numerical effort as well as the storage requirements are reduced by 50% without loss of accuracy. Furthermore, spurious solutions occurring in existing TLM schemes can be avoided by ATLM.

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Abstracts

Compensation of Coarseness Error in TLM Modeling of Microwave Structures with the Symmetrical Condensed Node

J.L. Herring and W.J.R. Hoefer. "Compensation of Coarseness Error in TLM Modeling of Microwave Structures with the Symmetrical Condensed Node." 1995 MTT-S International Microwave Symposium Digest 95.1 (1995 Vol. I [MWSYM]): 23-26.

The coarseness error inherent in a TLM simulation involving sharp edges is reduced by increasing the speed of pulse propagation around the discontinuity with only a local mesh modification. The implementation of the technique is described in detail and the method is applied to a narrow band E-plane filter.



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Abstracts

Application of the PML Absorbing Boundary Condition to the FDTD Analysis of Microwave Circuits

A. Bahr, A. Lauer and I. Wolff. "Application of the PML Absorbing Boundary Condition to the FDTD Analysis of Microwave Circuits." 1995 MTT-S International Microwave Symposium Digest 95.1 (1995 Vol. 1 [MWSYM]): 27-30.

The perfectly matched layer (PML) absorbing boundary condition is extended for the FDTD calculation of microwave circuits including dielectric boundaries. In addition a new source formulation is proposed, which becomes possible by the use of the PML. The theory is validated by the comparison of measured and calculated results for several microstrip components. It is shown, that the PML can be placed in the extreme nearfield of the structures under investigation without loss of accuracy.



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Abstracts

A Stretched Coordinate Technique for Numerical Absorption of Evanescent and Propagating Waves in Planar Waveguiding Structures (1995 Vol. I [MWSYM])

M.A. Gribbons, W.P. Pinello and A.C. Cangellaris. "A Stretched Coordinate Technique for Numerical Absorption of Evanescent and Propagating Waves in Planar Waveguiding Structures (1995 Vol. I [MWSYM])." 1995 MTT-S International Microwave Symposium Digest 95.1 (1995 Vol. I [MWSYM]): 31-34.

Berenger's PML technique is modified to allow for the absorption of evanescent waves, as well as propagating waves, in FDTD modeling of wave propagation in planar waveguiding structures. Analytical results are used to illustrate the validity and capability of the proposed modification. Results from FDTD and compact 2D-FDTD simulations demonstrate its performance.



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Abstracts

A Broadband Absorbing Boundary Condition for the FDTD Modeling of Circular Waveguides

T.G. Jurgens. "A Broadband Absorbing Boundary Condition for the FDTD Modeling of Circular Waveguides." 1995 MTT-S International Microwave Symposium Digest 95.1 (1995 Vol. I [MWSYM]): 35-38.

This paper outlines Berenger's Perfectly Matched Layer absorbing boundary condition applied to the Finite Difference Time Domain modeling of circular waveguides. The model employs a cylindrical body of revolution coordinate system.



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Treatment of Instabilities of One-Way Equation Absorbing Boundary Conditions Using Digital Filters

C. Eswarappa and W.J.R. Hoefer. "Treatment of Instabilities of One-Way Equation Absorbing Boundary Conditions Using Digital Filters." 1995 MTT-S International Microwave Symposium Digest 95.1 (1995 Vol. 1 [MWSYM]): 39-42.

This paper presents a general solution to the difficult problem of treating instabilities of one-way equation (local) absorbing boundary conditions in time domain electromagnetic simulations. Digital filters have been inserted between the mesh and the absorbing boundaries to filter out the high frequency numerical noise generated by the absorbing boundary interpolation equations. The problem arising out of the finite delay of the digital filters has been solved by making the filter delay equal to the time delay in the longer link lines of the graded mesh. By adopting this technique, instabilities have been eliminated.

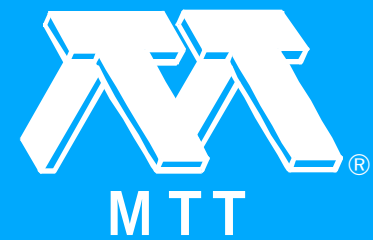
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Abstracts

Session TU1C -- Photonic Devices

"Session TU1C -- Photonic Devices." 1995 MTT-S International Microwave Symposium Digest 95.1 (1995 Vol. I [MWSYM]): 43-43.



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Ultrahigh Speed Cryogenic Laser Diodes for Broadband Optical Fiber Link Applications

R.-C. Yu, R. Nagarajan, T. Reynolds, J.E. Bowers, M. Shakouri, J. Park, K.Y. Lau, C.-E. Zah, W. Zou and J. Merz. "Ultrahigh Speed Cryogenic Laser Diodes for Broadband Optical Fiber Link Applications." 1995 MTT-S International Microwave Symposium Digest 95.1 (1995 Vol. I [MWSYM]): 45-48.

In this paper, we present the first systematic study of the temperature dependence of the high speed performance of various laser diodes from room temperature down to 10K. We found that as the threshold current of these diodes decreases by at least an order of magnitude at low temperatures, the modulation bandwidth is dramatically improved. The best result is 27 GHz at 100K for an InGaAsP multiple quantum well laser. We also present experiments on a broadband optical fiber link utilizing a cooled laser diode as a transmitter for 10 Gb/s digital data transmission and 28 GHz carrier video delivery applications.

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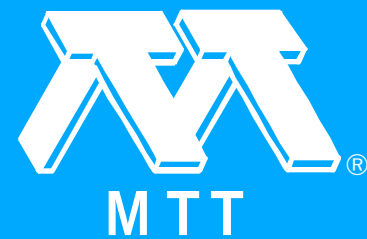


Abstracts

Analytical Model with Empirical Verification for Heterojunction Bipolar Transistors Under Illumination

L.E.M. de Barros, Jr., A. Paoella, P.R. Herczfeld and P. Enquist. "Analytical Model with Empirical Verification for Heterojunction Bipolar Transistors Under Illumination." 1995 MTT-S International Microwave Symposium Digest 95.1 (1995 Vol. I [MWSYM]): 49-52.

A new model for the HBT has been developed which solves for the electrical and photogenerated currents in base, emitter and collector. The model accounts for the discontinuity in quasi-fermi level by defining an effective carrier interface velocity. Experimental and theoretical curves relating to the device behavior are presented and compared.



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1x8 Metal-Semiconductor-Metal Photodetector and HEMT Receiver Array with 5 GHz Bandwidth

T. Seniuk, Q.Z. Liu and G.D. Cormack. "1x8 Metal-Semiconductor-Metal Photodetector and HEMT Receiver Array with 5 GHz Bandwidth." 1995 MTT-S International Microwave Symposium Digest 95.1 (1995 Vol. 1 [MWSYM]): 53-56.

A hybrid integrated three stage HEMT amplifier with a gain of 25 dB and a bandwidth of 5.4 GHz has been designed and constructed. When reconfigured as an optical receiver by using a linear 1x8 array of GaAs metal-semi-conductormetal photodetectors as the input, 41dB Omega of transimpedance is achieved up to frequencies higher than 5 GHz.

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A Low Noise Broadband GaAs MESFET Monolithic Distributed Preamplifier

A.P. Freundorfer and P. Lionais. "A Low Noise Broadband GaAs MESFET Monolithic Distributed Preamplifier." 1995 MTT-S International Microwave Symposium Digest 95.1 (1995 Vol. 1 [MWSYM]): 57-60.

It is shown that the equivalent input noise current density of a distributed preamplifier of an optical receiver can be improved by using large gate line matching impedance. A monolithic GaAs MESFET distributed preamplifier utilizing this design consideration was fabricated. Using a 35 μm InGaAs p-i-n photodiode, it was shown to have an equivalent input noise current density of 8 pA/radic Hz and an 8 GHz bandwidth. To date, this is the best known result for a 0.8 μm GaAs MESFET process.

Click on title for a complete paper.



Measurement of Intermodulation Distortion in Optical Diodes

B. Kanack. "Measurement of Intermodulation Distortion in Optical Diodes." 1995 MTT-S International Microwave Symposium Digest 95.1 (1995 Vol. I [MWSYM]): 61-64.

A measurement technique has been developed to directly determine the output two-tone, third-order intercept of microwave frequency p-i-n optical detector diodes. This method has been used to determine the bias dependence and frequency dependence of output third-order intercept for a p-i-n diode. It has been found that the third-order intercept increases monotonically with increasing reverse bias and decreases with increasing frequency. The maximum measurable output third-order intercept for a p-i-n diode has been found to be in excess 10 dBm at 2 GHz.





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Photonic Switched True Time Delay Beam Forming Network Integrated on Silica Waveguide Circuits

K. Horikawa, I. Ogawa, H. Ogawa and T. Kitoh. "Photonic Switched True Time Delay Beam Forming Network Integrated on Silica Waveguide Circuits." 1995 MTT-S International Microwave Symposium Digest 95.1 (1995 Vol. 1 [MWSYM]): 65-68.

This paper proposes an integrated variable true time delay (TTD) beam forming network (BFN) on the Silica-based optical waveguide circuits. This BFN has thermo-optic switches and variable time delay lines. The variable TTD unit test was carried out under the 2.5GHz microwave frequency range. The experimental results show that the phase error, that is the difference from the designed value, is less than or equal to 0.6 degrees and the amplitude error is less than or equal to 0.5 dB. These results also show adequate performance for a variable delay line. This Silica-based beam former will be one of the excellent alternatives for the phased array antennas.

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Abstracts

Session TU1D -- Sources and Control Components (1995 Vol. I [MWSYM])

"Session TU1D -- Sources and Control Components (1995 Vol. I [MWSYM])." 1995 MTT-S International Microwave Symposium Digest 95.1 (1995 Vol. I [MWSYM]): 69-69.



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A 60GHz MMIC Stabilized Frequency Source Composed of a 30GHz DRO and a Doubler

M. Funabashi, T. Inoue, K. Ohata, K. Maruhashi, K. Hosoya, M. Kuzuhara, K. Kanekawa and Y. Kobayashi. "A 60GHz MMIC Stabilized Frequency Source Composed of a 30GHz DRO and a Doubler." 1995 MTT-S International Microwave Symposium Digest 95.1 (1995 Vol. I [MWSYM]): 71-74.

This paper presents a 60GHz highly stabilized frequency source, which is composed of a 30GHz DRO and a doubler based on 0.15 μ m gate AlGaAs/InGaAs HJFET MMIC technologies. The 30GHz DRO exhibited low phase noise of -102dBc/Hz at 100kHz off-carrier with the maximum output power of 7.7dBm. The 30-to-60GHz doubler showed high conversion gain of -1.5dB at the input power of 7dBm. For the 60GHz frequency source, markedly low phase noise of -93dBc/Hz at 100kHz off-carrier and better than 1.9ppm/ C frequency stability has been achieved.

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Dielectric Loaded Gaussian Beam Oscillator in the 40 GHz Band

M. Kiyokawa, T. Matsui and N. Hirose. "Dielectric Loaded Gaussian Beam Oscillator in the 40 GHz Band." 1995 MTT-S International Microwave Symposium Digest 95.1 (1995 Vol. 1 [MWSYM]): 75-78.

A 40-GHz Gaussian output-beam oscillator, using a Gaussian-beam open resonator filled with a dielectric, is described. The dielectric resonator has a highly reflective convex spherical surface and a plane mirror surface having a coupling section with an active circuit. The circuit is fabricated using a commercial HEMT chip. The phase noise of -90 dBc/Hz at 100 kHz off carrier is expected. The output power is extracted as a Gaussian beam.

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Microwave Oscillator Control Using a Switched Delay-Line Technique

C.E. Free and C.S. Aitchison. "Microwave Oscillator Control Using a Switched Delay-Line Technique." 1995 MTT-S International Microwave Symposium Digest 95.1 (1995 Vol. 1 [MWSYM]): 79-82.

A novel arrangement is described which uses an oscillator feedback network, incorporating a switched delay line, to stabilize the oscillator frequency and to permit electronic frequency selection. The circuit, which has been fabricated and tested in hybrid MIC form, makes use of two simple microstrip circuits to achieve the delay line and switching functions. A three-port discriminator is used to provide the effective delay line and single PIN diode phase shifter is used to achieve delay switching. Results are presented which show that the circuit provides good frequency stabilization, together with predictable frequency switching and a reduction in oscillator phase noise.

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Microwave Oscillators and Filters Based on Microstrip Ring Resonators

D.K. Paul and P. Gardner. "Microwave Oscillators and Filters Based on Microstrip Ring Resonators." 1995 MTT-S International Microwave Symposium Digest 95.1 (1995 Vol. 1 [MWSYM]): 83-86.

Tunable microstrip ring resonator oscillators and filters are described. Two alternative techniques for suppression of unwanted higher order modes are reviewed. The practical oscillator has a tuning bandwidth of nearly 30%, and phase noise better than -90dBc, 10kHz from carrier. This is encouraging performance for a compact planar device.

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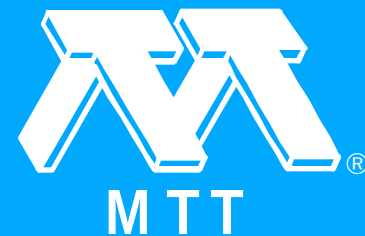


Abstracts

The Influence of I-Region Width Modulation on PIN Diode Attenuator Design

R.H. Caverly and Z.W. Tang. "The Influence of I-Region Width Modulation on PIN Diode Attenuator Design." 1995 MTT-S International Microwave Symposium Digest 95.1 (1995 Vol. I [MWSYM]): 87-90.

This paper discusses the effects of I-region width modulation on PIN diode attenuator performance. The work shows that the I-region thickness becomes thinner as the dc bias current decreases, and that over-estimates of PIN diode forward resistance can be the result.



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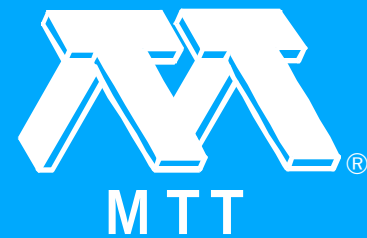


Abstracts

Micromechanical Membrane Switches for Microwave Applications

C. Goldsmith, T.-H. Lin, B. Powers, W.-R. Wu and B. Norvell. "Micromechanical Membrane Switches for Microwave Applications." 1995 MTT-S International Microwave Symposium Digest 95.1 (1995 Vol. 1 [MWSYM]): 91-94.

This paper proposes the fabrication of low-cost, low-loss microwave switches using thin metal membranes actuated by electrostatic fields. Measurement of switch test structures and modeling indicates that these devices have a potential 1,000 to 2,000-GHz figure-of-merit. Various aspects of fabrication, design, performance, and application of these devices are discussed.



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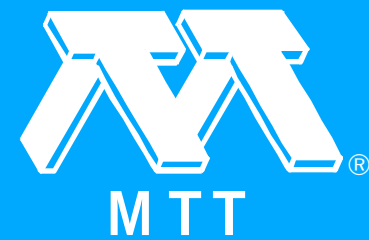
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Abstracts

Session TU1E -- Advances in Ferrite Technologies

"Session TU1E -- Advances in Ferrite Technologies." 1995 MTT-S International Microwave Symposium Digest 95.1 (1995 Vol. I [MWSYM]): 95-95.



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Monolithic Integration of an X-Band Circulator with GaAs MMICs

J.D. Adam, H. Buhay, M.R. Daniel, M.C. Driver, G.W. Eldridge, M.H. Hanes and R.L. Messham. "Monolithic Integration of an X-Band Circulator with GaAs MMICs." 1995 MTT-S International Microwave Symposium Digest 95.1 (1995 Vol. I [MWSYM]): 97-98.

Monolithic integration of circulators with GaAs MMICs offers the potential of lower cost, reduced size, improved over the present hybrid approaches. Development of MMIC compatible ferrite film deposition techniques, device design and fabrication will be described. Results on ferrite film circulators deposited on Si and GaAs substrates will be presented and integration with FETs discussed.

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Abstracts

Normal-Mode Analysis of Coupled-Slots with an Axially-Magnetized Ferrite Substrate

C.S. Teoh and L.E. Davis. "Normal-Mode Analysis of Coupled-Slots with an Axially-Magnetized Ferrite Substrate." 1995 MTT-S International Microwave Symposium Digest 95.1 (1995 Vol. I [MWSYM]): 99-102.

A normal-mode analysis of axially-magnetized coupled ferrite lines (CFL) is presented for the first time. This will permit optimization of propagation characteristics, impedance-matching and placement of ferrite for device applications. Potential applications include a novel distributed planar circulator which does not suffer the high-frequency limitations of the junction circulator.



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A Latching Ferrite Rotary-Field Phase Shifter

C.R. Boyd, Jr.. "A Latching Ferrite Rotary-Field Phase Shifter." 1995 MTT-S International Microwave Symposium Digest 95.1 (1995 Vol. I [MWSYM]): 103-106.

Ferrite rotary-field phase shifters have offered highly accurate reciprocal phase control for moderate to high microwave power levels, at the expense of continuous current excitation. This paper presents the concept, basic design considerations, and initial data for the first realization of a latching version that operates at remanent magnetization of the ferrite and requires excitation only during switching. Changes in configuration necessary for latching operation imply slightly larger rms phase errors and a reduced capability for average r-f power handling. Data are presented for a breadboard S-Band unit, and control advantages unique to this device are discussed.

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Thin Film Isolators Utilizing MSSW Transducers

E.-B. El-Sharawy and J.-S. Guo. "Thin Film Isolators Utilizing MSSW Transducers." 1995 MTT-S International Microwave Symposium Digest 95.1 (1995 Vol. I [MWSYM]): 107-110.

This paper presents a novel concept of ferrite isolators. The new type of isolator is comprised of a nonreciprocal surface wave transducer in the form a miniature strip line mated with a finite ground plane. The transducer is constructed on a thin YIG film grown on a GGG substrate. Since thin magnetic films can be grown on GaAs or Si, the present isolator can be built and integrated on the same chip with other passive and active devices. A 250 microns x 2000 microns version of the new structure gave a 6 dB insertion loss and about 30 dB of isolation at 7.8 GHz. The return loss was more than 20 dB.

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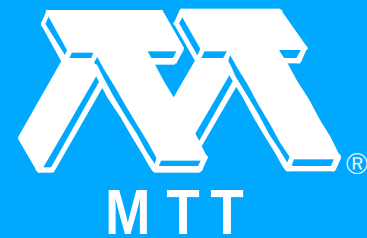


Abstracts

A Reflection Type of MSW Signal-to-Noise Enhancer in the 400-MHz Band

T. Kuki and T. Nomoto. "A Reflection Type of MSW Signal-to-Noise Enhancer in the 400-MHz Band." 1995 MTT-S International Microwave Symposium Digest 95.1 (1995 Vol. I [MWSYM]): 111-114.

We have developed a reflection type of signal-to-noise enhancer operating in the 400-MHz, which can easily be inserted into the second IF stage used in current DBS receivers. The new enhancer consists of a microstrip line using a ceramic substrate with a high dielectric constant and a LaGa-YIG film with low saturation magnetization. Enhancement of 8 dB was achieved in the 40-MHz bandwidth. We evaluated the effect of the new enhancer on noise reduction in DBS reception and found that the signal-to-noise enhancer achieved 2 to 3-dB noise reduction.



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Abstracts

Session TU2G -- (Plenary Session)

"Session TU2G -- (Plenary Session)." 1995 MTT-S International Microwave Symposium Digest 95.1 (1995 Vol. I [MWSYM]): 115-115.



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Abstracts

Session TU3A -- Mixers and Related Components

"Session TU3A -- Mixers and Related Components." 1995 MTT-S International Microwave Symposium Digest 95.1 (1995 Vol. I [MWSYM]): 117-117.



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Abstracts

A Monolithic Broadband Doubly Balanced EHF HBT Star Mixer with Novel Microstrip Baluns (1995 Vol. I [MWSYM])

Y.I. Ryu, K.W. Kobayashi and A.K. Oki. "A Monolithic Broadband Doubly Balanced EHF HBT Star Mixer with Novel Microstrip Baluns (1995 Vol. I [MWSYM])." 1995 MTT-S International Microwave Symposium Digest 95.1 (1995 Vol. I [MWSYM]): 119-122.

This paper describes a planar MMIC HBT Schottky diode mixer utilizing novel baluns fabricated on a 4 mil thick GaAs substrate. The balun is based on the Marchand balun structure and is implemented in a microstrip environment. The balun structure consists of 7 closely coupled microstrip lines and backside vias. Four $10 \times 10 \mu\text{m}^2$ HBT Schottky diodes in a star configuration provide the mixing function. The HBT diodes have cut-off frequencies in excess of 750 GHz. The mixer achieves 8- 10 dB conversion loss and very low spurious responses over a 26-40 GHz RF and LO bandwidth and DC - 11 GHz IF. This IF bandwidth is broader than a previously demonstrated CPW star mixer using InGaAs HEMT technology, and easier to integrate into an assembly due to its microstrip implementation.



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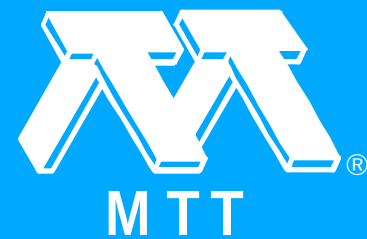


Abstracts

A PMHFET Based MMIC Gate Mixer for Ka-Band Applications (1995 Vol. I [MWSYM])

M. Matthes, J.-M. Dieudonne, W. Stiebler and L. Klapproth. "A PMHFET Based MMIC Gate Mixer for Ka-Band Applications (1995 Vol. I [MWSYM])." 1995 MTT-S International Microwave Symposium Digest 95.1 (1995 Vol. I [MWSYM]): 123-126.

A multipurpose MMIC gate mixer has been designed, fabricated and measured. The mixer exhibits a maximum conversion gain of about 0 dB in the frequency range of 32 GHz -- 38 GHz with an intermediate frequency (IF) of 100 MHz and an IF load of 50 Ω . With an external IF matching network a conversion gain up to 5 dB can be achieved. The mixer which consists of one pseudomorphic HFET represents state of the art performance.



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A K-Band Monolithic CPW Upconverter Utilizing a Source Mixing Concept (1995 Vol. I [MWSYM])

M. Madihian, L. Desclos, K. Maruhashi, K. Onda and M. Kuzuhara. "A K-Band Monolithic CPW Upconverter Utilizing a Source Mixing Concept (1995 Vol. I [MWSYM])." 1995 MTT-S International Microwave Symposium Digest 95.1 (1995 Vol. I [MWSYM]): 127-130.

This paper concerns with the design consideration and performance of a CPW upconverter MMIC for K-band wireless system applications. The upconverter consists of an FET as a "3-port" mixing element, IF, LO, and RF matching networks, and an output filter. Including a 3dB pass-band insertion loss of the filter, the upconverter exhibits a maximum conversion gain of -6dB with a port-to-port isolation better than 20dB.



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Monolithic Mixers with MESFETs Technology to Up and Down Convert Between C and V Band (1995 Vol. I [MWSYM])

J.P. Torres, F. Fortes, M.J. Rosario, J.M. Dieudonne and J.C. Freire. "Monolithic Mixers with MESFETs Technology to Up and Down Convert Between C and V Band (1995 Vol. I [MWSYM])." 1995 MTT-S International Microwave Symposium Digest 95.1 (1995 Vol. I [MWSYM]): 131-134.

In this paper the design of singly balanced mixers to convert C to V band signals are presented. A step by step design technique is described, based on harmonic balance simulations. The mixer devices are Schotky diodes compatible with a GaAs MESFET technology. The mixer was optimised for minimum conversion losses on the widest possible bandwidth when used as an up or downconverter in order to be used on a large number of applications. The experiments show a minimum conversion losses on the range of 6 to 8dB for both applications (up and downconverter) and a 3dB bandwidth larger then 6GHz.

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MMIC Active Bandpass Filter Using Negative Resistance Elements (1995 Vol. I [MWSYM])

U. Karacaoglu and I.D. Robertson. "MMIC Active Bandpass Filter Using Negative Resistance Elements (1995 Vol. I [MWSYM])." 1995 MTT-S International Microwave Symposium Digest 95.1 (1995 Vol. I [MWSYM]): 135-138.

This paper describes a monolithic bandpassfilter using lumped L-C resonators with single transistor negative resistance elements. The measured response of the filter exhibits a 400 MHz 3dB-bandwidth centered on 4.7 GHz, and has 0 dB insertion loss with only ± 0.1 dB ripple in the pass-band.

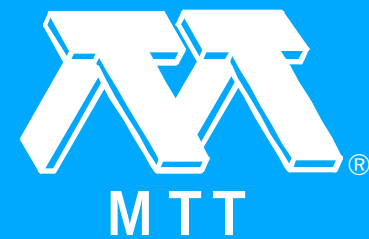
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Abstracts

Session TU3B -- Leaky-Wave Effects on Planar Transmission Lines

"Session TU3B -- Leaky-Wave Effects on Planar Transmission Lines." 1995 MTT-S International Microwave Symposium Digest 95.1 (1995 Vol. I [MWSYM]): 139-139.



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The Effect of Substrate Anisotropy on the Dominant-Mode Leakage from Stripline with an Air Gap (1995 Vol. I [MWSYM])

D. Nghiem, J.T. Williams, D.R. Jackson and A.A. Oliner. "The Effect of Substrate Anisotropy on the Dominant-Mode Leakage from Stripline with an Air Gap (1995 Vol. I [MWSYM])." 1995 MTT-S International Microwave Symposium Digest 95.1 (1995 Vol. I [MWSYM]): 141-144.

The fundamental properties of dominant leaky modes that exist on stripline structures having a small air gap above the conducting strip and uniaxial anisotropic substrates are summarized. Dominant leaky modes have a quasi-TEM strip current, and are often strongly excited by conventional stripline feeds. These leaky modes result in undesirable crosstalk and spurious stripline performance. New physical effects introduced by the substrate anisotropy are discussed.



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Abstracts

Simultaneous Propagation of Bound and Leaky Dominant Modes on Printed-Circuit Lines: A New General Effect (1995 Vol. I [MWSYM])

H. Shigesawa, M. Tsuji and A.A. Oliner. "Simultaneous Propagation of Bound and Leaky Dominant Modes on Printed-Circuit Lines: A New General Effect (1995 Vol. I [MWSYM])." 1995 MTT-S International Microwave Symposium Digest 95.1 (1995 Vol. I [MWSYM]): 145-148.

We were the first to report (at the 1993 IEEE International Microwave Symposium) that both the bound and leaky dominant modes can propagate simultaneously on conductor-backed coplanar strips over a frequency range. We have recently studied this interesting and initially unexpected effect in more detail, and we have made two important discoveries: (1) The simultaneous-propagation effect can actually occur on most printed-circuit transmission lines (its presence depending on the relative line dimensions), so that, contrary to earlier belief, the effect is rather general. (2) We have discovered the surprising presence of a new improper (or nonspectral) real solution, which is nonphysical but whose evolution as a function of dimensional change serves to explain how the simultaneous-propagation effect can occur. The new solution, and its behavior in a completely nonphysical region, thus govern otherwise-mysterious large changes in the physical, measurable solutions.



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Abstracts

Analysis and Design of Feeding Structures for Microstrip Leaky Wave Antenna (1995 Vol. I [MWSYM])

Y.D. Lin, J.-W. Sheen and C.-K.C. Tzuang. "Analysis and Design of Feeding Structures for Microstrip Leaky Wave Antenna (1995 Vol. I [MWSYM])." 1995 MTT-S International Microwave Symposium Digest 95.1 (1995 Vol. I [MWSYM]): 149-152.

Two methods to excite the microstrip leaky wave antenna are proposed and investigated in the paper. A full-wave spectral domain integral equation method combined with fundamental mode sampling technique is applied to determine the reflection coefficient of the excitation source. Dependence on structural parameters such as line width, overlap length and line spacing is fully analyzed to obtain the optimum excitation for microstrip leaky wave antenna. Also, an experimental setup is performed to check the validity of our numerical results and identify the radiation nature of the microstrip line higher order modes.



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Leaky Dominant Modes and Microwave Circuit Coupling in Layered Symmetric Coupled Lines

C.-K.C. Tzuang and S.-P. Liu. "Leaky Dominant Modes and Microwave Circuit Coupling in Layered Symmetric Coupled Lines." 1995 MTT-S International Microwave Symposium Digest 95.1 (1995 Vol. 1 [MWSYM]): 153-156.

The leaky dominant modes on symmetric coupled microstrips with and without super-strate have been investigated in details, which indicate that the generic mode spectra of the leaky dominant modes are rather similar to those of much simpler guided-wave structure such as a microstrip line. The rigorous full-wave mode-matching analyses take into account the conductor losses and finite metal thickness. Measured results of a special test circuit clearly reveal that the leaky dominant modes are responsible for circuit coupling at a higher frequency range beyond certain threshold frequency that separates the spectral gap region (nonphysical) and the leaky dominant mode region (improper but physical).

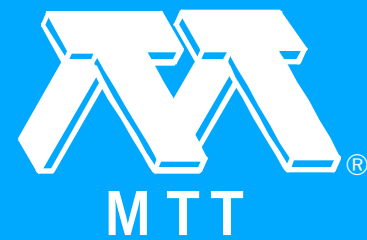
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Abstracts

Session TU3C -- Millimeter Wave Frequency Optical Detectors

"Session TU3C -- Millimeter Wave Frequency Optical Detectors." 1995 MTT-S International Microwave Symposium Digest 95.1 (1995 Vol. I [MWSYM]): 157-157.



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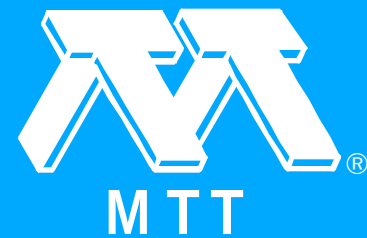


Abstracts

Travelling-Wave Photodetectors

K. Giboney, J. Bowers and M. Rodwell. "Travelling-Wave Photodetectors." 1995 MTT-S International Microwave Symposium Digest 95.1 (1995 Vol. I [MWSYM]): 159-162.

Attention to the microwave design of waveguide photodetectors leads to travelling-wave photodetectors. These devices show bandwidths as high as 172 GHz, the highest reported for a p-i-n photodetector, and bandwidth-efficiency products as large as 76 GHz, the largest reported for any photodetector without gain. Direct comparisons with vertically illuminated and waveguide photodetectors confirm the advantages of travelling-wave photodetectors.



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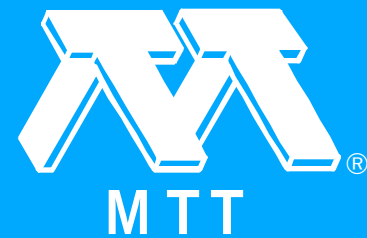


Abstracts

Travelling-Wave Optoelectronic Devices for Microwave Applications

D. Jager, R. Kremer and A. Stohr. "Travelling-Wave Optoelectronic Devices for Microwave Applications." 1995 MTT-S International Microwave Symposium Digest 95.1 (1995 Vol. I [MWSYM]): 163-166.

In this paper, we will discuss the fundamental concepts of ultrafast microwave photonic devices based upon the interaction between propagating microwaves and optical signal beams. Such travelling-wave optoelectronic devices utilizing, for example, microstrip or coplanar transmission lines as electrical waveguides exhibit cut-off frequencies not limited by the usual RC time constant. As a result, a high bandwidth together with improved efficiency and power capabilities are expected. In particular, travelling-wave photodetector, waveguide and vertical electrooptical modulators, microstrip optical switches and coplanar laser diodes are presented, Preliminary experimental results are also discussed.



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Abstracts

Session TU3D -- High Density Microwave Packaging (HDMP) Program

"Session TU3D -- High Density Microwave Packaging (HDMP) Program." 1995 MTT-S International Microwave Symposium Digest 95.1 (1995 Vol. I [MWSYM]): 167-167.



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Abstracts

High Density Microwave Packaging Program

E.D. Cohen. "High Density Microwave Packaging Program." 1995 MTT-S International Microwave Symposium Digest 95.1 (1995 Vol. I [MWSYM]): 169-172.

The objective of the High Density Microwave Packaging (HDMP) program is to develop and establish the producibility of complex shape, light weight, and high density microwave frequency transmit/receive (T/R) modules. The approach is to focus development on modules for active array radar applications, particularly for such platforms as the next-generation of F-22s, comparable Navy aircraft, and Army helicopters. A key technical requirement for successful fielding of active aperture phased arrays on aircraft and space-based platforms is to integrate all array elements, including radiating elements, microwave components, RF and DC interconnects, distribution channels, signal processing control elements, and thermal management systems into compact, minimum size packages that meet functional and environmental requirements.



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Abstracts

High Density Microwave Packaging Program Phase 1 - Texas Instruments/Martin Marietta Team

J.A. Reddick, III, R.K. Peterson, M. Lang, W.R. Kritzler, P. Piacente and W.P. Kornrumpf. "High Density Microwave Packaging Program Phase 1 - Texas Instruments/Martin Marietta Team." 1995 MTT-S International Microwave Symposium Digest 95.1 (1995 Vol. I [MWSYM]): 173-176.

On the ARPA sponsored High Density Microwave Packaging (HDMP) program, a team composed of Texas Instruments (TI), Martin Marietta, and General Electric (GE) is developing a packaging system to support tile conformal phased arrays. Significant volume and weight reductions are projected relative to today's microwave module technology. The team's approach utilizes a stacked module configuration, with a surface contact vertical interconnect between module layers. The module layers are built on a metal matrix composite AlSiC substrate with silicon and MMIC devices mounted face-up in substrate wells. Chip-to-chip interconnect is provided by an enhanced version of Martin Marietta's Microwave High Density Interconnect (MHDI) process. Stacked module assemblies are surface mounted on an RF/DC manifold on the back of the conformal array surface. Incremental technology demonstrations are planned as part of the program, culminating in a 96-element brassboard array demonstration.



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Abstracts

The Westinghouse High Density Microwave Packaging Program

*J.A. Costello, M. Kline, F. Kuss, W. Marsh, R. Kam, B. Fasano, M. Berry and N. Koopman.
"The Westinghouse High Density Microwave Packaging Program." 1995 MTT-S International Microwave Symposium Digest 95.1 (1995 Vol. I [MWSYM]): 177-180.*

The Westinghouse High Density Microwave Packaging (HDMP) Program investigates advanced packaging and interconnects for next generation Active Electronically Scanned Arrays (AESAs). Our teaming partners include TRW, IBM, and MCNC. The overall goal of the program is to develop appropriate designs, materials, and manufacturing processes that lead to the production of highly interconnected, very thin radar Transmit/Receive (T/R) modules with the following benefits (4: 1 Cost Reduction, 10:1 Volume, Weight Reduction). Early on, interim demonstrations are planned to establish advanced packaging and interconnect processes of multiple T/R cell tiles. In the last two years of the program, these processes will be used to fabricate functional T/R cell hardware culminating with the delivery of 50 T/R cells. In this paper, the program objectives, schedule, and technologies will be reviewed.



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High Density Microwave Packaging for T/R Modules

J. Wooldridge. "High Density Microwave Packaging for T/R Modules." 1995 MTT-S International Microwave Symposium Digest 95.1 (1995 Vol. 1 [MWSYM]): 181-184.

This paper describes the development of low cost 3-D packaging of transmit/receive (T/R) modules for an active array radar at X-band. The development focused on the design, manufacture and interconnection of multi-layer aluminum nitride (AlN) substrates. The substrates are electrically joined together with solderless interconnects. All GaAs and most silicon chips have been flipped for achieving low cost assembly and higher reliability. The major microwave transmission line is conductor backed coplanar line CBCPW which interfaces with the coplanar line used on the flipped microwave chip. The interconnect technology is applicable to commercial high speed data lines that are concerned about preserving the fast rise time of the signal.

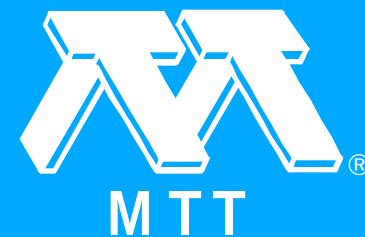
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Abstracts

Session TU3E -- Superconducting Components and Applications

"Session TU3E -- Superconducting Components and Applications." 1995 MTT-S International Microwave Symposium Digest 95.1 (1995 Vol. I [MWSYM]): 185-185.



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Abstracts

An Optical Switch for High Temperature Superconducting Microwave Band Reject Resonators

K.F. Raihn, N.O. Fenzi, E.R. Soares and G.L. Matthaei. "An Optical Switch for High Temperature Superconducting Microwave Band Reject Resonators." 1995 MTT-S International Microwave Symposium Digest 95.1 (1995 Vol. I [MWSYM]): 187-190.

A method for optically switching High Temperature Superconducting (H-TS) band reject resonators is presented. Fast low loss switching of HTS filter elements enables digital selection of arbitrary pass-bands and stop-bands. Patterned pieces of GaAs or silicon are used in the manufacture of the two terminal photoconductive switches. Fiber optic cabling is used to transfer the optical energy from an LED to the switch. The fiber optic cable minimizes the thermal loading of the filter package and de-couples the switch's power source from the RF circuit. This paper will discuss the development and implementation of the optical switch and its integration into a switched filter and switched filter-bank.



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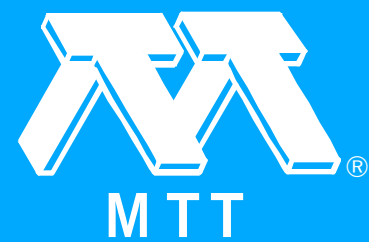
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High-Temperature Superconducting Microstrip Filters with High Power-Handling Capability

G.-C. Liang, D. Zhang, C.-F. Shih, M.E. Johansson, R. Withers, A.C. Anderson, D.E. Oates, P. Polakos, P. Mankiewicz, E. De Obaldia and R.E. Miller. "High-Temperature Superconducting Microstrip Filters with High Power-Handling Capability." 1995 MTT-S International Microwave Symposium Digest 95.1 (1995 Vol. I [MWSYM]): 191-194.

The performance of narrowband microstrip filters with low insertion loss and high power-handling capabilities made from YBa/sub 2/Cu/sub 3/O/sub 7 (YBCO) high-temperature superconducting (HTS) films is presented. Results are shown for two different novel designs that were chosen to optimize the power-handling capabilities. Both have a 2-GHz center frequency and 5-poles that incorporate coupled resonators with 10-12 internal impedances on 50-mm-diameter LaA1O/sub 3/ substrates. Both designs use parallel-coupled feed lines to avoid current crowding. The first design includes backward- and forward-coupled filters, has 1% bandwidth, and has handled over 25 watts of input power at 10 K with less than 0.25 dB compression. The second design has 1.2 % bandwidth and use only forward-coupled resonators. The minimum insertion loss is less than 0.2 dB at 45 K, it has a third-order intercept of 62 dBm. Another similar filter handled 36 watts of power at 45 K with less than 0.15 dB compression across the passband. We have developed a technique to visualize the power dissipation of the filter by observing the bubbles created by the filter when submerged in liquid helium, showing areas with local defects or where the current distribution is at its peak value.

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Miniature Circulators for Microwave Superconducting Systems

A. Fathy, E. Denlinger, D. Kalokitis, V. Pendrick, H. Johnson, A. Pique, K.S. Harshavardhan and E. Belohoubek. "Miniature Circulators for Microwave Superconducting Systems." 1995 MTT-S International Microwave Symposium Digest 95.1 (1995 Vol. I [MWSYM]): 195-198.

Ultraminiature high performance lumped element high temperature (HTS) circulators have been successfully demonstrated. Epitaxial HTS YBCO films have been deposited by pulsed laser deposition (PLD) onto buffered Yttrium Iron Garnet (YIG) substrates with measured surface resistance values ($<1\text{m}\Omega$ at 10 GHz @ 77K) comparable to those of HTS films on lanthanum aluminate. The lumped element circulators occupy an area about an order of magnitude smaller in size than that of conventional disc junction circulators. Excellent low loss (<0.23 dB) and high isolation ($>30\text{dB}$) over 5% bandwidth have also been demonstrated.

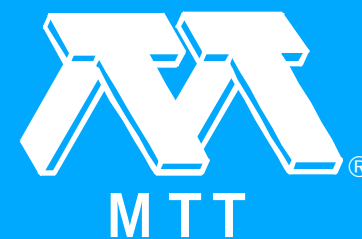
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Abstracts

Session TU4A -- Monolithic Receiver Components

"Session TU4A -- Monolithic Receiver Components." 1995 MTT-S International Microwave Symposium Digest 95.1 (1995 Vol. I [MWSYM]): 199-199.



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A Novel Baseband-1.5 GHz Monolithic HBT Variable Gain Amplifier with PIN Diode Gain Control (1995 Vol. I [MWSYM])

K.W. Kobayashi, A.K. Oki, L. Tran and D.C. Streit. "A Novel Baseband-1.5 GHz Monolithic HBT Variable Gain Amplifier with PIN Diode Gain Control (1995 Vol. I [MWSYM])." 1995 MTT-S International Microwave Symposium Digest 95.1 (1995 Vol. I [MWSYM]): 201-204.

This paper reports on a GaAs HBT Variable Gain Amplifier (VGA) which monolithically integrates a GaAs PIN diode as a variable resistor to achieve wide gain control. The PIN diode is made from the intrinsic MBE layers of the HBT collector-base junction which consists of a 7000Å angstrom thick i-region. The novel VGA topology employs active feedback and output buffering to obtain high IP3 performance and is the first PIN-HBT VGA reported of its kind. The VGA obtains 10 dB gain and over 25 dB of gain control range at 1 GHz. The output IP3 is 15.1 dBm and the noise figure is 9.3 dB at maximum gain. The corresponding input IP3 is +5.1 dBm and remains constant over gain control which is an attractive feature of the HBT-PIN VGA. The PIN diode VGA design is realized in a miniature 0.8x0.4 mm² area. Integrated with a previously developed HBT LNA, the resultant low noise VGA MMIC demonstrates 2.1 dB noise figure, >35 dB gain, +13.5 dBm OIP3, and over 25 dB of gain control at 1 GHz.

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A 9-16 GHz Monolithic HEMT Low Noise Amplifier with Embedded Limiters (1995 Vol. I [MWSYM])

P. Huang, W.L. Jones, A. Oki, D. Streit, W. Yamasaki, P. Liu, S. Bui and B. Nelson. "A 9-16 GHz Monolithic HEMT Low Noise Amplifier with Embedded Limiters (1995 Vol. I [MWSYM])." 1995 MTT-S International Microwave Symposium Digest 95.1 (1995 Vol. I [MWSYM]): 205-206.

A novel 9-16 GHz monolithic HEMT low noise amplifier with on-chip limiters has been designed, fabricated, and measured. This paper presents the design topology, the new fabrication technology, and the on-wafer measurements of this circuit. The limiter consists of one PIN diode and one Schottky diode. The low noise amplifier itself is a single stage balanced amplifier with one limiter embedded in each single-ended amplifier.

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A W-Band Monolithic Low Noise AlGaAs/InGaAs Pseudomorphic HEMT Amplifier Mounted on a Small Hermetically-Sealed Package with Waveguide Interface (1995 Vol. I [MWSYM])

Y. Itoh, M. Nakayama, K. Nakahara, T. Takagi, T. Sakura, N. Yoshida, T. Katoh, T. Kashiwa and Y. Ito. "A W-Band Monolithic Low Noise AlGaAs/InGaAs Pseudomorphic HEMT Amplifier Mounted on a Small Hermetically-Sealed Package with Waveguide Interface (1995 Vol. I [MWSYM])." 1995 MTT-S International Microwave Symposium Digest 95.1 (1995 Vol. I [MWSYM]): 207-210.

A W-band monolithic low noise AlGaAs/InGaAs/ GaAs pseudomorphic HEMT amplifier mounted on a small hermetically-sealed package has been developed for use in Advanced Microwave Scanning Radiometer. A six-stage amplifier cascading three two-stage MMIC amplifier chips is assembled on a small hermetically-sealed package with wave guide interface and has achieved a noise figure of 4.3 dB with a gain of 28.1 dB at 91 GHz. The overall amplifier measures 12 x 32.8 x 5.4 mm³. This is the first W-band multi-stage monolithic low noise amplifier mounted on a hermetically-sealed package.





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A Monolithic Integrated HEMT Frontend in CPW Technology from 10-50 GHz for Measurement Systems or Broadband Receivers (1995 Vol. I [MWSYM])

R. Heilig, D. Hollmann and G. Baumann. "A Monolithic Integrated HEMT Frontend in CPW Technology from 10-50 GHz for Measurement Systems or Broadband Receivers (1995 Vol. I [MWSYM])." 1995 MTT-S International Microwave Symposium Digest 95.1 (1995 Vol. I [MWSYM]): 211-214.

In this paper the design, performance and fabrication of a broadband frontend is shown. The frontend consists of a broadband matrix distributed amplifier with a gain of about 10 dB and a noise figure of 6.5 dB, a four stages distributed amplifier with 5 dB gain and an output power of 12 dBm, and a distributed mixer with a conversion gain of 0 dB with LO-power of 0 dBm including the LO buffer amplifier. The active devices are 0.2 μ m recessed gate AlGaAs-HEMTs and the coplanar waveguide is used as the propagation medium. The devices have been simulated by using own models for the device a nonlinear HEMT model was used. The total size of the frontend is 6 mm x 6 mm including bias networks and block capacitors.



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A 2-32 GHz Coplanar Waveguide InAlAs/InGaAs-InP HBT Cascode Distributed Amplifier

K.W. Kobayashi, J. Cowles, L. Tran, T. Block, A.K. Oki and D.C. Streit. "A 2-32 GHz Coplanar Waveguide InAlAs/InGaAs-InP HBT Cascode Distributed Amplifier." 1995 MTT-S International Microwave Symposium Digest 95.1 (1995 Vol. 1 [MWSYM]): 215-218.

A 2-32 GHz InAlAs/InGaAs-InP HBT CPW distributed amplifier (DA) has been demonstrated which benchmarks the highest bandwidth reported for an HBT DA. The DA combines a 100 GHz f_{max} and 60 GHz $f_{sub T}$ HBT technology with a cascode coplanar waveguide DA topology to achieve this record bandwidth. The cascode CPW DA demonstrates both design techniques and technology capability which can be applied to more complex circuit functions such as active baluns for mixers, active combiners/dividers, and low dc power-broadband amplification at millimeter-wave frequencies.

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A Distributed Optical Receiver Preamplifier with Unequal Gate/Drain Impedances (1995 Vol. I [MWSYM])

I. Darwazeh, P. Moreira, A. Borjak and J. O'Reilly. "A Distributed Optical Receiver Preamplifier with Unequal Gate/Drain Impedances (1995 Vol. I [MWSYM])." 1995 MTT-S International Microwave Symposium Digest 95.1 (1995 Vol. I [MWSYM]): 219-222.

A near dc to 16.4 GHz wide band distributed amplifier, constructed using a 20 GHz MMIC GaAs process and optimised to operate as an optical receiver front end preamplifier, has been designed, realised and tested at 10 Gbit/s. The design uses a 75 Omega gate line impedance to maximise the overall transimpedance gain without introducing severe bandwidth restriction.

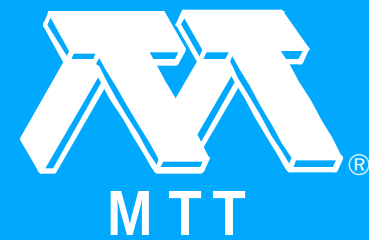
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Abstracts

Session TU4B -- Leaky-Wave Effects and Discontinuities

"Session TU4B -- Leaky-Wave Effects and Discontinuities." 1995 MTT-S International Microwave Symposium Digest 95.1 (1995 Vol. I [MWSYM]): 223-223.



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Mode Conversion and Leaky-Wave Excitation at Open-End Coupled Microstrip Discontinuities (1995 Vol. I [MWSYM])

J. Cina and L. Carin. "Mode Conversion and Leaky-Wave Excitation at Open-End Coupled Microstrip Discontinuities (1995 Vol. I [MWSYM])." 1995 MTT-S International Microwave Symposium Digest 95.1 (1995 Vol. I [MWSYM]): 225-228.

The method of moments (MoM) is used to study mode conversion and leaky-wave excitation at an asymmetric coupled-microstrip discontinuity. The results show that significant mode conversion can occur at such discontinuities and that fundamental leaky-wave modes can be excited strongly. Numerical issues with regard to the MoM analysis of such discontinuities are addressed as well, and it is shown that inclusion of a complete-domain basis function for the fundamental leaky mode improves numerical stability dramatically.



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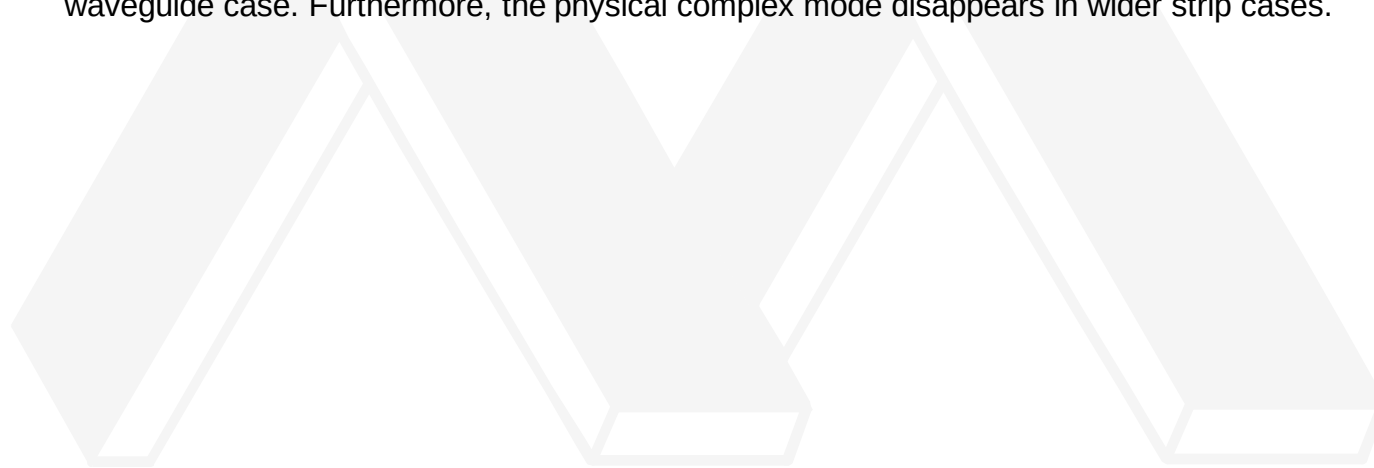
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Surface-Wave Leakage Properties of Coplanar Strips

Y.D. Lin, J.-W. Sheen and C.-Y. Chang. "Surface-Wave Leakage Properties of Coplanar Strips." 1995 MTT-S International Microwave Symposium Digest 95.1 (1995 Vol. 1 [MWSYM]): 229-232.

Propagation characteristics of coplanar strips (CPS), balanced transmission line widely used in uniplanar circuits, is investigated with the spectral domain analysis. Besides the conventional coplanar strips mode, an extra surface-wavelike dominant mode can be supported by coplanar strips in lower frequency region. The bound modes evolve into a complex leaky mode in higher frequency region in a similar way to those of coplanar waveguide (CPW). No sharp and deep minima in leakage constants are found after the onset of the leakage, as in the coplanar waveguide case. Furthermore, the physical complex mode disappears in wider strip cases.



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Analysis of the Effects of Metal Discontinuities in Nonradiative Dielectric Waveguide

C. Di Nallo, F. Frezza, A. Galli and P. Lampariello. "Analysis of the Effects of Metal Discontinuities in Nonradiative Dielectric Waveguide." 1995 MTT-S International Microwave Symposium Digest 95.1 (1995 Vol. I [MWSYM]): 233-236.

The introduction of thin metallic elements (sheets, chips, etc.) is usual practice for a variety of devices in nonradiative dielectric (NRD) guide technology. The unexplored discontinuity effects due to such metal obstacles inserted in the NRD guide are theoretically investigated in this work. The transmission-line circuit characterization of the most typical metalizations (used for instance in NRD-guide mixers and oscillators) is achieved through a rigorous variational approach. The numerical implementation is then carried out for a vertical symmetrical diaphragm. Making also use of a reference approach developed through a FEM code, the reactive effects due to such discontinuities are quantified and discussed as a function of the structural parameters.

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Abstracts

Study of Non-Leaky Coplanar (NLC) Waveguide Discontinuities

C.-Y. Lee, Y. Liu and T. Itoh. "Study of Non-Leaky Coplanar (NLC) Waveguide Discontinuities." 1995 MTT-S International Microwave Symposium Digest 95.1 (1995 Vol. 1 [MWSYM]): 237-240.

The discontinuities of non-leaky coplanar (NLC) waveguide is analyzed by using the extended spectral domain approach. It is found that the SMA-to-NLC transition will cause power leakage during experiment. Except for the small leakage, the theoretical and experimental results agree well.



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Multimode Network Representation for H- and E-Plane Uniform Bends in Rectangular Waveguide

B. Gimeno and M. Guglielmi. "Multimode Network Representation for H- and E-Plane Uniform Bends in Rectangular Waveguide." 1995 MTT-S International Microwave Symposium Digest 95.1 (1995 Vol. 1 [MWSYM]): 241-244.

In this paper we describe new multimode network representations for both H- and E-plane uniform bends in terms of impedance and admittance multimode coupling matrices, respectively. The key element of the network is the transition from the straight waveguide to the curved waveguide. The relevant multimode equivalent network representation is obtained following a simple procedure that has been used already with success for other types of junctions involving straight waveguides. In the talk, the details of the formulations will be discussed together with comparisons between our simulations and available published data, both measured and theoretical, indicating very good agreement as well as very good computational efficiency.

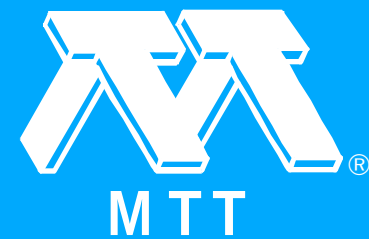
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Abstracts

Session TU4C -- High Speed Optical Modulators Fabricated on III-V Compounds

"Session TU4C -- High Speed Optical Modulators Fabricated on III-V Compounds." 1995 MTT-S International Microwave Symposium Digest 95.1 (1995 Vol. I [MWSYM]): 245-245.



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Integrated Laser/Modulators for High Capacity WDM Transmission Systems

*W.T. Tsang, J.E. Johnson, P.A. Morton, T. Tanbun-Ek, S.N.G. Chu and W.D. Johnston.
"Integrated Laser/Modulators for High Capacity WDM Transmission Systems." 1995 MTT-S
International Microwave Symposium Digest 95.1 (1995 Vol. I [MWSYM]): 247-250.*

Monolithically integrated electroabsorption modulated laser grown by selective-area epitaxy using MOVPE is a very essential source for multigigabit long-haul WDM transmission systems employing EDFAs. Such EML offers very low chirp, low drive voltage, long-term reliability and compact size.

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Ultra Wide Electrical Bandwidth GaAs/AlGaAs Electrooptic Modulators

N. Dagli, R. Spickermann, S. Sakamoto and M. Peters. "Ultra Wide Electrical Bandwidth GaAs/AlGaAs Electrooptic Modulators." 1995 MTT-S International Microwave Symposium Digest 95.1 (1995 Vol. 1 [MWSYM]): 251-254.

A high speed GaAs/AlGaAs traveling wave Mach-Zehnder electrooptic modulator has been fabricated. The device uses a novel slow wave electrode design to achieve phase velocity matching and has a measured electrical bandwidth greater than 40 GHz. An improved electrode design has been characterized and is currently being integrated into a modulator to increase the bandwidth further.

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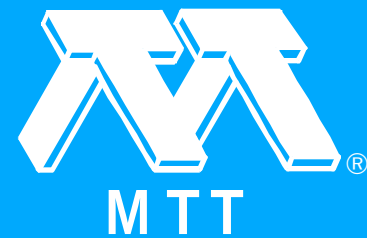


Abstracts

High-Speed Directional Coupler Modulator with Velocity-Matched Electrode Structure

M. Yu and A. Gopinath. "High-Speed Directional Coupler Modulator with Velocity-Matched Electrode Structure." 1995 MTT-S International Microwave Symposium Digest 95.1 (1995 Vol. I [MWSYM]): 255-258.

The 3dB bandwidth of 17GHz has obtained for the directional coupler modulator with capacitive-loaded electrode structure, and is in good agreement with the 20GHz predicted result. We believe that this is the highest bandwidth obtained in the directional coupler modulators.



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Integrated Optic Distributed Bragg Reflector Fabry-Perot Modulator for Microwave Applications

W.J. Zubrzycki, B.V. Borges, P.R. Herczfeld, S.H. Kravitz, G.R. Hadley, G.A. Vawter, R.F. Corless, R.E. Smith, J.R. Wendt, J.C. Word and T.M. Bauer. "Integrated Optic Distributed Bragg Reflector Fabry-Perot Modulator for Microwave Applications." 1995 MTT-S International Microwave Symposium Digest 95.1 (1995 Vol. I [MWSYM]): 259-262.

An integrated optic Fabry-Perot modulator is considered. The device, fabricated on III-V materials, uses distributed Bragg reflectors as mirrors. The greatest technical challenge in the realization of this device was the fabrication of the gratings with nanometer feature sizes. First order gratings 0.09 μ m in width and of 0.8 μ m in depth were written on a 2 μ m wide rib waveguide and successfully etched. The design, fabrication, and performance of the device is discussed.

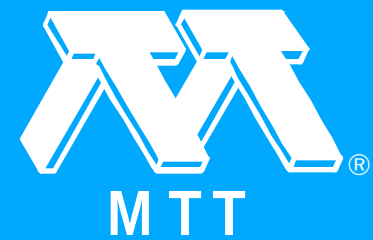
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Abstracts

Session TU4D -- Field Theory I

"Session TU4D -- Field Theory I." 1995 MTT-S International Microwave Symposium Digest 95.1 (1995 Vol. I [MWSYM]): 263-263.



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Field Theory Analysis of Circular Ridge Waveguides with Partial Dielectric Filling

S. Xiao, R. Vahldieck and M. Guglielmi. "Field Theory Analysis of Circular Ridge Waveguides with Partial Dielectric Filling." 1995 MTT-S International Microwave Symposium Digest 95.1 (1995 Vol. 1 [MWSYM]): 265-268.

The circular ridge waveguide (CRW) is a very useful structure for tuningless dual mode filters and septum polarizers. In this paper we present a rigorous analysis of the mode spectrum of CRW which is based on the cylindrical method of lines (CMOL). The advantage of the CMOL is that only one space variable need to be discretized and that spurious modes as well as relative convergence phenomena are not encountered. Partial dielectric filling as well as structures with mixed cylindrical/ rectangular boundaries can be easily included in the analysis. Results will be given for homogeneously filled CRW and for rectangular waveguides with cylindrical dielectric blocks.

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Generalized Scattering Matrix of Waveguide Corners Distorted by Discontinuities in the Resonator Region

V.A. Labay and J. Bornemann. "Generalized Scattering Matrix of Waveguide Corners Distorted by Discontinuities in the Resonator Region." 1995 MTT-S International Microwave Symposium Digest 95.1 (1995 Vol. 1 [MWSYM]): 269-272.

A new generalized scattering matrix formulation is presented for the calculation of waveguide corners distorted by discontinuities. The novel approach lies in the fact that the introduction of shorting planes some distance away from the actual discontinuity as is common practise in analyses known so far is entirely avoided. Therefore, this method allows the computation of components in which other structures are connected as closely as possible to the waveguide corner. This follows directly from the rigorous incorporation of higher-order mode interactions. Previously, only fundamental-mode scattering parameters could be calculated and, therefore, connected components had to be far enough away from the waveguide corner in order to avoid interference of reactive fields. Consequently, the theory presented in this paper will, first, allow the calculation and design of more complex waveguide components and, secondly, contribute to a more efficient use of component space. At the examples of 90 and 180 degree waveguide bends, the theoretical model is compared with measurements and a finite-element analysis. Results are found to be in good agreement.





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A Wide-Band S-Parameter Extraction Procedure for Arbitrarily Shaped, Inhomogeneous Structures Using Time Domain Numerical Techniques

J. Ritter, V.J. Brankovic, D.V. Krupezevic and F. Arndt. "A Wide-Band S-Parameter Extraction Procedure for Arbitrarily Shaped, Inhomogeneous Structures Using Time Domain Numerical Techniques." 1995 MTT-S International Microwave Symposium Digest 95.1 (1995 Vol. I [MWSYM]): 273-276.

A new, simple and very efficient technique for the wide-band extraction of scattering parameters using time domain methods (e.g. FDTD, TLM) is introduced which avoids the hitherto necessary high requirements for appropriate absorbing boundary conditions. The technique is based on the modal S-parameter definition for unmatched ports and achieves, even with standard non-dispersive Mur's absorbing boundaries, excellent and reliable results also for dispersive microwave structures and inhomogeneous input and output ports. The proposed method is verified by excellent agreement with measurements or with mode-matching

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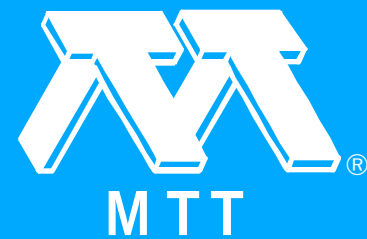


Abstracts

The Generalized Scattering Matrix Separation Technique Combined with the MM/FE Method for the Efficient Modal Analysis of a Comprehensive Class of 3D Passive Waveguide Circuits

R. Beyer and F. Arndt. "The Generalized Scattering Matrix Separation Technique Combined with the MM/FE Method for the Efficient Modal Analysis of a Comprehensive Class of 3D Passive Waveguide Circuits." 1995 MTT-S International Microwave Symposium Digest 95.1 (1995 Vol. 1 [MWSYM]): 277-280.

A novel and versatile technique for the efficient modal analysis of passive waveguide structures, called the generalized scattering matrix separation (GSMS) technique, is introduced. Its combination with the well-proven hybrid mode-matching/finite element (MM/FE) method achieves the fast and rigorous modal analysis of a comprehensive class of three-dimensional waveguide components which include homogeneous segments of arbitrarily shaped cross-section and one or more side coupled rectangular waveguide ports. This combined method takes the higher order mode coupling between all discontinuities or ports into account and requires only one frequency independent application of the two-dimensional finite element (FE) method. The method is verified by excellent agreement with measurements.



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Modelling of Cascaded Coplanar Waveguide Discontinuities by the Mode-Matching Approach

R. Schmidt and P. Russer. "Modelling of Cascaded Coplanar Waveguide Discontinuities by the Mode-Matching Approach." 1995 MTT-S International Microwave Symposium Digest 95.1 (1995 Vol. 1 [MWSYM]): 281-284.

Cascaded coplanar waveguide discontinuities with transverse dimensions in the order of some micrometers are analyzed by the mode-matching approach based on a full-wave analysis of the electromagnetic field also in the metallic regions. Compared with full-wave analysis assuming perfect conductors and a subsequent loss computation based on the surface impedance model the accuracy is considerably enhanced.

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Axisymmetric Edge-Based Finite Element Formulation for Bodies of Revolution: Application to Dielectric Resonators

M.F. Wong, M. Prak and V.F. Hanna. "Axisymmetric Edge-Based Finite Element Formulation for Bodies of Revolution: Application to Dielectric Resonators." 1995 MTT-S International Microwave Symposium Digest 95.1 (1995 Vol. I [MWSYM]): 285-288.

This paper stresses on the treatment of bodies of revolution by the finite element method (FEM) with edge elements. It clearly states an inherent difficulty on the axis of rotation specially when considering the first azimuthal mode. We propose a formulation which is not a straightforward application of standard edge elements in FEM. It takes explicitly into account a not very well known axis condition with the help of an axisymmetrical-designed edge element. Results on dielectric resonators are given and compared to measurement and to calculations from a 3D edge-based FEM code.

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Abstracts

Session TU4E -- Biomedical Applications

"Session TU4E -- Biomedical Applications." 1995 MTT-S International Microwave Symposium Digest 95.1 (1995 Vol. I [MWSYM]): 289-289.



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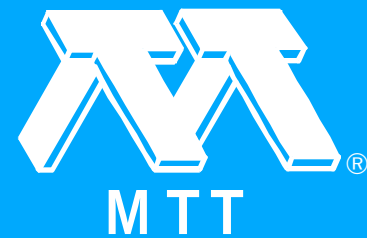


Abstracts

Field Calculation in Models of Man in the Near-Field of Antennas

G. Schaller, R. Engelbrecht and J. Erb. "Field Calculation in Models of Man in the Near-Field of Antennas." 1995 MTT-S International Microwave Symposium Digest 95.1 (1995 Vol. I [MWSYM]): 291-294.

For two examples the electromagnetic field is calculated inside and in the vicinity of properly modelled man in the near-field of antennas. The first example illustrates the SAR - distribution in a medical attendant near a deep hyperthermia system, whereas in the second example fields are calculated in a human head exposed to hand-held E-net phones. Both cases are investigated applying a 3-D field calculation program based on a finite integration algorithm.



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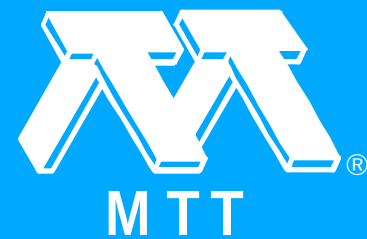


Abstracts

Variations of the Somatosensory Evoked Potentials Due to Microwave Fields in Rabbits Spinal Cord

J. Teng, D.C. de Tournai, F. Duhamel and A. Vander Vorst. "Variations of the Somatosensory Evoked Potentials Due to Microwave Fields in Rabbits Spinal Cord." 1995 MTT-S International Microwave Symposium Digest 95.1 (1995 Vol. I [MWSYM]): 295-298.

The paper presents an in-vivo experiment concerning cerebral evoked potentials of rabbits, without and with microwave irradiation of the spinal cord at 4.2 GHz. There is ample evidence of microwave effects. A first careful calculation of the absorbed power seems to show no evidence of a non-thermal effect on the nervous system.



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Modeling a Microwave Catheter Antenna for Cardiac Ablation

A. Khebir, Z. Kaouk and P. Savard. "Modeling a Microwave Catheter Antenna for Cardiac Ablation." 1995 MTT-S International Microwave Symposium Digest 95.1 (1995 Vol. 1 [MWSYM]): 299-302.

This article studies the possibility of using microwave energy for cardiac ablation as an alternative to IRF energy since the latter has several clinical limitations. For this endeavor, a computer code, based on the powerful finite element method, was developed and used to design a prototype circular microwave catheter antenna its volume heating was studied and compared to that of an RF electrode of similar dimensions and found that the former yields a lesion size as twice as large as the latter while respecting most of the clinical considerations.

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Monopoles for Microwave Catheter Ablation of Heart Tissue

S. Labonte, H.O. Ali and L. Roy. "Monopoles for Microwave Catheter Ablation of Heart Tissue." 1995 MTT-S International Microwave Symposium Digest 95.1 (1995 Vol. I [MWSYM]): 303-306.

The finite-element method is applied to the study of monopole antennas for microwave catheter ablation. Three geometries are considered: open-tip, dielectric-tip and metal-tip. Calculations are made for the magnetic field, the reflection coefficient and the power deposition pattern of the antennas immersed in normal saline. The theoretical results agree with measurements performed on prototypes. The differences between the antennas suggest that the metal-tip monopole best fulfills the requirements of catheter ablation of the endocardium. Optimal dimensions for a metal-tip monopole are also presented.





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Field Simulation of Applicators for Interstitial Microwave Hyperthermia

G. Schaller, J. Erb, R. Engelbrecht and H.M. Seegenschmiedt. "Field Simulation of Applicators for Interstitial Microwave Hyperthermia." 1995 MTT-S International Microwave Symposium Digest 95.1 (1995 Vol. 1 [MWSYM]): 307-310.

The electromagnetic field near clinically applied coaxial microwave applicators for interstitial hyperthermia is calculated using a finite integration algorithm program. Simulations of E-field and SAR distributions of different conventional applicators in a muscle phantom are presented and compared with measurements. The applied calculation method allows also design optimization and improvement of more sophisticated applicator types, e.g. those using a triaxial technique.

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Coupled Radiation Between Concentrically Placed Waveguide Applicators: Optimization of the Deposited Power Distribution Inside a Lossy Medium

K.S. Nikita, N.K. Uzunoglu and N.G. Maratos. "Coupled Radiation Between Concentrically Placed Waveguide Applicators: Optimization of the Deposited Power Distribution Inside a Lossy Medium." 1995 MTT-S International Microwave Symposium Digest 95.1 (1995 Vol. I [MWSYM]): 311-314.

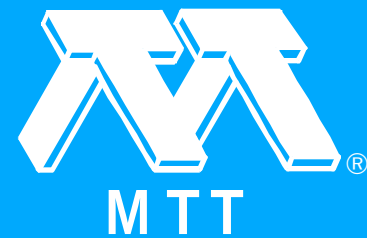
A method is proposed for determining the optimal amplitude and phase excitations of a phased array hyperthermia system consisting of four waveguide applicators, in order to attain an improved Specific Absorption Rate (SAR) distribution inside and outside of malignant tissues. The method is based on a rigorous electromagnetic analysis which takes into account coupling phenomena between array elements. A penalty function technique, using the downhill simplex method, is applied to solve the optimization problem. Numerical simulations have been performed to check the effectiveness of the proposed method.



Design and Modeling of Multipatches Planar Applicators for Microwave Hyperthermia

C. Michel, L. Dubois, P.-Y. Cresson, M. Chive and J. Pribetich. "Design and Modeling of Multipatches Planar Applicators for Microwave Hyperthermia." 1995 MTT-S International Microwave Symposium Digest 95.1 (1995 Vol. I [MWSYM]): 315-318.

This paper describes a new type of external planar applicators with several patches which have been developed for microwave hyperthermia controlled by microwave radiometry. The possibility to obtain larger heating patterns than with the single patch applicators is clearly focused by the theoretical results which are presented and verified by experimental measurements.



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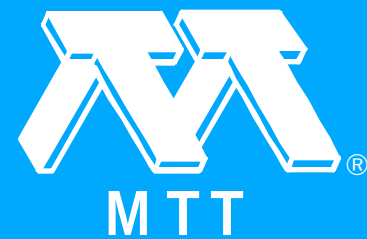
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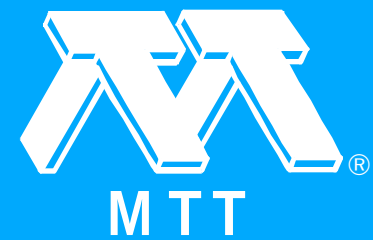
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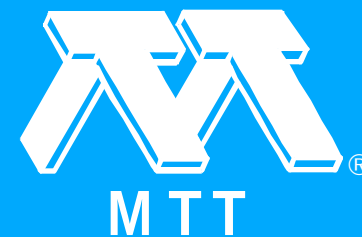
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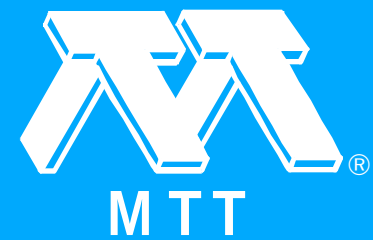
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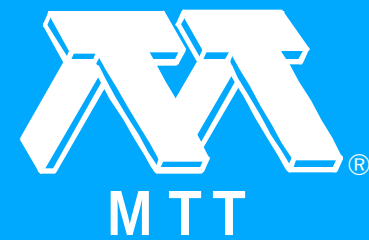
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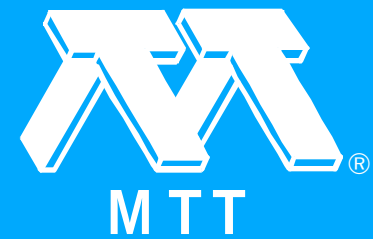
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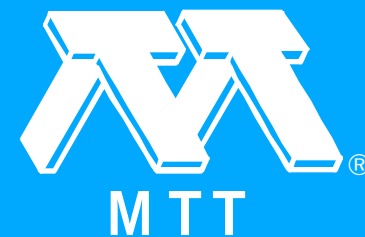
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Session WE1A -- Microwave Power Devices and Amplifiers I

"Session WE1A -- Microwave Power Devices and Amplifiers I." 1995 MTT-S International Microwave Symposium Digest 95.2 (1995 Vol. II [MWSYM]): 321-321.



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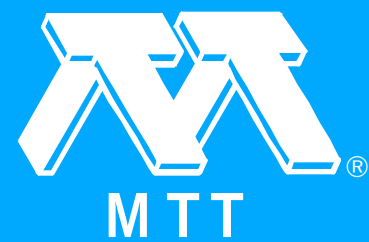
High Power, High Efficiency PHEMTs for Use at 8 GHz

D. Teeter, S. Bouthillette, L. Aucoin, A. Platzker, C. Alfaro and D. Bradford. "High Power, High Efficiency PHEMTs for Use at 8 GHz." 1995 MTT-S International Microwave Symposium Digest 95.2 (1995 Vol. II [MWSYM]): 323-326.

Power PHEMTs from 4.8 mm to 14.4 mm gate periphery have been characterized at 8 GHz to study the effect of device scaling on output power, gain, and efficiency. The effect of unit gate width, gate to gate spacing, and substrate thickness on PHEMT performance is also described. A 14.4 mm device delivered 8.09 W with 12.67 dB associated gain and 55.8 % PAE under 8 V operation at 8 GHz.

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A High Efficiency 10 Watt HBT Power Amplifier Assembly Using Combining Techniques

G. Ferrell, L. Dickens, J. Gipprich, B. Hayes and F. Sacks. "A High Efficiency 10 Watt HBT Power Amplifier Assembly Using Combining Techniques." 1995 MTT-S International Microwave Symposium Digest 95.2 (1995 Vol. II [MWSYM]): 327-330.

Six 2 Watt AlGaAs/GaAs Heterojunction Bipolar Transistor (HBT) MMIC amplifiers have been combined using low loss, low temperature cofired ceramic (LTCC) splitting and combining networks. The six MMIC amplifiers were combined in a compact, testable, and producible assembly. The amplifier assembly produced 10 Watts peak output power and 30% peak power added efficiency (PAE) over an 8.0 to 14.0 GHz bandwidth. This wideband power amplifier has applications in solid state transmitters and transmit/receive (T/R) modules that require high gain, high power, high efficiency, and compact size.

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Abstracts

Development of a Low Cost X-Band Solid State Transmitter for Low Volume Commercial Applications

J. Faulkner, E. Lee, J. Masti and M. Pingor. "Development of a Low Cost X-Band Solid State Transmitter for Low Volume Commercial Applications." 1995 MTT-S International Microwave Symposium Digest 95.2 (1995 Vol. II [MWSYM]): 331-334.

A low cost X-Band solid state transmitter has been successfully demonstrated for low volume commercial applications. Advanced modeling techniques, novel circuit design, concurrent specification flowdown and automated processing technologies were utilized to develop a robust design which maximized yield and achieved the low cost goals required for solid state transmitter amplification in low volume commercial applications.



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Ku-Band 10W High Efficiency HJFET Power Amplifier

K. Matsunaga, Y. Okamoto and M. Kuzuhara. "Ku-Band 10W High Efficiency HJFET Power Amplifier." 1995 MTT-S International Microwave Symposium Digest 95.2 (1995 Vol. II [MWSYM]): 335-338.

This paper describes a record power performance of a Ku-band power amplifier fabricated with a one-chip 0.45 μ m gate GaAs-based heterojunction FET (HJFET). The developed HJFET amplifier with 16.8mm gate periphery exhibited a 40.1 dBm(10.2W) output power with 50% power-added efficiency (PAE) and 9.5dB linear gain at 12GHz. This is the highest PAE, gain and output power combination achieved by a single FET power amplifier at this frequency.

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An 11 W Ku-Band Heterostructure FET with WSi/Au T-Shaped Gate

J. Udomoto, S. Chaki, M. Komaru, T. Kunii, Y. Kohno, S. Goto, K. Gotoh, A. Inoue, N. Tanino, T. Takagi and O. Ishihara. "An 11 W Ku-Band Heterostructure FET with WSi/Au T-Shaped Gate." 1995 MTT-S International Microwave Symposium Digest 95.2 (1995 Vol. II [MWSYM]): 339-342.

We developed a Heterostructure FET (HFET) with a high output power and a high power-added efficiency (PAE) at Ku-band. 8 W and 11.2 W output powers were obtained with power-added efficiencies of 48% and 41% and linear gains of 9 dB and 8.6 dB at 12 GHz, respectively. This is the highest power and efficiency ever reported which is achieved by a single FET chip at this frequency.

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Ku-Band 20 W Power GaAs FETs

Y. Saito, T. Kuzuhara, T. Ohmori, K. Kai, H. Ishimura and H. Tokuda. "Ku-Band 20 W Power GaAs FETs." 1995 MTT-S International Microwave Symposium Digest 95.2 (1995 Vol. II [MWSYM]): 343-346.

High power Ku-band internally matched GaAs FETs have been developed using multi-chip power combiner/divider technology. An output power of 43.2 dBm at 1 dB gain compression with 6.9 dB gain and 29.5 % power-added-efficiency has been obtained at 14 GHz. This state-of-the-art performance has been achieved by (1) optimizing the carrier concentration profiles of the active layer and making the buffer layer resistivity higher, (2) adopting the double-recess structure to get the higher breakdown voltage and (3) designing the high efficiency power combiner/divider circuits.

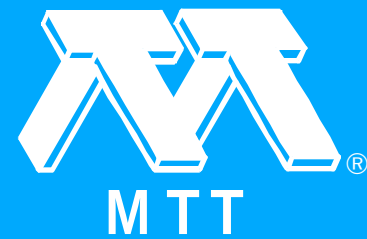
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Abstracts

Session WE1B -- Applications of Time Domain Methods

"Session WE1B -- Applications of Time Domain Methods." 1995 MTT-S International Microwave Symposium Digest 95.2 (1995 Vol. II [MWSYM]): 347-347.



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3D FDTD Simulation of Superconductor Coplanar Waveguides

S. Xiao and R. Vahldieck. "3D FDTD Simulation of Superconductor Coplanar Waveguides." 1995 MTT-S International Microwave Symposium Digest 95.2 (1995 Vol. II [MWSYM]): 349-352.

3D superconductor coplanar waveguide structures are simulated using the 3D FDTD method with graded mesh. Using the two-fluid model, Maxwell's equations are expressed in the time domain and discretized in time and all three space directions. By using a combination of the forward and central finite difference scheme in conjunction with a graded mesh layout of second order accuracy, 3D superconductor CPW discontinuities are calculated. Tensor properties of the substrate are taken into account as well as thin buffer layers between the superconductor and the supporting substrate.

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Analysis of Anisotropic Conductors on Anisotropic Substrates

M.A. Megahed and S.M. El-Ghazaly. "Analysis of Anisotropic Conductors on Anisotropic Substrates." 1995 MTT-S International Microwave Symposium Digest 95.2 (1995 Vol. II [MWSYM]): 353-356.

A full-wave finite-difference time-domain technique is used to study the anisotropy associated with anisotropic conductors on anisotropic substrates. The scheme is applied to analyze high temperature superconductor (HTS) YBCO film deposited on anisotropic sapphire substrate. The effect of the anisotropy on the performance of the coplanar wave guide and the microstrip line is evaluated. The losses and the dispersion characteristics, as well as the current distributions inside the HTS, are calculated. It is shown that the 90° r-cut sapphire substrate structure has lower loss and lower effective dielectric constant than the 0° r-cut substrate.

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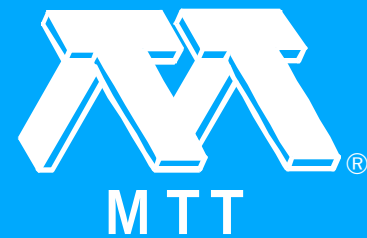


Abstracts

FDTD Simulation of a Microwave Amplifier

C.-N. Kuo, S.T. Chew, B. Houshmand and T. Itoh. "FDTD Simulation of a Microwave Amplifier." 1995 MTT-S International Microwave Symposium Digest 95.2 (1995 Vol. II [MWSYM]): 357-360.

This paper presents the application of the Finite-Difference Time-Domain (FDTD) method to microwave circuits. An amplifier with a three-terminal active device is analyzed. The active device is replaced with equivalent current sources to integrate with FDTD simulation. The simulation results are compared with measured data and show good agreement.



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Simulation of HF Circuits with FDTD Technique Including Non-Ideal Lumped Elements

P. Ciampolini, P. Mezzanotte, L. Roselli, D. Sereni, R. Sorrentino and P. Torti. "Simulation of HF Circuits with FDTD Technique Including Non-Ideal Lumped Elements." 1995 MTT-S International Microwave Symposium Digest 95.2 (1995 Vol. II [MWSYM]): 361-364.

An extension of the FDTD algorithm is devised, accounting for high-frequency models of lumped elements. Bipolar transistors, junction and Schottky diodes are considered, as well as their associated non linear capacitances. Several validation examples are given. In particular, a simple, yet complete, structure has been simulated, consisting of an L-band unbalanced mixer and including a microstrip stub, a microstrip to microstrip TEE junction, a microstrip gap and a shielding package. Results favourably compare with alternative simulation techniques.

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Modelling of General Constitutive Relationships in SCN TLM

L. de Menezes and W.J.R. Hoefer. "Modelling of General Constitutive Relationships in SCN TLM." 1995 MTT-S International Microwave Symposium Digest 95.2 (1995 Vol. II [MWSYM]): 365-368.

The modelling of general constitutive relationships in SCN (Symmetrical Condensed Node) TLM is presented. The technique consists of decoupling the scattering matrix from the medium by using equivalent node sources with state-variable formulation of the constitutive relationships. The procedure requires few modifications to TLM. Numerical examples are presented.



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Dispersion Characteristics of the TLM Scheme with Symmetrical Super-Condensed Node

M. Krumpholz, L. Roselli and P. Russer. "Dispersion Characteristics of the TLM Scheme with Symmetrical Super-Condensed Node." 1995 MTT-S International Microwave Symposium Digest 95.2 (1995 Vol. II [MWSYM]): 369-372.

The dispersion of the Symmetrical Super Condensed Node (SSCN) for isotropic media is investigated. Based on the dispersion analysis, the relations between the parameters of the scattering matrix and the parameters describing the media are given. The results are compared with those obtained for the FDTD method.

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Dispersion of TLM Condensed Nodes in Media with Arbitrary Electromagnetic Properties

V. Trenkic, C. Christopoulos and T.M. Benson. "Dispersion of TLM Condensed Nodes in Media with Arbitrary Electromagnetic Properties." 1995 MTT-S International Microwave Symposium Digest 95.2 (1995 Vol. II [MWSYM]): 373-376.

New analytical closed forms of the dispersion relation for TLM condensed nodes modelling general materials (stubbed symmetrical condensed node, symmetrical super-condensed node) are presented and validated by numerical results. The range of dispersion errors and bilateral behavior are fully explored and practical guidance is offered to users.



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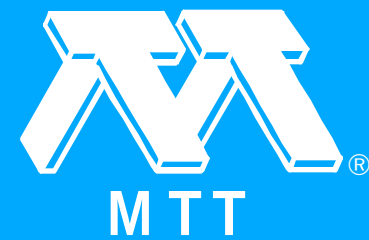
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Abstracts

Session WE1C -- Miniaturized Filters

"Session WE1C -- Miniaturized Filters." 1995 MTT-S International Microwave Symposium Digest 95.2 (1995 Vol. II [MWSYM]): 377-377.



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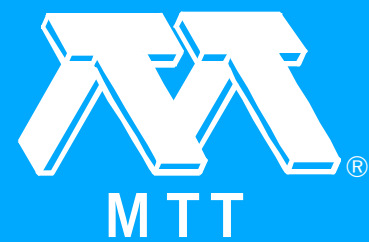
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Narrowband Lumped-Element Microstrip Filters Using Capacitively-Loaded Inductors (1995 Vol. II [MWSYM])

D. Zhang, G.-C. Liang, C.F. Shih and R.S. Withers. "Narrowband Lumped-Element Microstrip Filters Using Capacitively-Loaded Inductors (1995 Vol. II [MWSYM])." 1995 MTT-S International Microwave Symposium Digest 95.2 (1995 Vol. II [MWSYM]): 379-382.

Coupling between microstrip resonators decreases very slowly as a function of the resonator separation. Therefore it is difficult to realize narrowband filters (e.g. $<0.1\%$ bandwidth) in microstrip form due to the very weak coupling values required. In this paper, we have developed a class of lumped-element filters that uses capacitively-loaded inductors to give frequency-dependent inductance values. A novel frequency-transformation technique is used in the design process. Using this approach, strong coupling can be used in narrowband filter designs. The frequency-dependent inductance transforms the filter to a narrower bandwidth than the original circuit prototype, and does not require hard-to-realize weak coupling. We present a 0.3% bandwidth superconducting microstrip prototype filter. It was designed with the coupling of a 1% bandwidth filter, and then transformed to 0.3% fractional bandwidth using an appropriate inductance slope parameter, $dL/d\omega$. Measurement showed good agreement with theory.

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A New Semi-Lumped Microwave Filter Structure

A.F. Sheta, K. Hettak, J.P. Coupez, C. Person, S. Toutain and J.P. Blot. "A New Semi-Lumped Microwave Filter Structure." 1995 MTT-S International Microwave Symposium Digest 95.2 (1995 Vol. II [MWSYM]): 383-386.

A novel narrow-band microwave filter structure is presented. The merit of this circuit lies in the simplicity of design formulas readily applicable to narrow-band filters. The structure can be realized in planar or uniplanar technology. The design formulas yield good results for bandwidths lower than 10%. Bandpass filter with 4% relative bandwidth at 3GHz was designed with the proposed theory and then implemented in both microstrip and coplanar technologies. Experimental results show good agreement with theoretical predictions.

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A Novel MMIC Filter - Measured and Simulated Data

F. Mernyei, I. Aoki and H. Matsuura. "A Novel MMIC Filter - Measured and Simulated Data." 1995 MTT-S International Microwave Symposium Digest 95.2 (1995 Vol. II [MWSYM]): 387-390.

We introduced new MMIC band-pass filters with Triple Coupled CPW (TCC) lines. We realized 7th order filters at 17GHz center frequency with 10GHz pass-bands. The pass-band insertion loss is about 5 dB. The size of the smallest filter layout is $0.3\lambda_{\text{sub } g} \times 0.4\lambda_{\text{sub } g}$, the smallest passive uniplanar filters reported as we know. The measured characteristics agreed well with the design.

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A Miniatureized Ceramic Bandpass Filter for Cordless Phone Systems

S. Kobayashi and K. Saito. "A Miniatureized Ceramic Bandpass Filter for Cordless Phone Systems." 1995 MTT-S International Microwave Symposium Digest 95.2 (1995 Vol. II [MWSYM]): 391-394.

Miniaturized band-pass filter, which size is 3.0mm x 2.0mm x 1.5mm, was developed by two different dielectric ceramics with low and high permittivities. The filter was constructed by putting strip line made by high permittivity ceramics ($\epsilon_r=75$) between micro strip line made by low permittivity ceramics ($\epsilon_r=15$). As its filter characteristics, two attenuation poles were observed at the lower frequency and higher frequency than the pass band. The reason for two attenuation poles' appearances was discussed using by the theoretical equivalent circuit.



Abstracts

Generalized Slot Coupled Comblines Filters

H.-W. Yao, K.A. Zaki, A.E. Atia and R. Hershtig. "Generalized Slot Coupled Comblines Filters." 1995 MTT-S International Microwave Symposium Digest 95.2 (1995 Vol. II [MWSYM]): 395-398.

The resonant frequency and the slot coupling of combline cavities are analyzed by a rigorous method. The validation and accuracy of the method are confirmed by comparing the numerical results with measured data. It is shown how to achieve both capacitive and inductive coupling and how to realize generalized slot coupled combline filters, with finite transmission zeros. A 6-pole slot coupled combline filter with asymmetrical transmission zeros is designed and tested. Excellent filter response is obtained.



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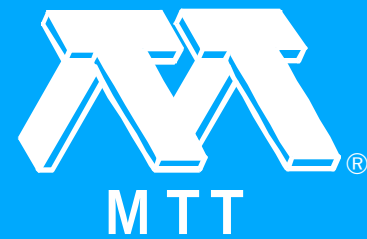
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Abstracts

Session WE1D -- Wireless Communications Systems

"Session WE1D -- Wireless Communications Systems." 1995 MTT-S International Microwave Symposium Digest 95.2 (1995 Vol. II [MWSYM]): 399-399.



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Recent Advances on Millimeterwave PCN System Development in Europe

H.H. Meinel. "Recent Advances on Millimeterwave PCN System Development in Europe." 1995 MTT-S International Microwave Symposium Digest 95.2 (1995 Vol. II [MWSYM]): 401-404.

The possibility to apply millimeter-waves for various applications in the commercial arena has a long history, as the technical advantages being offered by such systems are known since more than 3 decades. Within the last 5 years the necessity of turning their attention away from the military sector towards commercial products has forced more and more companies to look at millimeterwave communications very thoroughly. As a matter of fact and fortunately this was accompanied by the advent of low-cost integration procedures, i.e. Hybrid- and Monolithic-Integration Techniques, respectively. Having the necessary technology at hand, mature and commercially available, a wide field of employment areas has been opened. From indoor high-speed radio communication systems at 10.6 GHz, as proposed by NTT of Japan, over "gateways" for mobile or new, 'deregulated' stationary telephone systems at 38 and 55 GHz, being available from northern telecom, UK, and WLAN's at 60 GHz, like the MBS project, being under research within the European RACE-programme, to the optic microwave hybrid approach for pico-cellular PCN's, as proposed by ALCATEL-SEL of Germany and CNET of France the scope of today's applications is spanning. While the military market is still decreasing, the commercial application of millimeterwaves is ongoing to increase very rapidly. The actual status and the upcoming technology trends, as they can be seen from Europe, will be surveyed.

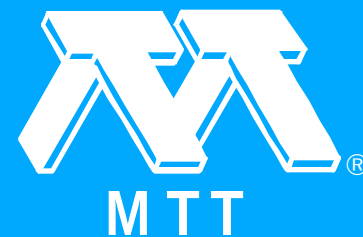


Abstracts

Recent Activities on Millimeter Wave Indoor LAN System Development in Japan

Y. Takimoto. "Recent Activities on Millimeter Wave Indoor LAN System Development in Japan." 1995 MTT-S International Microwave Symposium Digest 95.2 (1995 Vol. II [MWSYM]): 405-408.

The necessity for 60 GHz band development in Japan, the features of millimeter wave (MM-wave) indoor LAN, developments needed for its realization, and propagation studies to implement indoor LAN are reviewed. This paper describes a MM-wave minimum delay spread LAN under development in Japan, results of its propagation simulation, absorbable construction materials being considered for the system, and MMIC devices needed for the system.



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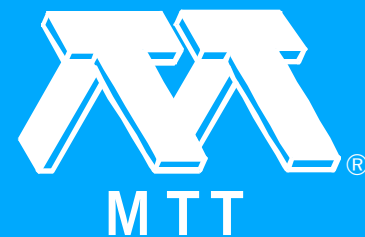


Abstracts

Advanced MMIC Components for Ka-Band Communications Systems - A Survey

J.-M. Dieudonne, B. Adelseck, P. Narozny and H. Dambkes. "Advanced MMIC Components for Ka-Band Communications Systems - A Survey." 1995 MTT-S International Microwave Symposium Digest 95.2 (1995 Vol. II [MWSYM]): 409-412.

The key MMIC circuit functions for Ka-Band communication systems have been fabricated. Low noise amplifiers, a medium power amplifier, mixers and DRO have been developed using a common 0.25 μm PMHFET technology allowing a future integration of several key components on a single chip. A voltage controlled oscillator has been realized in a GaInP/GaAs HBT technology for improvement of the phase noise performances. Low noise Schottky diode upconverter and downconverter are also available in 0.25 μm MESFET technology with buried n/sup +/- layer.



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Microwave and Millimetre-Wave Technology Requirements for the European Fourth Framework Programme

J.G. Gardiner. "Microwave and Millimetre-Wave Technology Requirements for the European Fourth Framework Programme." 1995 MTT-S International Microwave Symposium Digest 95.2 (1995 Vol. II [MWSYM]): 413-415.

The 'Advanced Communications Technologies and Services' (ACTS) research programme forms part of the European Fourth Framework and addresses the communications environment of the first decade of next century. This paper sets out the European Commission philosophy of integration of UMTS, satellite-mobile, wireless-LAN and mm-wave broadband mobile systems into a single structure and the research methodology involving 'National Hosts'.



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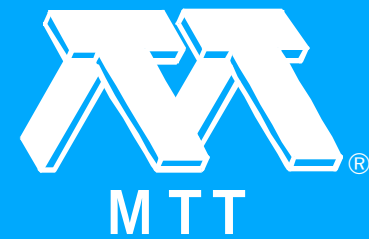
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Abstracts

Session WE1E -- Millimeter-Wave Circuits and Systems

"Session WE1E -- Millimeter-Wave Circuits and Systems." 1995 MTT-S International Microwave Symposium Digest 95.2 (1995 Vol. II [MWSYM]): 417-417.



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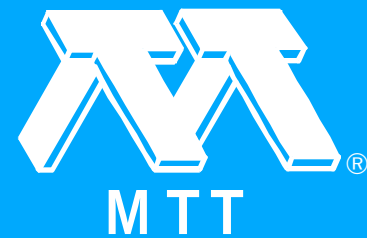


Abstracts

A W-Band Monolithic 175-mW Power Amplifier

H. Wang, Y. Hwang, T.H. Chen, M. Biedenbender, D.C. Streit, D.C.W. Lo, G.S. Dow and B.R. Allen. "A W-Band Monolithic 175-mW Power Amplifier." 1995 MTT-S International Microwave Symposium Digest 95.2 (1995 Vol. II [MWSYM]): 419-422.

A monolithic W-band power amplifier has been developed to promote the output power performance. This monolithic two-stage balanced power amplifier has demonstrated a small signal gain of 7 dB and an output power of 175 mW at 90 GHz, which represents state-of-the-art output power performance for a monolithic amplifier at this frequency. This monolithic chip is fabricated using 0.1- μ m AlGaAs/InGaAs/GaAs pseudomorphic power HEMT MMIC production process.



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W-Band Integrated Monopulse Radar Transceiver

P. Toullos, Y.-H. Shu, J. Navarro and R. Knox. "W-Band Integrated Monopulse Radar Transceiver." 1995 MTT-S International Microwave Symposium Digest 95.2 (1995 Vol. II [MWSYM]): 423-426.

Millimeter wavelength components remain difficult and expensive to fabricate. The use of these components for integrated transceivers further complicates designs and results in higher costs. This paper describes an integrated 94 GHz monopulse transceiver using microstrip and insular guide transmission lines. This hybrid integration uses four dielectric rod antennas which feed four insular lines configured to provide the monopulse comparator circuit for the transceiver front-end.

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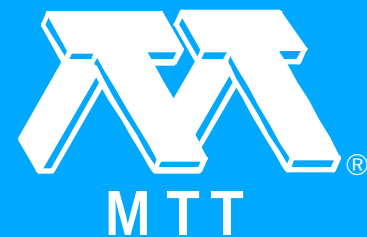


Abstracts

A 40 to 50 GHz HEMT Test Fixture

A. Prabhu and N. Erickson. "A 40 to 50 GHz HEMT Test Fixture." 1995 MTT-S International Microwave Symposium Digest 95.2 (1995 Vol. II [MWSYM]): 427-429.

A probe station has been built in the 40 to 50 GHz band to accurately measure the noise and S parameters of mm-wave HEMT's. The probe impedances are close to the optimum terminating impedance of the HEMT and have very low loss. This in turn is expected to enhance the accuracy of the measured noise and S parameters. A TRL calibration using micro-coax lines is being investigated. The fixture and the calibration procedure are described.



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Manufacturable and Reliable Millimeter-Wave HJFET MMIC Technology Using Novel 0.15 μm MoTiPtAu Gates

Y. Hori, K. Onda, M. Funabashi, H. Mizutani, K. Maruhashi, A. Fujihara, K. Hosoya, T. Inoue and M. Kuzuhara. "Manufacturable and Reliable Millimeter-Wave HJFET MMIC Technology Using Novel 0.15 μm MoTiPtAu Gates." 1995 MTT-S International Microwave Symposium Digest 95.2 (1995 Vol. II [MWSYM]): 431-434.

This paper describes a manufacturable and reliable millimeter-wave heterojunction FET (HJFET) MMIC technology, in which a novel 0.15 μm MoTiPtAu T-shaped gate has been successfully employed. Excellent DC and RF device characteristics, including I_{max} of $\sim 600\text{mA/mm}$, BV_{gd} of $>10\text{V}$ and F_{max} of $\sim 200\text{GHz}$, were confirmed. High temperature DC-bias tests predict an MTTF of 1.5×10^7 hours at a channel temperature of 150°C . The 2-stage MMIC amplifier, fabricated using the developed technology, exhibited a 69.5mW output power with 14.4% power-added efficiency at 56GHz with good uniformity.

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A High Performance, High Yield, Dry-Etched, Pseudomorphic HEMT for W-Band Use

N.I. Cameron, M.R.S. Taylor, H. McLelland, M. Holland, I.G. Thayne, K. Elgaid and S.P. Beaumont. "A High Performance, High Yield, Dry-Etched, Pseudomorphic HEMT for W-Band Use." 1995 MTT-S International Microwave Symposium Digest 95.2 (1995 Vol. II [MWSYM]): 435-438.

A GaAs pseudomorphic HEMT process has been optimised for high performance and yield at w-band. Several key nano-fabrication techniques are explored for performance, manufacturability and process sensitivity. The molecular beam epitaxially grown pHEMT layer is optimised for reduced short channel effects, high transconductance (690 mS/mm) and reliability. Electron-beam lithography produces ultra short T-gates with high reproducibility. Selective reactive ion etching enables both the depth and width of the gate recess to be accurately controlled. 0.2 μm pHEMTs with two 50 μm gate fingers exhibit average values for $f_{\text{sub T}}$ and $f_{\text{sub max}}$ of 121 and 157 GHz with low standard deviations of 4.6 and 2.9 GHz respectively.

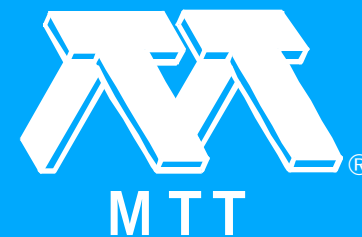
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Abstracts

Session WE2A -- Microwave Power Devices and Amplifiers II

"Session WE2A -- Microwave Power Devices and Amplifiers II." 1995 MTT-S International Microwave Symposium Digest 95.2 (1995 Vol. II [MWSYM]): 439-439.



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Variable Output, High Efficiency-Low Distortion S-Band Power Amplifiers and Their Performances Under Single Tone and Noise Power Excitations

A. Platzker and S. Bouthillette. "Variable Output, High Efficiency-Low Distortion S-Band Power Amplifiers and Their Performances Under Single Tone and Noise Power Excitations." 1995 MTT-S International Microwave Symposium Digest 95.2 (1995 Vol. II [MWSYM]): 441-444.

A family of one stage, high efficiency-low distortion variable output power MIC amplifiers for narrow band applications at S-band was developed. The amplifiers utilize 0.5 μm gatelength PsHEMT devices with 4.8mm to 19.2mm peripheries. High efficiency (>60%) is maintained under CW operation at 2.45GHz over 12dB of input range by varying V_{ds} between 2 and 8V. At 2.45GHz, amplifiers with 19.2mm devices biased at V_{ds} =8V, provide 12W of single tone power at 62% PAE with 13dB gain (1dBc) and 36.5dBm noise power at NPR=17dB (40 MHz wide noise with 700KHz notch) with 43% efficiency.

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Abstracts

High-Performance 0.15- μm -Gate-Length pHEMTs Enhanced with a Low-Temperature-Grown GaAs Buffer

R. Actis, K.B. Nichols, W.F. Kopp, T.J. Rogers and F.W. Smith. "High-Performance 0.15- μm -Gate-Length pHEMTs Enhanced with a Low-Temperature-Grown GaAs Buffer." 1995 MTT-S International Microwave Symposium Digest 95.2 (1995 Vol. II [MWSYM]): 445-448.

An improved GaAs power pHEMT is presented. The device utilizes a low-temperature-grown (LTG) GaAs buffer layer instead of the conventional-buffer layers commonly used by pHEMT manufacturers. When contrasted with identical devices using a conventional buffer, these LTG-buffered pHEMTs have shown a 45% increase in channel breakdown voltage, a 12% increase in power output, and a record 63% power-added efficiency at 20 GHz.



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Robust GaAs MMIC Amplifiers Using Planar Ion-Implanted Power MESFETs with Improved Open-Channel Burnout

D.C. Miller, R.A. Sadler and A.H. Peake. "Robust GaAs MMIC Amplifiers Using Planar Ion-Implanted Power MESFETs with Improved Open-Channel Burnout." 1995 MTT-S International Microwave Symposium Digest 95.2 (1995 Vol. II [MWSYM]): 449-451.

Planar ion-implanted GaAs MESFETs with modified drain n/sup +/- regions show increased open-channel burnout voltage, making them robust against transient overvoltages. This increases circuit yields through pulsed on-wafer testing from < 50% to ~90%. Higher drain biases can also be used, allowing 9 W of output power to be produced with $V_{DS}/=13V$ by an X-band MMIC amplifier designed to produce 4 W with $V_{DS}/=7V$.



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GaAs/InGaAs Heterostructure FETs with 1.6W Output Power at 1GHz

J.W. Lee, M.K. Gong, S.G. Cho and B. Kim. "GaAs/InGaAs Heterostructure FETs with 1.6W Output Power at 1GHz." 1995 MTT-S International Microwave Symposium Digest 95.2 (1995 Vol. II [MWSYM]): 453-456.

Data are presented on high power GaAs/InGaAs pseudomorphic heterostructure FETs with delta doped channels, which are applicable for the low voltage operating cellular phone power modules. Process yields of such AlGaAs-free device are significantly improved in epitaxy and ohmic metalization. With a 5V Class A bias condition, the packaged device with a 1.2mm x 12mm gate exhibits a power output of 1.6W and a power added efficiency of 44-percent at 1GHz operation. The smaller device with a 1.2 μ m x 2mm gate shows a 160 mW output and a 34-percent efficiency at 2GHz with a 3.3V bias. These results imply that the GaAs/InGaAs HFET can be a strong candidate for the low cost commercial source of many kinds of high power microwave devices operating at relatively low operating voltages.

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A Scalable MMIC-Compatible Power HBT

G. Jackson, D. Teeter, D. Bradford and M. Cobb. "A Scalable MMIC-Compatible Power HBT." 1995 MTT-S International Microwave Symposium Digest 95.2 (1995 Vol. II [MWSYM]): 457-460.

A MMIC-compatible, scalable HBT, utilizing heatsinking through Au interconnects to local via-holes, is described. At 2.45 GHz, 960 μm^2 area HBTs exhibit 34.5 dBm output power, 15.5 dB gain and 57% PAE. At 10 GHz, 600 μm^2 HBTs have 33 dBm output, 8 dB gain, 47% PAE. Thermal impedance is reduced 40% on smaller devices, and the need for emitter ballasting is eliminated.

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Three-Dimensional Modeling of Thermal Flow in Multi-Finger High Power HBTs

R. Hattori, T. Shimura, M. Kato, T. Sonoda and S. Takamiya. "Three-Dimensional Modeling of Thermal Flow in Multi-Finger High Power HBTs." 1995 MTT-S International Microwave Symposium Digest 95.2 (1995 Vol. II [MWSYM]): 461-464.

Three-dimensional modeling of thermal flow in multi-finger HBTs has been investigated with thermal network method to find out the optimal structure which can effectively reduce the junction temperature uniformly in whole fingers under the high power operation. Thermal cross-talk effects and temperature distribution in a finger or between the fingers are examined. The HBT structure with emitter air-bridge connected to via hole is proposed as an optimal structure. The estimation accuracy of the calculation was confirmed from the good agreement between the calculation result and the measured value of the thermal resistance in HBT with the emitter air-bridge structure.

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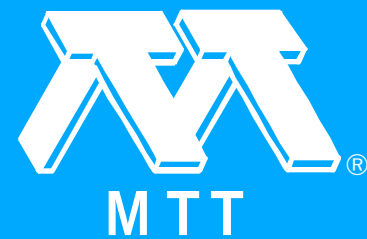


Abstracts

High Performance Millimeter Wave AlInAs/GaInAs/InP HEMTs with Individually Grounded Source Finger Vias

K.Y. Hur, R.A. McTaggart, M.P. Ventresca, R. Wohlert, L.M. Aucoin and T.E. Kazior. "High Performance Millimeter Wave AlInAs/GaInAs/InP HEMTs with Individually Grounded Source Finger Vias." 1995 MTT-S International Microwave Symposium Digest 95.2 (1995 Vol. II [MWSYM]): 465-468.

Millimeter wave AlInAs/GaInAs/InP HEMTs with individually grounded source finger vias and end source vias have been fabricated and characterized. Although DC IV characteristics of the HEMTs with individually grounded source finger vias and end source vias were similar, RF measurements yielded higher small signal gain on the HEMT with individually grounded source finger vias. Power measurements at 44 GHz further revealed that the HEMT with individually grounded source finger vias produced higher output power, power added efficiency, and associated gain compared to the HEMT with end source vias.



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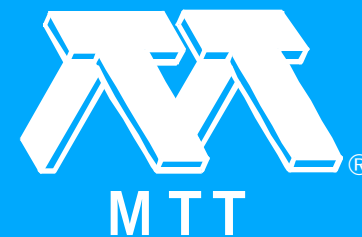
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Abstracts

Session WE2B -- Frequency-Domain Electromagnetic Modeling

"Session WE2B -- Frequency-Domain Electromagnetic Modeling." 1995 MTT-S International Microwave Symposium Digest 95.2 (1995 Vol. II [MWSYM]): 469-469.



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Abstracts

An Entire-Domain Basis Galerkin's Method for the Modeling of Integrated MM-Wave and Optical Circuits

G. Athanasoulas and N.K. Uzunoglu. "An Entire-Domain Basis Galerkin's Method for the Modeling of Integrated MM-Wave and Optical Circuits." 1995 MTT-S International Microwave Symposium Digest 95.2 (1995 Vol. II [MWSYM]): 471-474.

The propagation characteristics of coupled rectangular dielectric waveguides are analyzed using the electric field integral equation. In contrast with the widely used subdomain basis Galerkin's method, in this work a novel set of entire-domain basis functions is utilized. This set consists of plane wave functions that satisfy Maxwell's equations in each guiding region. Computed dispersion curves are presented for a mm-wave transmission line and compare very closely to results of other techniques. The present implementation can also deal with integrated optical circuits and its main advantage is superior numerical efficiency.



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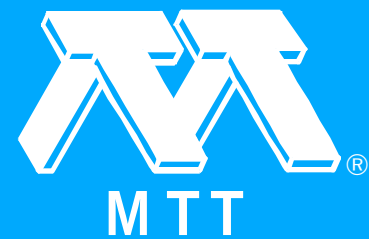
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Proximity Coupled Microstrip Elements and Interconnects of Arbitrary Shape in Multilayered Media

M.-J. Tsai and N.G. Alexopoulos. "Proximity Coupled Microstrip Elements and Interconnects of Arbitrary Shape in Multilayered Media." 1995 MTT-S International Microwave Symposium Digest 95.2 (1995 Vol. II [MWSYM]): 475-478.

The performance of microstrip elements of arbitrary shape as resonators, directional couplers, antennas and multilevel interconnects is examined in this paper. The mixed potential integral equation (MPIE) method is employed with triangular patch functions to model microstrip elements of arbitrary shape. The model is equally applicable to microstrip circuit and/or microstrip antenna design. The paper includes thorough investigation of the excitation mechanism. This presentation will focus on proximity coupled microstrip elements and multilevel interconnects.

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Abstracts

Full-Wave Modal Analysis of Arbitrarily-Shaped Dielectric Waveguides through an Efficient Boundary-Element-Method Formulation (1995 Vol. II [MWSYM])

C. Di Nallo, F. Frezza and A. Galli. "Full-Wave Modal Analysis of Arbitrarily-Shaped Dielectric Waveguides through an Efficient Boundary-Element-Method Formulation (1995 Vol. II [MWSYM])." 1995 MTT-S International Microwave Symposium Digest 95.2 (1995 Vol. II [MWSYM]): 479-482.

In this work an original procedure, based on the boundary element method (BEM), is carried out for the full-wave modal analysis of dielectric waveguiding structures with arbitrary cross section. A new advantageous integral-equation formulation is reached after a careful analysis of the dyadic kernel's discontinuities. Numerical solutions are then derived by means of both conventional and novel algorithms. Various results for important microwave applications, compared to data from other numerical approaches and from measurements, emphasize the notable accuracy and efficiency of such implementation.



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Abstracts

The Finite-Integration Beam-Propagation Method (FIBPM)

M. Niederhoff, W. Heinrich and P. Russer. "The Finite-Integration Beam-Propagation Method (FIBPM)." 1995 MTT-S International Microwave Symposium Digest 95.2 (1995 Vol. II [MWSYM]): 483-486.

We present a novel full-vector beam-propagation method where the discretization of Maxwell's equations is performed by finite integration (FIBPM). This allows to include thin layers of complex permittivity without increasing mesh density. A FIBPM code for a massively parallel computer has been developed and applied successfully to laser diode structures.



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A New Frequency-Domain TLM Symmetrical Condensed Node Derived Directly from Maxwell's Equations

H. Jin and R. Vahldieck. "A New Frequency-Domain TLM Symmetrical Condensed Node Derived Directly from Maxwell's Equations." 1995 MTT-S International Microwave Symposium Digest 95.2 (1995 Vol. II [MWSYM]): 487-490.

This paper presents a new frequency-domain TLM symmetrical condensed node derived directly from Maxwell's equations by using centered differencing and averaging. Direct correspondence between the FDTLM and finite difference method is established. The node scattering matrices and field expressions are given for the general case with graded mesh and anisotropic materials including both electric and magnetic losses. It is demonstrated that this new FDTLM node always has 2nd-order accuracy regardless of a uniform or graded mesh discretization of the space.

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Abstracts

The Method of Lines for the Hybrid Analysis of Multilayered Dielectric Resonators

D. Kremer and R. Pregla. "The Method of Lines for the Hybrid Analysis of Multilayered Dielectric Resonators." 1995 MTT-S International Microwave Symposium Digest 95.2 (1995 Vol. II [MWSYM]): 491-494.

In this paper the Method of Lines has been used in the hybrid analysis of dielectric resonators. The resonant frequencies, as well as Q- factors caused by radiation or dielectric loss and the corresponding field distributions, will be determined with the described algorithm based on the Method of Lines. For the five lowest order modes the resonant frequencies and the Q-factors due to radiation are presented for a dielectric resonator of the relative permittivity of 38. The results are compared with those of other rigorous numerical methods and with the newest measurement available in the literature.



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Abstracts

Session WE2C -- Coupled Mode Waveguide Filters

"Session WE2C -- Coupled Mode Waveguide Filters." 1995 MTT-S International Microwave Symposium Digest 95.2 (1995 Vol. II [MWSYM]): 495-495.



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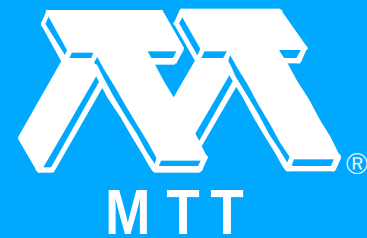


Abstracts

Direct Synthesis of Cascaded Quadruplet (CQ) Filters (1995 Vol. II [MWSYM])

R. Levy. "Direct Synthesis of Cascaded Quadruplet (CQ) Filters (1995 Vol. II [MWSYM])." 1995 MTT-S International Microwave Symposium Digest 95.2 (1995 Vol. II [MWSYM]): 497-500.

Previous designs for CQ filters have required matrix-rotation operations on the coupling matrix of the canonic form of the cross-coupled filters. This is a rather awkward and not entirely satisfactory process since the theory is not general, requiring the application of equations specific to each order of filter, and in fact has been developed only as far as even order 10. A new direct CQ synthesis has now been discovered having no such limitations.



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Mixed Modes Cylindrical Planar Dielectric Resonator Filters with Rectangular Enclosure (1995 Vol. II [MWSYM])

C. Wang, H.-W. Yao and K.A. Zaki. "Mixed Modes Cylindrical Planar Dielectric Resonator Filters with Rectangular Enclosure (1995 Vol. II [MWSYM])." 1995 MTT-S International Microwave Symposium Digest 95.2 (1995 Vol. II [MWSYM]): 501-504.

A compact mixed modes cylindrical planar dielectric resonator filter in rectangular enclosure with excellent spurious free performance is presented. Space coupling between different mode's dielectric resonators and iris coupling between identical mode's dielectric resonators are realized in the filters. All couplings are computed by rigorous full wave mode matching technique. A 6-pole elliptic function filter is designed, constructed and tested. Excellent filter frequency response is obtained.

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Complete Design for Five-Pole in Line Elliptic Filter

P. Guillot, H. Baudrand, S. Vigneron and B. Theron. "Complete Design for Five-Pole in Line Elliptic Filter." 1995 MTT-S International Microwave Symposium Digest 95.2 (1995 Vol. II [MWSYM]): 505-508.

The complete design of a five-pole in line elliptic filter using TE/sub 113/ and TM/sub 012/ modes is presented. A multimodal variational method is used in order to determine all iris dimensions and positions. Simultaneous TE / TE and TE / TM mode couplings between the dual and triple mode cavities are provided by a single displaced rectangular iris. A filter has been designed and realized using our theoretical iris dimensions (central frequency: 12.57 GHz and bandwidth 47 MHz). The required and experimental responses are in very good agreement.

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Dual-Mode Dielectric-Loaded Resonators with Cross-Coupling Flats

J.-F. Liang, K.A. Zaki and R. Levy. "Dual-Mode Dielectric-Loaded Resonators with Cross-Coupling Flats." 1995 MTT-S International Microwave Symposium Digest 95.2 (1995 Vol. II [MWSYM]): 509-512.

Cross coupling in dual-mode dielectric resonators is obtained by introducing asymmetries in the normally circular cross section of the resonator in the form of flattened regions at an angle of 45 degree to the two orthogonal modes. When the dielectric resonator occupies the full length of the cavity the coupling is obtained based on the relationship between the waveguide polarizer and filter coupling coefficient as described in [1], and a perturbation theory is applied to obtain the dimensions. The theory has been checked against results obtained by a three dimensional field theory program. When the dielectric resonator is shorter than the cavity the simple relationship between waveguide polarizability and filter coupling coefficient no longer applies, but good results are still obtained from perturbation theory.

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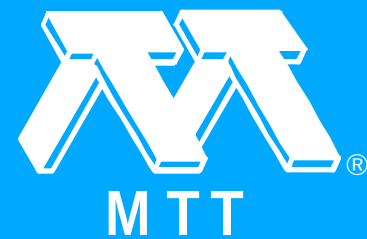


Abstracts

Mode-Selective Negative Coupling for Implementing Multiple Attenuation Poles in Evanescent-Mode Waveguide Filters

K. Iguchi, M. Tsuji and H. Shigesawa. "Mode-Selective Negative Coupling for Implementing Multiple Attenuation Poles in Evanescent-Mode Waveguide Filters." 1995 MTT-S International Microwave Symposium Digest 95.2 (1995 Vol. II [MWSYM]): 513-516.

This paper presents interesting improvements on evanescent-mode-waveguide bandpass filters which was reported by us at the 1994 IEEE International Microwave Symposium. Those improvements are now successful for newly introducing both the mode-selective negative coupling and the L-angled corner coupling scheme. Experimental results that we took prove the effectiveness of our improvements.



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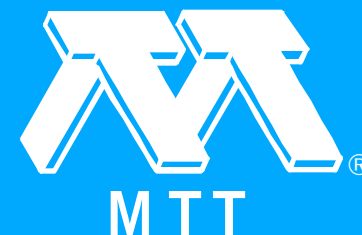
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Abstracts

Session WE2D -- Wireless Technologies

"Session WE2D -- Wireless Technologies." 1995 MTT-S International Microwave Symposium Digest 95.2 (1995 Vol. II [MWSYM]): 517-517.



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A Low Cost Mixer for Wireless Applications

J.-M. Mourant. "A Low Cost Mixer for Wireless Applications." 1995 MTT-S International Microwave Symposium Digest 95.2 (1995 Vol. II [MWSYM]): 519-522.

A new GaAs Integrated Circuit mixer is presented that services wireless communication requirements. Low cost, small size and good electrical performance are achieved through the use of a one balun-one FET scheme, a mature MESFET process and plastic packaging. Measured data is shown for 900 MHz and 1800 MHz parts. This mixer offers the best performance-to-price ratio in the marketplace.

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A Low-Current Linearity Sweet Spot in HFET's

R. Vaitkus, V. Nair and S. Tehrani. "A Low-Current Linearity Sweet Spot in HFET's." 1995 MTT-S International Microwave Symposium Digest 95.2 (1995 Vol. II [MWSYM]): 523-526.

Planar doped HFET's exhibit a narrow bias region of low intermodulation distortion, a linearity sweet spot, at low drain current levels. The bias condition associated with this sweet spot is shown to be near the low-current inflection point of the transconductance versus gate voltage characteristic. It is also shown that the bias condition for the sweet spot can be controlled in dual-gate HFET's. This feature in the HFET characteristics can be exploited to design low-power front-end MMIC's with better intercept points for applications in wireless communications.

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A Novel 3V, 7 mA PHEMT GaAs Active MMIC Mixer/LNA for Wireless Applications

H. Morkner, M. Frank and B. Ingram. "A Novel 3V, 7 mA PHEMT GaAs Active MMIC Mixer/LNA for Wireless Applications." 1995 MTT-S International Microwave Symposium Digest 95.2 (1995 Vol. II [MWSYM]): 527-530.

A novel monolithic integrated active Mixer/LNA utilizing advanced pseudomorphic GaAs FETs has been developed. RF Frequency coverage is 900 MHz to 2400 MHz. The Mixer/LNA operates on a single 3 Volt supply at 7 mA. The mixer provides 4 dB conversion gain with a -10 dBm LO drive. The LNA provides a 1.6 dB noise figure and 14 dB gain. The die is small packaged in the SSOP-16 plastic package to keep costs low. This is the only GaAs PHEMT active Mixer/LNA known to provide such performance from such a small DC requirement.

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A Double-Polysilicon Bipolar Process with a 0.3- μm Minimum Emitter Width and NMOS Transistors for Low Power Wireless Applications

K. O, C. Tsai, T. Tewksbury, G. Dawe, C. Kermarrec and J. Yasaitis. "A Double-Polysilicon Bipolar Process with a 0.3- μm Minimum Emitter Width and NMOS Transistors for Low Power Wireless Applications." 1995 MTT-S International Microwave Symposium Digest 95.2 (1995 Vol. II [MWSYM]): 531-534.

A 0.6- μm 3.5-V silicon bipolar process is developed for low power and high speed operation in wireless applications. The process features 35-GHz $f_{\text{sub T}}$ bipolar transistors with a 0.3- μm electrical emitter width, lateral pnp transistors, polysilicon-to-n/sup +/ plug capacitors, NMOS transistors with a 10-nm gate oxide layer for low on-resistance, and inductors fabricated using a double level metal process. Improvement of the low power and high speed performance of the npn transistors is demonstrated by examining the trade-offs among $r_{\text{sub b}}/r_{\text{sub e}}$, collector current required to achieve a fixed $f_{\text{sub T}}$, and device geometry. Microwave and RF capabilities are demonstrated by fabricating and characterizing low noise amplifiers and NMOS transistors.

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Abstracts

A Low Cost 3.6V Single-Supply GaAs Power Amplifier IC for the 1.9-GHz DECT System

J. Griffiths and V. Sadhir. "A Low Cost 3.6V Single-Supply GaAs Power Amplifier IC for the 1.9-GHz DECT System." 1995 MTT-S International Microwave Symposium Digest 95.2 (1995 Vol. II [MWSYM]): 535-538.

A GaAs power amplifier IC in a SOIC-16 plastic package has been developed for the 1.9 GHz Digital European Cordless Telephone (DECT) system. The power amplifier consists of two stages with all matching structures on chip and has a total area of 1.84 mm². At -2 dBm input power and 3.6 volts, the typical power amplifier achieves 26 dBm output power with 30% power-added efficiency, while operating from a single power supply in the SOIC-16 plastic package.



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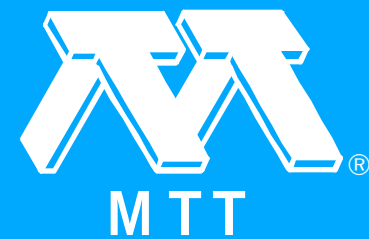
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Abstracts

Session WE2E -- Millimeter Wave Sources and Measurements

"Session WE2E -- Millimeter Wave Sources and Measurements." 1995 MTT-S International Microwave Symposium Digest 95.2 (1995 Vol. II [MWSYM]): 539-539.



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60-GHz Monolithic Oscillator Using InGaP/InGaAs/GaAs HEMT Technology

Y. Kawasaki, K. Shirakawa, Y. Ohashi and T. Saito. "60-GHz Monolithic Oscillator Using InGaP/InGaAs/GaAs HEMT Technology." 1995 MTT-S International Microwave Symposium Digest 95.2 (1995 Vol. II [MWSYM]): 541-544.

Using 0.11- μm InGaP/InGaAs/GaAs pseudomorphic HEMT technology, we have developed a 60-GHz buffered free-running monolithic oscillator which has an output power of 9.1 dBm at 59.7 GHz and a phase noise of -60 dBc/Hz at 100 kHz from the carrier frequency. We operated the oscillator's HEMT in a reverse channel configuration and introduced an empirical nonlinear HEMT model for the configuration.

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Abstracts

New Insight in Operation Principles and Accurate Design of Fundamental and Harmonic Millimeter-Wave Oscillators

M. Curow. "New Insight in Operation Principles and Accurate Design of Fundamental and Harmonic Millimeter-Wave Oscillators." 1995 MTT-S International Microwave Symposium Digest 95.2 (1995 Vol. II [MWSYM]): 545-548.

A new time-domain simulation method for design and optimization of millimeter-wave oscillators with Gunn and IMPATT devices is presented. The method allows load impedance functions of any complexity as calculated by mode-matching or other techniques to be used as input and is combined with an efficient and accurate hydrodynamic model for the active device. The operation principles of practical oscillator circuits are clarified. Results of this approach are compared with calculations based on impressed voltages and currents in order to determine the real power limits of GaAs Gunn oscillators.



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A Ka-Band Planar Tripler Based on a Stacked Symmetric InP Heterostructure-Barrier Varactor

K. Krishnamurthi, E. Boch and R.G. Harrison. "A Ka-Band Planar Tripler Based on a Stacked Symmetric InP Heterostructure-Barrier Varactor." 1995 MTT-S International Microwave Symposium Digest 95.2 (1995 Vol. II [MWSYM]): 549-552.

The symmetric heterostructure barrier varactor (HBV) lends itself to frequency tripling with no need for bias or for a second harmonic idler circuit. This paper presents the performance of the first planar microstrip Ka-band frequency tripler based on a stacked HBV structure. A minimum conversion loss of 11.2 dB with a maximum power output of 10.78 dBm at 40.35 GHz is obtained.

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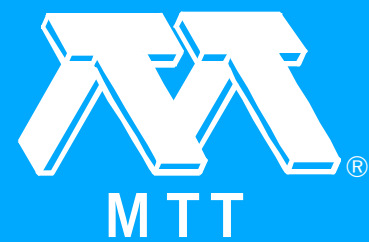
Millimeter-Wave Fresnel Zone Planar Lens and Antenna (1995 Vol. II [MWSYM])

H.D. Hristov and M.H.A.J. Herben. "Millimeter-Wave Fresnel Zone Planar Lens and Antenna (1995 Vol. II [MWSYM])." 1995 MTT-S International Microwave Symposium Digest 95.2 (1995 Vol. II [MWSYM]): 553-556.

A new variety of millimeter-wave Fresnel zone planar lens with enhanced focusing quality is described. Each full-wave zone is divided into four quarter-wave subzones covered by equal in thickness dielectric rings having different permittivities. More precise expression for the lens thickness is deduced. On the base of this planar lens configuration a Fresnel-zone lens antenna with about 52% aperture efficiency for a frequency of 62.1GHz is developed and examined theoretically.

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Absolute Loss Measurement of Highly Reflective Samples by Using a High Q Gaussian Beam Open Resonator at Short Millimeter Wave Frequencies

T. Matsui, M. Kiyokawa and K. Araki. "Absolute Loss Measurement of Highly Reflective Samples by Using a High Q Gaussian Beam Open Resonator at Short Millimeter Wave Frequencies." 1995 MTT-S International Microwave Symposium Digest 95.2 (1995 Vol. II [MWSYM]): 557-560.

A high Q Gaussian beam open resonator and a new arrangement of it are described as a new method for determining absolute loss due to surface resistance of highly reflective materials at short millimeter- and sub-millimeter wave frequencies. The Gaussian beam open resonator consists of a pair of spherical mirrors with highly reflective partially transparent circular coupling regions and a plane mirror, where the plane mirror is the test sample. Application of this new method to reflection type measurement enabled simultaneous attainment of high Q factor and high signal-to-noise ratio, which would have been impossible using a conventional reflection-type open resonator with a small coupling hole. Moreover, the use of a pair of identical spherical mirrors enabled direct measurement of the Q of these mirrors, which is equal to Q_{sub} others, without changing the experimental conditions. Surface loss measurements of metal films are made at 100 GHz band. In the room temperature experiment, surface resistance of 110 m-Ohms was measured with an accuracy of $\pm 7.6\%$.

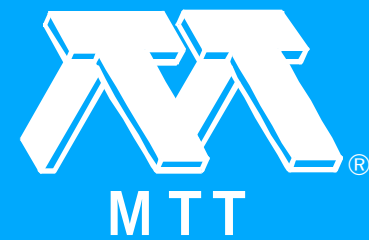
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Abstracts

Session WE3A -- Power Amplifiers for Wireless Applications

"Session WE3A -- Power Amplifiers for Wireless Applications." 1995 MTT-S International Microwave Symposium Digest 95.2 (1995 Vol. II [MWSYM]): 561-561.



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Low-Voltage High-Performance Silicon RF Power Transistors

M. Versleijen, R. Dekker, W.V.D. Einde and A. Pruijboom. "Low-Voltage High-Performance Silicon RF Power Transistors." 1995 MTT-S International Microwave Symposium Digest 95.2 (1995 Vol. II [MWSYM]): 563-566.

The high-frequency power performance of mounted discrete silicon bipolar transistors, that have been optimised for low-voltage application, has been evaluated. At 1.8GHz and 3.5V a power gain of 14dB and a power-added efficiency of 60% at an RF power density of 1W/mm emitter length have been measured. These results demonstrate that also at low supply voltages silicon BJTs have excellent power amplifying capabilities.

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Analogue/Digital Dual Power Module Using-Ion-Implanted GaAs MESFETs

H. Masato, M. Maeda, H. Fujimoto, S. Morimoto, M. Nakamura, Y. Yoshikawa, H. Ikeda, H. Kosugi and Y. Ota. "Analogue/Digital Dual Power Module Using-Ion-Implanted GaAs MESFETs." 1995 MTT-S International Microwave Symposium Digest 95.2 (1995 Vol. II [MWSYM]): 567-570.

An analogue and digital dual power module using ion-implanted GaAs MESFETs with high breakdown voltage has been developed for North American Digital Cellular (NADC). In the analogue operation, the module exhibited high power-added efficiency (PAE) of 56.0% at $V_{dd}=3.7V$. In the digital operation, the high efficiency of 46.9% and the low adjacent channel leakage power (P_{adj}) of -29.1dBc at +30kHz P_{adj} and of -52.7dBc at +60kHz P_{adj} were simultaneously obtained at $f=836.5MHz$, $P_{out}=31.0dBm$ and $V_{dd}=4.7V$. This device is quite suitable for the dual mode application.

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A 3.3V, 1.4W GaAs Power Amplifier for CDMA/AMPS Dual-Mode Cellular Phone

S.-J. Maeng, C.-S. Lee, K.-J. Youn, J.-L. Lee and H.-M. Park. "A 3.3V, 1.4W GaAs Power Amplifier for CDMA/AMPS Dual-Mode Cellular Phone." 1995 MTT-S International Microwave Symposium Digest 95.2 (1995 Vol. II [MWSYM]): 571-574.

For CDMA/AMPS dual-mode cellular phones, a power amplifier operating at 3.3V has been developed for the first time. The amplifier shows an output power of 31.5 dBm and a power-added efficiency of 61% for AMPS mode. The third order intermodulation and the fifth order one are measured to be -32 dBc and -45 dBc at an output power of 26 dBm for CDMA mode. These are good enough for dual-mode requirements.

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Abstracts

A High Power Density and High Efficiency UHF-Band HFET for Low Voltage Operation

T. Kunii, Y. Kohno, T. Kitano, S. Miyakuni, J. Udomoto, K. Yamamoto, K. Maemura, H. Takano, O. Ishihara and N. Tsubouchi. "A High Power Density and High Efficiency UHF-Band HFET for Low Voltage Operation." 1995 MTT-S International Microwave Symposium Digest 95.2 (1995 Vol. II [MWSYM]): 575-578.

A high power density and high efficiency AlGaAs/GaAs Heterostructure FET (HFET) for 0.9GHz Digital Cellular Phone Systems has been successfully developed. The device has delivered a high power density of 117mW/mm with a power-added efficiency (PAE) of 37.6% with a low adjacent channel power (ACP) of -53.4dBc at a low drain bias of 3.3V at 950 MHz operating frequency.



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A High Power and High Efficiency Amplifier with Controlled Second-Harmonic Source Impedance

M. Maeda, H. Takehara, M. Nakamura, Y. Ota and O. Ishikawa. "A High Power and High Efficiency Amplifier with Controlled Second-Harmonic Source Impedance." 1995 MTT-S International Microwave Symposium Digest 95.2 (1995 Vol. II [MWSYM]): 579-582.

A novel technology that drastically improves output power and efficiency of amplifiers has been developed. A record high 74% power added efficiency (PAE) with an output power (Pout) of 31.4dBm (1.4W) has been achieved from an ion-implanted GaAs MESFET at a low supply voltage of 3.5V and 930MHz, by optimally terminating second-harmonic source impedance as well as second-harmonic load impedance. By using this technology, a small sized (0.4cc) power amplifier module for cellular phones has been developed. It has realized a high PAE of 66% with Pout of 31dBm (1.25W) under the condition of 3.5V around 915-945 MHz band.

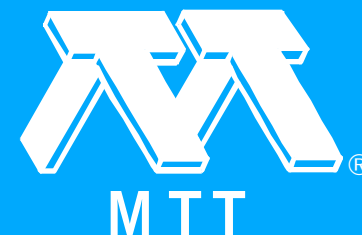
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Abstracts

Session WE3B -- Quasi-Optical Passive and Amplifier Arrays

"Session WE3B -- Quasi-Optical Passive and Amplifier Arrays." 1995 MTT-S International Microwave Symposium Digest 95.2 (1995 Vol. II [MWSYM]): 583-583.



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High-Power Hybrid Quasi-Optical Ka-Band Amplifier Design

J. Hubert, J. Schoenberg and Z.B. Popovic. "High-Power Hybrid Quasi-Optical Ka-Band Amplifier Design." 1995 MTT-S International Microwave Symposium Digest 95.2 (1995 Vol. II [MWSYM]): 585-588.

We report the first demonstration of a quasi-optical millimeter-wave amplifier. The amplifier unit cell consists of a MMIC driver amplifier chip followed by a two-stage high power amplifier chip. Input as well as output antennas are anti-resonant slots fabricated on a GaAs monolithic antenna array. A 6x6 array is designed for an output power in excess of 8 Watts. The array allows a variety of MMIC amplifier chips to populate any number of cells up to the full array size. An absolute power gain of 6 dB was achieved at 29 GHz. A liquid-cooled test fixture was designed to remove excess heat from the amplifiers. Amplifiers of this type could be used in communication or radar systems to produce high power with reduced size, weight, and lower system cost.

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



Two Stage Double Layer Microstrip Spatial Amplifiers

T. Ivanov and A. Mortazawi. "Two Stage Double Layer Microstrip Spatial Amplifiers." 1995 MTT-S International Microwave Symposium Digest 95.2 (1995 Vol. II [MWSYM]): 589-592.

Several two stage spatial amplifiers are presented. The amplifiers were constructed on double layer back to back microstrip circuits with a shared ground plane. The ground plane provides an effective isolation between the receiving antenna array and the transmitting antenna array. Furthermore, it serves as a heat sink in high power amplifier design. The coupling between the two stages is accomplished through microstrip to slot transitions, therefore there is no electrical contact from one layer to another. This facilitates monolithic fabrication of such amplifiers. The measured gain of a 3x3 spatial amplifier at 9.95 GHz is 18.0 dB.





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Quasi-Optical Amplifier Array Using Direct Integration of MMICs and 50 Omega Multi-Slot Antennas

H.S. Tsai and R.A. York. "Quasi-Optical Amplifier Array Using Direct Integration of MMICs and 50 Omega Multi-Slot Antennas." 1995 MTT-S International Microwave Symposium Digest 95.2 (1995 Vol. II [MWSYM]): 593-596.

A new 50-Ohm planar antenna structure is presented for finite thickness dielectric substrates. Direct integration of these antennas and commercial MMICS amplifier chips is explored for quasi-optical power combining. A prototype 4 x 4 array demonstrated 10dB gain with 4% bandwidth @ 11 GHz with no matching networks.

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



Metal Mesh Couplers Using Evanescent Waves at Millimeter and Submillimeter Wavelengths

J. Bae, J.-C. Chiao, K. Mizuno and D.B. Rutledge. "Metal Mesh Couplers Using Evanescent Waves at Millimeter and Submillimeter Wavelengths." 1995 MTT-S International Microwave Symposium Digest 95.2 (1995 Vol. II [MWSYM]): 597-600.

A metal mesh evanescent wave coupler which makes use of coupling of evanescent waves between a metal mesh and a tuning dielectric plate, has been developed as a quasi-optical component for millimeter and submillimeter wavelengths. The coupling coefficient of the capacitive evanescent wave coupler can be changed more than 70% by moving the silicon plate only 60 μm at around 53 GHz. The transmission properties of the evanescent wave couplers depending on the mesh period and the silicon plate thickness have been studied.

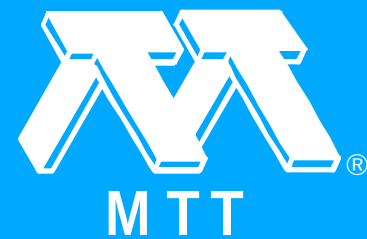


Abstracts

Analysis of Cascaded Quasi-Optical Grids

S.C. Bundy, W.A. Shiroma and Z.B. Popovic. "Analysis of Cascaded Quasi-Optical Grids." 1995 MTT-S International Microwave Symposium Digest 95.2 (1995 Vol. II [MWSYM]): 601-604.

A general analysis method for cascaded grids is presented. The method is based on a full-wave theory for arbitrary periodic metal gratings printed on dielectrics and loaded with active or passive lumped devices. Each quasi-optical component is characterized by a multiport network, in which two of the ports represent the free-space regions on both sides of the grid surface, and the remaining ports are connected to the lumped loads. This approach allows cascading of quasi-optical components using transmission-line theory. Experimental validation between 2-18 GHz is presented for cascaded gratings loaded with lumped capacitors and resistors.



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Quasi-Optical Antenna Array Amplifiers

J. Schoenberg, T. Mader, B. Shaw and Z.B. Popovic. "Quasi-Optical Antenna Array Amplifiers." 1995 MTT-S International Microwave Symposium Digest 95.2 (1995 Vol. II [MWSYM]): 605-608.

Several quasi-optical transmission wave amplifiers are presented: (1) a two-level power-combining PHEMT patch-antenna lens amplifier with 8 dB of absolute power gain at 9.7 GHz used for beamforming and beam-switching; (2) a saturated class-A polarization-preserving 24-MESFET patch array which produces 0.7 Watts at 10 GHz with 21 % power-added efficiency; and (3) an X-band 2-stage low-noise CPW PHEMT amplifier cell using anti-resonant slot antennas with 21.7 dB active gain, 3.2 dB noise figure and a 6 % 3-dB bandwidth.

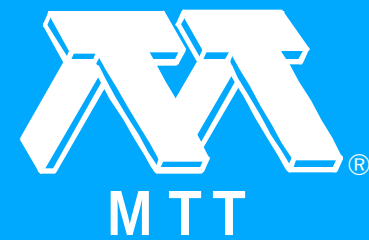
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Abstracts

Session WE3C -- Active Device Modeling

"Session WE3C -- Active Device Modeling." 1995 MTT-S International Microwave Symposium Digest 95.2 (1995 Vol. II [MWSYM]): 609-609.



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New MODFET Small Signal Circuit Model Required for Millimeter-Wave MMIC Design: Extraction and Validation to 120 GHz

P.J. Tasker and J. Braunstein. "New MODFET Small Signal Circuit Model Required for Millimeter-Wave MMIC Design: Extraction and Validation to 120 GHz." 1995 MTT-S International Microwave Symposium Digest 95.2 (1995 Vol. II [MWSYM]): 611-614.

A new MODFET circuit model required for millimeter-wave MMIC design has been developed, since it was found that the conventional MODFET circuit topology normally used was not able to accurately simulate measurement data above 75 GHz. This new model accounts for distributed effects in the transistor layout and includes a modified intrinsic transistor circuit topology. This circuit model has been experimentally validated by on-wafer S-parameter measurements performed to 120 GHz. This was made possible by the development of two advanced millimeter-wave on-wafer S-parameter measurement systems.

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An Improved GaAs MESFET Model for the Pulsed I-V Measurement

K. Fujii. "An Improved GaAs MESFET Model for the Pulsed I-V Measurement." 1995 MTT-S International Microwave Symposium Digest 95.2 (1995 Vol. II [MWSYM]): 615-618.

This paper describes an improved large signal model of the GaAs MESFET that agrees accurately with the I-V characteristics produced by the pulsed I-V measurement of the GaAs MESFET. The pulsed I-V measurement system developed and used to evaluate the performance of the model is also described. The calculated results for a microwave power amplifier predicted using an improved large signal model show good agreement with the experimental results obtained using the pulsed I-V measurement system.

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High-Frequency Large-Signal Physical Modeling of Microwave Semiconductor Devices

M.A. Alsunaidi and S.M. El-Ghazaly. "High-Frequency Large-Signal Physical Modeling of Microwave Semiconductor Devices." 1995 MTT-S International Microwave Symposium Digest 95.2 (1995 Vol. II [MWSYM]): 619-622.

High frequency characterization of microwave semiconductor devices is presented based on physical modeling. The active device is simulated using a fast and accurate model based on the hydrodynamic equations which simulate the behavior of short gate field-effect transistors (FETs). The device response is analyzed as a function of the input signal frequency and its amplitude.

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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." 1995 MTT-S International Microwave Symposium Digest 95.2 (1995 Vol. II [MWSYM]): 623-626.

A new algorithm is presented for construction of an accurate table-based bias and temperature dependent FET small-signal and noise model. The algorithm provides orders of magnitude data reduction over the alternate approach of storing multiple S-parameter and noise parameter data files (to represent different bias and temperature conditions). The algorithm performs 2-D linear interpolation on a single stored data table to quickly produce accurate bias and temperature dependent model simulations.

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A Novel Algorithm for Bias-Dependent Cascode FET Modeling

P.B. Winson, L.P. Dunleavy, H.C. Gordon, Jr., M.V. Calvo and J. Sherman. "A Novel Algorithm for Bias-Dependent Cascode FET Modeling." 1995 MTT-S International Microwave Symposium Digest 95.2 (1995 Vol. II [MWSYM]): 627-630.

In this work, we present a novel algorithm for a flexible table-based, bias-dependent, small-signal cascode MESFET model. The model utilizes 2-port D.C. and R.F. characterizations of a single-gate, common-source MESFET in contrast to the typical 3-port characterization approach typically applied to dual-gate and cascode FETs. Cascode FET simulations enabled by the new model are shown to track measured data over varying bias conditions.

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Small-Signal Equivalent Circuit Scaling Properties of AlGaAs/GaAs HBTs

D.-W. Wu, M. Fukuda, Y.-H. Yun and D.L. Miller. "Small-Signal Equivalent Circuit Scaling Properties of AlGaAs/GaAs HBTs." 1995 MTT-S International Microwave Symposium Digest 95.2 (1995 Vol. II [MWSYM]): 631-634.

The equivalent circuit model parameters are directly extracted from measured S-parameters and then carefully correlated with the device physical layout to provide accurate scaling rules for the design and modeling of HBTs. For devices fabricated with a scaling factor of 4, the predicted MSG/MAG is less than 0.5 dB while normalized error in S-parameters is less than 10% of measurements for the frequency range of 0.045 to 26 GHz.

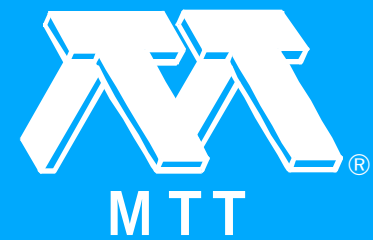
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Abstracts

Session WE3D -- Field Theory II

"Session WE3D -- Field Theory II." 1995 MTT-S International Microwave Symposium Digest 95.2 (1995 Vol. II [MWSYM]): 635-635.



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Radial Mode Matching Analysis of Ridged Circular Waveguide

U. Balaji and R. Vahldieck. "Radial Mode Matching Analysis of Ridged Circular Waveguide." 1995 MTT-S International Microwave Symposium Digest 95.2 (1995 Vol. II [MWSYM]): 637-640.

Single ridged circular waveguides are useful for the development of compact septum polarizers. The design of these structures is based on the knowledge of modes in the semicircular and ridged waveguide sections. In this paper a radial mode matching analysis is presented to calculate rigorously the TE and TM modes that are excited in such a structure. Results are presented for variations of the ridge depth and ridge thickness and are compared to results from a finite element analysis.

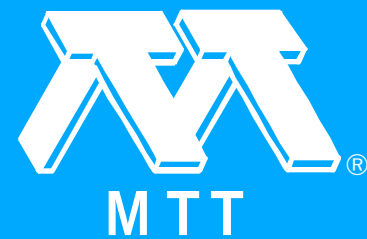
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Slow-Wave Phenomena and Pulse Distortions in Optically Excited Schottky-Contacted Coplanar Waveguide

A.S. Rong, S.M. Goodnick, V.K. Tripathi, H.X. Wang, Z.L. Sun and W.B. Dou. "Slow-Wave Phenomena and Pulse Distortions in Optically Excited Schottky-Contacted Coplanar Waveguide." 1995 MTT-S International Microwave Symposium Digest 95.2 (1995 Vol. II [MWSYM]): 641-644.

The slow-wave phenomena and the pulse distortions in optically excited Schottky-contacted coplanar waveguides are analyzed in this paper. The localized excitation model presented is formulated by the combination of the original and frequency-dependent versions of the FDTD method. Some attractive physical properties of Schottky-contacted CPW under optical illumination are examined.



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A Novel Wide Band Absorbing Boundary Condition for FDTD Method Simulations

A.S. Rong, Z.L. Sun, V.K. Tripathi, H.X. Wang and W.B. Dou. "A Novel Wide Band Absorbing Boundary Condition for FDTD Method Simulations." 1995 MTT-S International Microwave Symposium Digest 95.2 (1995 Vol. II [MWSYM]): 645-648.

A wide band absorbing boundary condition that utilizes the basic relations between transverse fields of a guided traveling wave in the frequency domain is presented for FDTD method simulations. The resultant ABC operator ensures that the outgoing waves on the boundaries can be absorbed over the total frequency band of interest. The exponential approximation is used to recursively implement our ABC in the FDTD simulation, avoiding the need for the complete time history of field components. The numerical experiments are used to demonstrate that the present ABC consistently has a superior absorbing performance over a wide frequency band.

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Abstracts

Full Wave Analysis of Microstrip Filters Containing Dielectric and Metallic Resonators with the Method of Lines

A. Kornatz and R. Pregla. "Full Wave Analysis of Microstrip Filters Containing Dielectric and Metallic Resonators with the Method of Lines." 1995 MTT-S International Microwave Symposium Digest 95.2 (1995 Vol. II [MWSYM]): 649-652.

In this paper it will be shown how the method of lines can be adapted to the analysis of microstrip filters. The filters consist of a dielectric lossy resonator of arbitrary shape excited by a microstrip line. Field distributions and scattering parameters will be presented.



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Analysis of Planar Structures by an Integral Multi-Scale Approach

M. Nadarassin, H. Aubert and H. Baudrand. "Analysis of Planar Structures by an Integral Multi-Scale Approach." 1995 MTT-S International Microwave Symposium Digest 95.2 (1995 Vol. II [MWSYM]): 653-656.

A Multi-scale Integral Method based on the intermediate basis concept is proposed. This method is particularly well-adapted to the rigorous determination of the impedance viewed by an active element placed on a complex circuit of small dimensions which is itself integrated on a large planar structure. A patch including a small circuit is characterized.

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A Novel Leaky-Mode Cylindrical Dielectric Resonator Used as Feeds of Omnidirectional Antenna for Wireless Communications

T. Wang, H. An, K. Wu, J.-J. Laurin and R.G. Bosisio. "A Novel Leaky-Mode Cylindrical Dielectric Resonator Used as Feeds of Omnidirectional Antenna for Wireless Communications." 1995 MTT-S International Microwave Symposium Digest 95.2 (1995 Vol. II [MWSYM]): 657-660.

This paper presents a novel leaky-mode cylindrical dielectric resonator including mounting holder and radial-step, which can be used as feeds of a class of omnidirectional antennas suitable for wireless communication systems. An enhanced spectral domain (SDA) approach is extended to determining resonant properties of the proposed resonator. Numerical results are focused on low-order leaky TM-mode properties. The effects of different structural parameters on resonant frequencies and quality factors are studied in detail. Theoretical results are verified by experiments.

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Abstracts

Session WE3E -- Passive Planar Components

"Session WE3E -- Passive Planar Components." 1995 MTT-S International Microwave Symposium Digest 95.2 (1995 Vol. II [MWSYM]): 661-661.



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MMIC Wilkinson Couplers for Frequencies up to 110 GHz

D. Kother, B. Hopf, T. Sporkmann and I. Wolff. "MMIC Wilkinson Couplers for Frequencies up to 110 GHz." 1995 MTT-S International Microwave Symposium Digest 95.2 (1995 Vol. II [MWSYM]): 663-666.

Reciprocal power splitters and combiners can be realized by using Wilkinson couplers. However, for frequencies lower than a few GHz such couplers are normally too large for application in MMICs. At the same time, for designing Wilkinson couplers at high frequencies discontinuities must be considered. For the first time, this paper reports on miniaturized Wilkinson couplers for 1.8GHz with space requirements of $1.2 \times 0.8 \text{ mm}^2$ as well as on designing couplers for frequencies up to 80GHz.



Abstracts

A New Wide-Band and Reduced-Size Uniplanar Magic-T

L. Fan, S. Kanamaluru and K. Chang. "A New Wide-Band and Reduced-Size Uniplanar Magic-T." 1995 MTT-S International Microwave Symposium Digest 95.2 (1995 Vol. II [MWSYM]): 667-670.

This paper presents a new reduced-size uniplanar magic-T using coplanar waveguide (CPW) and a slotline ring that is 20% smaller than comparable designs. The circuit provides good amplitude and phase characteristics over a broad bandwidth. Experimental results show that the magic-T has a maximum power dividing imbalance of 0.4 dB and a maximum phase imbalance of 2.5° over the entire 1.6 octave bandwidth from 2 to 6 GHz.



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A Broadband, High Directivity 3 dB Coupler Using Coplanar Waveguide Technology

E. Rius, T. Le Gouguec, K. Hettak, J.P. Coupez and S. Toutain. "A Broadband, High Directivity 3 dB Coupler Using Coplanar Waveguide Technology." 1995 MTT-S International Microwave Symposium Digest 95.2 (1995 Vol. II [MWSYM]): 671-674.

We propose to design high directivity-high level couplers using coplanar waveguide technology. This allows geometrical parameters to be chosen to design 3 dB couplers while limiting the difference between the phase velocities of the normal modes in order to obtain higher directivity. A 40% bandwidth, 30 dB directivity 3 dB coupler is achieved.

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Abstracts

Miniature Stub and Filter Designs Using the Microshield Transmission Line

T.M. Weller and L.P. Katehi. "Miniature Stub and Filter Designs Using the Microshield Transmission Line." 1995 MTT-S International Microwave Symposium Digest 95.2 (1995 Vol. II [MWSYM]): 675-678.

This paper presents new CPW-type stub and filter configurations which are useful approaches for compact microwave circuit design. It is shown that conventional open- and short-end quarter wavelength stubs can be shortened by a factor of three by folding the center conductor. Also, narrowband open-end stubs are demonstrated which have thin-film overlay capacitors integrated across the stub sections. In this work the circuits have been implemented using microshield transmission line, a geometry in which a 1.4 μm -thick dielectric membrane supports coplanar conducting lines virtually in free-space. The new stub configurations, however, are also suitable for standard substrate-supported CPW.



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Quasi Static Analysis of Microstrip Bondwire Interconnects

F. Alimenti, U. Goebel and R. Sorrentino. "Quasi Static Analysis of Microstrip Bondwire Interconnects." 1995 MTT-S International Microwave Symposium Digest 95.2 (1995 Vol. II [MWSYM]): 679-682.

A quasi-static approach for the analysis of microstrip bondwire interconnects is presented. The bondwire has been modelled as a cascade of inhomogeneous and nonuniform transmission lines, using the Conformal-Mapping method to determine the line characteristics and the theory of nonuniform transmission line to evaluate the effect of the variable height of the wire over the substrate.

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Broadband Uniplanar Microstrip to Slot-Line Transitions

N.I. Dib, R.N. Simons and L.P.B. Katehi. "Broadband Uniplanar Microstrip to Slot-Line Transitions." 1995 MTT-S International Microwave Symposium Digest 95.2 (1995 Vol. II [MWSYM]): 683-686.

New in line uniplanar microstrip-to-slotline transitions for MIC/MMIC and phased array slotline antenna applications are described. Such transitions are compact and suitable to be used in an open environment or inside a package or a multichip module. The transitions share the concept of using a balun which consists of two microstrip lines connected to a slotline through a pair of coupled microstrips. In this paper, the transitions are studied theoretically using the FDTD technique and measured experimentally using an HP8510C Network Analyzer. For a back-to-back configuration, an insertion loss of less than 1.3 dB per transition is achieved over a 40% 3-dB bandwidth with a minimum of 0.6 dB at the design frequency.

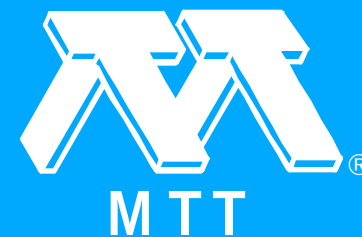
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Abstracts

Session WE3F -- Open Forum I

"Session WE3F -- Open Forum I." 1995 MTT-S International Microwave Symposium Digest 95.2 (1995 Vol. II [MWSYM]): 687-687.



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A Comparison of Low Frequency Noise in GaAs and InP-Based HBTs and VCOs

J. Cowles, L. Tran, T. Block, D. Streit, C. Grossman, G. Chao and A. Oki. "A Comparison of Low Frequency Noise in GaAs and InP-Based HBTs and VCOs." 1995 MTT-S International Microwave Symposium Digest 95.2 (1995 Vol. II [MWSYM]): 689-692.

The low frequency collector noise spectra for GaAs-based and InP-based HBTs have been measured and compared as a function of emitter material, bias and temperature. Al/sub 20/Ga/sub 80/As/GaAs and InAlAs/InGaAs HBTs exhibited classic 1/f noise spectra while the Al/sub 30/Ga/sub 70/As/GaAs HBTs showed a pronounced burst noise component. Identical VCO circuit topologies implemented in Al/sub 20/Ga/sub 80/As/GaAs and InAlAs/InGaAs HBTs demonstrated a 10 dB improvement in phase noise at a 1 MHz offset over the Al/sub 30/Ga/sub 70/As/GaAs HBT-based VCO.

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Ultra Low Noise Microwave Oscillators with Low Residual Flicker Noise

J.K.A. Everard and M. Page-Jones. "Ultra Low Noise Microwave Oscillators with Low Residual Flicker Noise." 1995 MTT-S International Microwave Symposium Digest 95.2 (1995 Vol. II [MWSYM]): 693-696.

This paper describes the design of two low noise microwave oscillators operating at 7.6 GHz. These oscillators use room temperature Sapphire resonators operating in the TE/sub 01/delta mode which demonstrate unloaded Q's of 44,000. Silicon transposed gain amplifiers are used to produce low Flicker noise corners of 1 to 2KHz and a phase noise of -131dBc at 10 KHz offset. Further improvements of 30 dB are expected using this technique.

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Comparison of the Phase Noise Performance of HEMT and HBT Based Oscillators

X. Zhang, D. Sturzebecher and A.S. Daryoush. "Comparison of the Phase Noise Performance of HEMT and HBT Based Oscillators." 1995 MTT-S International Microwave Symposium Digest 95.2 (1995 Vol. II [MWSYM]): 697-700.

This paper presents a comparative study on the phase noise contribution of HBT and HEMT oscillators. For a quantitative comparison, HBT and HEMT oscillators were constructed at 5.6 GHz using the same circuit topology. Experimental results show that the low-frequency (LF) noise (i.e. $1/f$ noise) in HBT is relatively lower than that in HEMT; however, the lowest phase noise can be achieved in the HEMT oscillator due to its low LF noise up-conversion to the phase noise. A proposed theoretical model explains the difference in noise up-conversion performance of HEMT and HBT. The experimental investigation emphasizes the importance of LF noise level and its up-conversion factor in the design of microwave oscillators.

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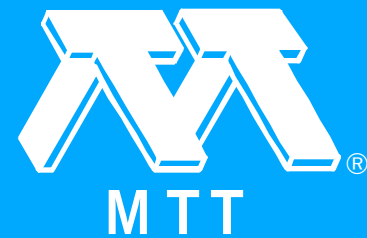


Abstracts

Power Combining of Ku-Band Active Dipoles in a Cylindrical Resonant Cavity

O.-P. Lunden. "Power Combining of Ku-Band Active Dipoles in a Cylindrical Resonant Cavity." 1995 MTT-S International Microwave Symposium Digest 95.2 (1995 Vol. II [MWSYM]): 701-704.

This paper presents a Ku-band source with a new simple technique to combine the output powers of individual HEMT oscillators using half-wave dipole antennas and a cylindrical resonant cavity. The structure of the source should have potential also for millimeter-wave power combining.



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High Efficiency Amplifier Using Rectangular Waveform

S. Toyoda. "High Efficiency Amplifier Using Rectangular Waveform." 1995 MTT-S International Microwave Symposium Digest 95.2 (1995 Vol. II [MWSYM]): 705-708.

This paper describes a new high efficiency amplifier. It consists of two circuits: the first one produces the rectangular waveform, and the second one makes its operating angle (current flowing angle) small. Using this waveform with small operating angle, we can obtain an amplifier having large power added efficiency. A single power amplifier using the rectangular waveform was constructed and tested. In the experiment, the operating frequency was in the 0.9 GHz band. The maximum power was 5.1 W, and the power added efficiency was 65% and 76% when the operating angle was 70° and 30° respectively.

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Nonlinear Analysis of $f/2$ Loop Oscillation of High Power Amplifiers

M. Mochizuki, M. Nakayama, Y. Tarui, Y. Itoh, S. Tsuji and T. Takagi. "Nonlinear Analysis of $f/2$ Loop Oscillation of High Power Amplifiers." 1995 MTT-S International Microwave Symposium Digest 95.2 (1995 Vol. II [MWSYM]): 709-712.

A novel nonlinear analysis of high power amplifier instability has been developed. This analysis method deals with a loop oscillation and presents the conditions for oscillation under large-signal operation by taking account of a mixing effect of FETs. Applying this analysis method to the high power amplifier instability that an output power decreases at some compression point where an $f/2$ -wave is observed, it has been found that this instability is caused by an $f/2$ loop oscillation. In addition, it has been verified by analysis and measurement that the oscillation can be removed by employing an isolation resistor in a closed loop circuit.

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RF-Stressed Life Test of Pseudomorphic InGaAs Power HEMT MMIC at 44 GHz

C.H. Chen, G. Zell, Y. Saito, H.C. Yen, R. Lai, K. Tan and J. Loper. "RF-Stressed Life Test of Pseudomorphic InGaAs Power HEMT MMIC at 44 GHz." 1995 MTT-S International Microwave Symposium Digest 95.2 (1995 Vol. II [MWSYM]): 713-716.

An RF-stressed accelerated life test was performed to establish the reliability of the recently developed high power HEMT MMICs at 44 GHz. The results showed a MTF (median time to failure) of 1.7×10^6 hours at 125°C channel temperature with the activation energy of 1.6 eV. The failure mode was a gradual output power degradation. A combination of surface states degradation and gate sinking were postulated as the failure mechanisms.

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Comprehensive Experimental Investigation of Gate Current Limitation Effects on Power GaAs FETs RF Performances

N. Constantin and F.M. Ghannouchi. "Comprehensive Experimental Investigation of Gate Current Limitation Effects on Power GaAs FETs RF Performances." 1995 MTT-S International Microwave Symposium Digest 95.2 (1995 Vol. II [MWSYM]): 717-720.

This paper presents for the first time a detailed experimental investigation of gate current limitation effects on power GaAs FETs RF performances. This gate current limitation is entirely accomplished by dynamic compensation of the gate bias voltage. Effects of this current limitation on power added efficiency and output power performance have been examined through an extensive experimental investigation over the entire Smith chart. Comprehensive results are given and allow to determine the optimal resistor value needed for the gate current limitation. Thermal runaway problem is also taken into consideration when selecting the gate resistor.

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A Study of Class C Operation of GaAs Power HBTs

F. Ali, A. Gupta, M. Salib and B. Veasel. "A Study of Class C Operation of GaAs Power HBTs." 1995 MTT-S International Microwave Symposium Digest 95.2 (1995 Vol. II [MWSYM]): 721-724.

GaAs power HBTs are traditionally biased in Class A or Class AB mode for power amplifiers. This paper describes the tradeoffs of operating these devices in Class C bias. We find that power-added efficiency (PAE) improves and power gain decreases in Class C when compared to Class AB bias. At 6 GHz, the PAE increased by greater than 10 percentage points (from 68.9% in Class AB to 80.6% in Class C) with concurrent loss of 4.3 dB in power gain. The efficiency improves monotonically with lower operating frequency. In a single-tone environment, the second harmonic increases by ~7 dB in Class C over Class AB. To our knowledge, this is the first report on the experimental study of Class C operation of GaAs HBTs.

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Performance Capabilities of the Ring Network Circulator for Integrated Circuits

J.A. Weiss and G.F. Dionne. "Performance Capabilities of the Ring Network Circulator for Integrated Circuits." 1995 MTT-S International Microwave Symposium Digest 95.2 (1995 Vol. II [MWSYM]): 725-728.

The theoretical model of a ring network junction circulator introduced in 1965 is re-examined and further elaborated, in view of its prospects for compatibility with accomplished and anticipated advances in microcircuit technology. Following a brief review of the theory, solutions are presented to illustrate the potential for novel, efficient designs with options including miniature, self-magnetized, reversible, broadband, superconducting, or other advantageous characteristics. New experimental models are showing good conformance to theoretical predictions for this promising alternative circulator design concept.



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Nonreciprocal Characteristics of Broadside-Coupled Fin Lines with Magnetized Ferrites

T. Kitazawa and T. Sugano. "Nonreciprocal Characteristics of Broadside-Coupled Fin Lines with Magnetized Ferrites." 1995 MTT-S International Microwave Symposium Digest 95.2 (1995 Vol. II [MWSYM]): 729-732.

A hybrid-mode analytical method is describe to evaluate the nonreciprocal characteristics of various types of the broadside-coupled fin lines with the magnetized ferrite and the finite metallization thickness. Numerical results demonstrate the nonreciprocal properties not only on the phase constants, but also on the characteristic impedances and the conductor losses.



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Intermodulation Characteristics of High-Power Bandpass Filter Using Dielectric Rod Resonators Loaded in a High-Tc Superconducting Cylinder

Y. Kobayashi, M. Sasaki, T. Senju, Y. Kasuga and K. Haginuma. "Intermodulation Characteristics of High-Power Bandpass Filter Using Dielectric Rod Resonators Loaded in a High-Tc Superconducting Cylinder." 1995 MTT-S International Microwave Symposium Digest 95.2 (1995 Vol. II [MWSYM]): 733-736.

A narrow-bandwidth bandpass filter with a bandwidth of 36MHz at a center frequency of 12GHz, is constructed by orienting a pair of TM/sub 01delta/-mode dielectric rod resonators in the center of a YBCO high-Tc superconducting bulk cylinder. The high-power and intermodulation characteristics of this filter is compared with those for a similar filter structure using a Cu cylinder in place of the YBCO cylinder. This filter realizes the low-loss characteristic below 0.2dB up to 5W, the high power-handling capability over 10W and the third-order intermodulation intercept of 100dBm at 77K.

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Abstracts

Novel Architecture and MMICs for an Integrated Front End of a Spectrum Analyzer (1995 Vol. II [MWSYM])

T. Takenaka, A. Miyazaki and H. Matsuura. "Novel Architecture and MMICs for an Integrated Front End of a Spectrum Analyzer (1995 Vol. II [MWSYM])." 1995 MTT-S International Microwave Symposium Digest 95.2 (1995 Vol. II [MWSYM]): 737-740.

This paper proposes a novel architecture and MMICs for an integrated front end of a 2-32 GHz spectrum analyzer. The architecture achieves miniaturization by eliminating the YIG tracking filter. The MMICs achieve ultra-wideband performances as well as chip-size reduction by utilizing novel FET cells for the basic circuit functions.



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A New Technique for Obtaining High Isolations in Microwave Mixers Based on the Concepts of Distributed Mixing and Transversal Filtering (1995 Vol. II [MWSYM])

A.H. Baree and I.D. Robertson. "A New Technique for Obtaining High Isolations in Microwave Mixers Based on the Concepts of Distributed Mixing and Transversal Filtering (1995 Vol. II [MWSYM])." 1995 MTT-S International Microwave Symposium Digest 95.2 (1995 Vol. II [MWSYM]): 741-744.

A new technique for obtaining high RF/LO to IF isolations in microwave mixers is reported. The technique is derived from the concepts of transversal filtering and distributed mixing. An MMIC prototype has been developed which measures only 1.4mm x 1.3mm. Over 30dB of RF/LO to IF isolations have been achieved at X-band and Ku-band.



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Broadband and Tunable Negative Monolithic Circuits for Microwave Active Filters Compensation (1995 Vol. II [MWSYM])

A. Brucher, P. Meunier, C. Cenac, B. Jarry and P. Guillon. "Broadband and Tunable Negative Monolithic Circuits for Microwave Active Filters Compensation (1995 Vol. II [MWSYM])." 1995 MTT-S International Microwave Symposium Digest 95.2 (1995 Vol. II [MWSYM]): 745-748.

In this article, GaAs MMIC negative resistance chips are presented. These devices are used to improve the performances of planar microstrip resonators structures. The broadband capabilities of these negative resistance circuits are illustrated with their use to compensate for the losses of two 4-pole bandpass microstrip half wave filters designed with alumina substrate and centered respectively at 1.5 GHz and 4 GHz. Finally, experimental results of bandstop active filters built on lossy high permittivity dielectric substrate ($\epsilon_r=36$) and also compensated for with these monolithic circuits confirm their great interest.

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Systematic Analysis Method of E- and H-Plane Circular Bend of Rectangular Waveguide Based on the Planar Circuit Equations and Equivalent Network Representation

J.-P. Hsu and T. Anada. "Systematic Analysis Method of E- and H-Plane Circular Bend of Rectangular Waveguide Based on the Planar Circuit Equations and Equivalent Network Representation." 1995 MTT-S International Microwave Symposium Digest 95.2 (1995 Vol. II [MWSYM]): 749-752.

E- and H-plane circular bends of the rectangular waveguide, shown in Table 1(A), are very familiar waveguide components. So far, many works have been done for the analysis of this structure, but their results are practically limited for the gradual bend case only. Therefore, wide-band frequency characteristics with wide range of bend parameters (=bend angle and curvature*) including sharp bend are still not clear, but are needed for the future microwave integrated circuit design. This paper solves these problems by the following procedure.

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Experimental Study on Spiral Inductors

S. Chaki, S. Aono, N. Andoh, Y. Sasaki, N. Tanino and O. Ishihara. "Experimental Study on Spiral Inductors." 1995 MTT-S International Microwave Symposium Digest 95.2 (1995 Vol. II [MWSYM]): 753-756.

An experimental study of spiral inductor loss is described quantitatively. For the evaluation of the loss, over one hundred types of spiral inductors with different figures (square, circle, octagon) and line/space widths are fabricated, then pi-network equivalent circuits are extracted from measured s-parameters. The results show that the resistance R of circular and octagonal shaped inductors is smaller by 10% than that of a square shaped inductor with the same inductance value. They also indicate that minimization of the line space is more effective for reducing the loss of the inductor with the same inductance value than maximization of the line width.

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Ridge Waveguide T-Junctions

A. Abdelmonem and K.A. Zaki. "Ridge Waveguide T-Junctions." 1995 MTT-S International Microwave Symposium Digest 95.2 (1995 Vol. II [MWSYM]): 757-760.

The ridge waveguide T-junction is introduced and modeled using the single port mode matching technique. The ridge configuration allows the reduction of the size of T-junction as well as increasing its bandwidth. The three-port scattering matrix of the T-junction is obtained from seven reflection coefficient computations at the perpendicular arm. An example of the design of a wide band T-junction covering both C and X bands is presented. This T-junction has low reflection at the input and equal power division between the straight arm and perpendicular arm and is thus appealing to diplexer applications. The measured response of the T-junction is in perfect agreement with the computed one.

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Efficient Analysis of a Waveguide Pi-Junction with an Inductive Post

Z. Ma and E. Yamashita. "Efficient Analysis of a Waveguide Pi-Junction with an Inductive Post." 1995 MTT-S International Microwave Symposium Digest 95.2 (1995 Vol. II [MWSYM]): 761-764.

The waveguide pi-junction with an inductive post is utilized as the element of a multiple-way power divider in a slotted waveguide array. Based on the port reflection coefficient method (PRCM), an efficient full wave approach is proposed for the accurate characterization of the pi-junction. Scattering behaviors of the four-port junction are provided as a function of the geometric dimensions of the structure, and they are helpful for the design of power dividers using this pi-junction configuration. The results are compared with available data, and good agreement is found.

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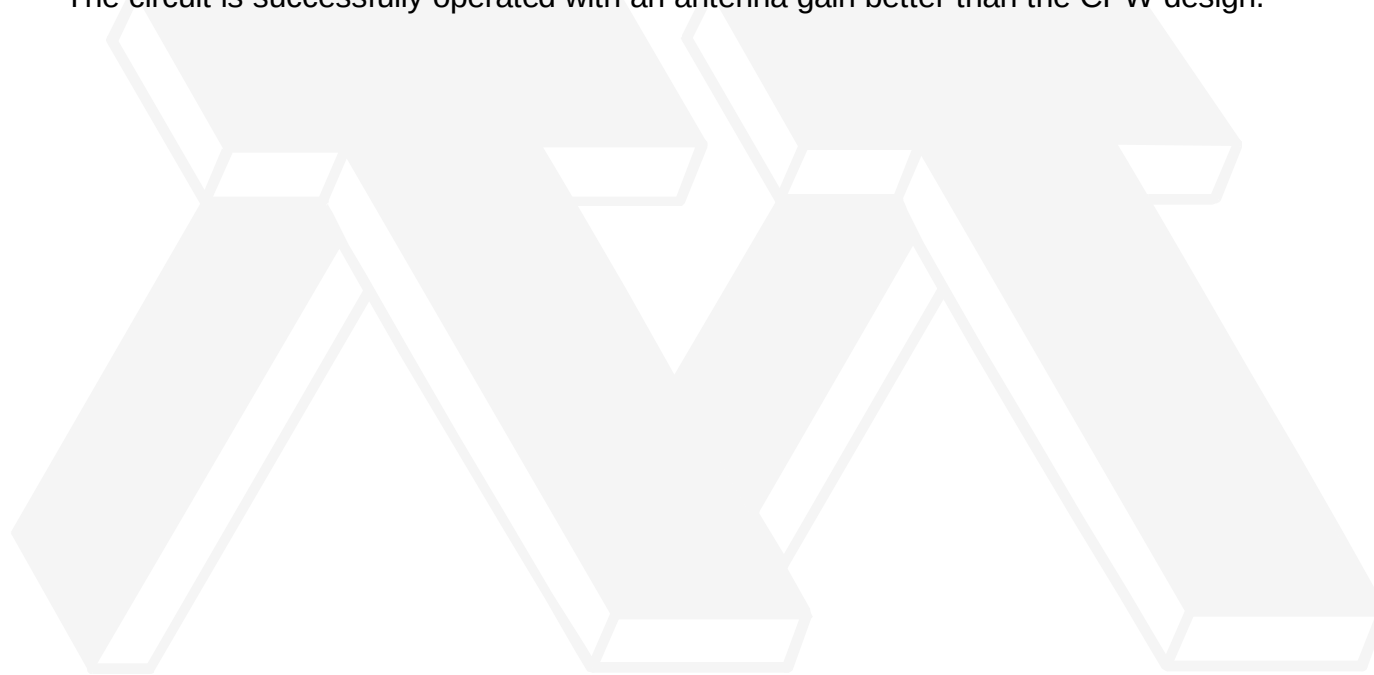
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Non-Leaky Coplanar Waveguide Active Antenna

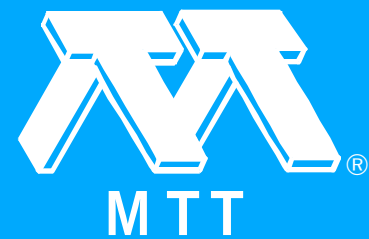
K. Cha, Y. Liu, C.-Y. Lee and T. Itoh. "Non-Leaky Coplanar Waveguide Active Antenna." 1995 MTT-S International Microwave Symposium Digest 95.2 (1995 Vol. II [MWSYM]): 765-767.

A newly developed structure, non-leaky coplanar waveguide (NLC), is used for an active antenna. Spectral domain and FDTD codes are developed to provide the design parameters. The circuit is successfully operated with an antenna gain better than the CPW design.



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Phase Noise Reduction in Scanning Oscillator Arrays

X. Cao and R.A. York. "Phase Noise Reduction in Scanning Oscillator Arrays." 1995 MTT-S International Microwave Symposium Digest 95.2 (1995 Vol. II [MWSYM]): 769-772.

A five element coupled voltage controlled oscillator array using injection locking technique to obtain low phase noise combined power output is described. Spectrum measurement shows that a great improvement on the spectrum purity of the combined output of the array has been achieved. Measured radiation patterns indicate that phase-shifterless beam scanning technique works properly when a single element is phase-locked to a low phase noise source.

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A Microstrip-Based Quasi-Optical Polarization Rotator Array

N.J. Kolas and R.C. Compton. "A Microstrip-Based Quasi-Optical Polarization Rotator Array." 1995 MTT-S International Microwave Symposium Digest 95.2 (1995 Vol. II [MWSYM]): 773-776.

A low-loss quasi-optical Ka-band polarization rotator array with 18% bandwidth has been designed and tested. Each cell of the array consists of a pair of input probe antennas connected via microstrip lines to orthogonally oriented output probe antennas. The design shows promise for use as an active array, as multi-stage MMIC amplifiers can be inserted in a straightforward manner into each cell.

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Analytic Johns Matrix and its Applications in TLM Diakoptics

Z. Chen. "Analytic Johns Matrix and its Applications in TLM Diakoptics." 1995 MTT-S International Microwave Symposium Digest 95.2 (1995 Vol. II [MWSYM]): 777-780.

The storage of a general TLM Johns matrix is large because the dimension of Johns matrix is dependent on the iteration number. The time-domain convolution with Johns matrix is computationally intensive as the whole time history of the incident impulses is involved. In this paper, analytic Johns matrix is derived. A recursive convolution formulas is then developed, resulting in a considerable reduction of the computation count.



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On the Accuracy of the Finite-Difference Method Using Mesh Grading

P. Mezzanotte, L. Roselli, C. Huber, H. Zscheile and W. Heinrich. "On the Accuracy of the Finite-Difference Method Using Mesh Grading." 1995 MTT-S International Microwave Symposium Digest 95.2 (1995 Vol. II [MWSYM]): 781-784.

The coarseness error of the Finite-Difference method is studied using a typical planar waveguide as a reference. Because of the field singularities involved a graded mesh proves to be superior compared to the equidistant case. A grading strategy with optimum efficiency is presented.

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A Rigorous Study of Wire-Bonding and Via-Hole Effects on GaAs Field Effect Transistors

T.-S. Horng. "A Rigorous Study of Wire-Bonding and Via-Hole Effects on GaAs Field Effect Transistors." 1995 MTT-S International Microwave Symposium Digest 95.2 (1995 Vol. II [MWSYM]): 785-788.

A new procedure is presented for evaluation of the wire-bonding and via-hole effects on a GaAs FET at microwave frequencies. The analysis not only provides a rigorous characterization of the passive elements, like bond-wires, via-holes and microstrips, on a GaAs FET but also includes their mutual coupling with the active region. For practical applications, the corresponding gate, source and drain inductances, which are the important extrinsic parameters of a CAD oriented equivalent circuit model, are extracted based on the calculated S parameters.

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An Improved 2D-FDTD Method for TWFET Bandwidth Characterization

C. Angiolini, G. D'Inzeo and P. Rota. "An Improved 2D-FDTD Method for TWFET Bandwidth Characterization." 1995 MTT-S International Microwave Symposium Digest 95.2 (1995 Vol. II [MWSYM]): 789-792.

A new 2D-FDTD method has been proposed to analyze the dispersion diagram of planar circuits. Traveling wave field effect transistor (TWFET) is a solid state device designed to amplify signals over a wide bandwidth. An analysis of the passive behavior of this device has been performed using mode-matching technique and assuming that the passive structure performances are affected only by the width of the T bar of the gate electrode. To verify such hypothesis and to determine the cut-off frequency of the higher order modes that limits its bandwidth, we have simplified the 2D-FDTD method with a particular normalization, that permits the analysis of the case $\beta=0$. The proposed approach was tested calculating the dispersion for some known structures and it has been used in the TWFET characterization.

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Integrated Harmonic Balance and Electromagnetic Optimization with Geometry Capture

J.W. Bandler, R.M. Biernacki, Q. Cai, S.H. Chen and P.A. Grobelny. "Integrated Harmonic Balance and Electromagnetic Optimization with Geometry Capture." 1995 MTT-S International Microwave Symposium Digest 95.2 (1995 Vol. II [MWSYM]): 793-796.

This paper presents an integrated approach to nonlinear circuit optimization. Electromagnetic simulations are seamlessly integrated into harmonic balance simulation and optimization. For the first time, complicated planar structures can be made fully optimizable through the parameterization process of our breakthrough Geometry Capture technique. They are then treated as individual elements in electromagnetic simulations and are embedded into the overall nonlinear circuit to be optimized. A comprehensive class B frequency doubler design demonstrates our approach.

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Compact Two-Dimensional FD-TD Analysis of Attenuation Properties of Lossy Microstrip Lines

M. Fujii and S. Kobayashi. "Compact Two-Dimensional FD-TD Analysis of Attenuation Properties of Lossy Microstrip Lines." 1995 MTT-S International Microwave Symposium Digest 95.2 (1995 Vol. II [MWSYM]): 797-800.

A compact two-dimensional FDTD (2-D FDTD) algorithm has been applied to the analysis of propagation properties of lossy microstrip lines. The electromagnetic field in the conductors are analyzed by forming grids inside the conductors to consider the conductor loss of microstrip lines. Furthermore, the autoregressive (AR) signal analysis method is combined to obtain accurate propagation constants, and good agreement between computational and experimental results is obtained.

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Abstracts

Fast Procedures for Highly Dispersive Absorbing Boundary Conditions

M. Mrozowski, M. Niedzwiecki and P. Suchomski. "Fast Procedures for Highly Dispersive Absorbing Boundary Conditions." 1995 MTT-S International Microwave Symposium Digest 95.2 (1995 Vol. II [MWSYM]): 801-804.

The paper presents fast digital filter algorithms for time domain diakoptics. As an example of application a highly dispersive absorbing boundary condition is implemented using low order zero-pole and Laguerre filters. The filters presented in this paper can be used for modeling of various dispersive phenomena.



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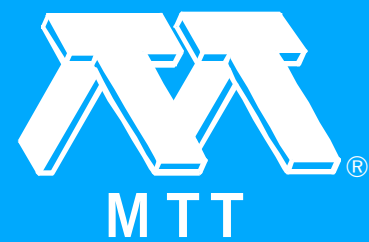
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An Extended Complex Finite Difference Method for the Analysis of Semiconductor Lasers with Electrode Discontinuities

S. Chen and R. Vahldieck. "An Extended Complex Finite Difference Method for the Analysis of Semiconductor Lasers with Electrode Discontinuities." 1995 MTT-S International Microwave Symposium Digest 95.2 (1995 Vol. II [MWSYM]): 805-808.

The complex finite difference method is extended to form a self-consistent 3-D analysis tool for gain- and index- guided semiconductor lasers. Single- and double-strip laser diodes with and without strip discontinuities (to accommodate the bias current contact pad) are investigated by directly discretizing the 3-D Laplace equation, the 2-D carrier rate equation and the scalar wave equation. In combination with the Rayleigh variational principle, the complex propagation constant of the first two lowest order laser modes can be calculated as well as the complex refractive index distribution in the active layer.

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A Numerical TRL De-Embedding Technique for the Extraction of S-Parameters in a 2/sup 1/2/D Planar Electromagnetic Simulator

B. Linot, M.F. Wong, V.F. Hanna and O. Picon. "A Numerical TRL De-Embedding Technique for the Extraction of S-Parameters in a 2/sup 1/2/D Planar Electromagnetic Simulator." 1995 MTT-S International Microwave Symposium Digest 95.2 (1995 Vol. II [MWSYM]): 809-812.

A numerical application of the TRL calibration for a planar discontinuity is proposed to be used in electromagnetic simulators in order to calculate its scattering matrix without the need of either defining the port characteristic impedance as in the slotted line numerical simulation or of normalizing with respect to a specified value of reference impedance as in other known de-embedding methods. The proposed technique is applied, in a 2/sup 1/2/D planar electromagnetic simulator using integral equations technique solved by the moment method, on a case study of a step in width coplanar waveguide discontinuity and we have demonstrated how many numerical problems encountered previously when using other techniques were eliminated.

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Abstracts

Electromagnetic Analysis of Composite Coaxial Cells for Wideband Measurements of Highly Dispersive Materials

J. Huang, K. Wu, P. Morin and C. Akyel. "Electromagnetic Analysis of Composite Coaxial Cells for Wideband Measurements of Highly Dispersive Materials." 1995 MTT-S International Microwave Symposium Digest 95.2 (1995 Vol. II [MWSYM]): 813-816.

In this paper, a new transmission line matrix node is proposed for electromagnetic analysis of a composite coaxial cell which is used to characterize highly dispersive materials over a large frequency band. A variety of measurements using such a coaxial line cell have been done with different liquid samples to verify the wide-band characteristics. It is shown that theoretical and experimental results have a very good agreement.



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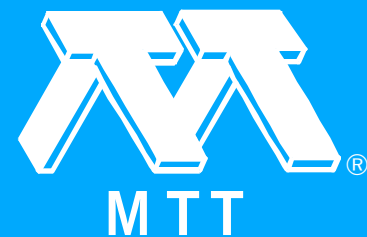


Abstracts

A New Formulation for the Analysis of Non-Uniform Transmission Lines Using Frequency-Varying Basis Functions

A.B. Kouki, A. Hamade and F.M. Ghannouchi. "A New Formulation for the Analysis of Non-Uniform Transmission Lines Using Frequency-Varying Basis Functions." 1995 MTT-S International Microwave Symposium Digest 95.2 (1995 Vol. II [MWSYM]): 817-820.

A new method of moment based formulation for the solution of the telegraphist's equations in non-uniform transmission lines is presented. Entire domain basis function that build-in a frequency variation are used to cover wider frequency and physical dimension ranges. The results obtained using the proposed formulation are validated by comparison to those obtained by a CAD package and to measured data.



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Systematic Searching for Cavity and Waveguide Modes by Making Use of Foster's Theorem

A. Jostingmeier, C. Rieckmann and A.S. Omar. "Systematic Searching for Cavity and Waveguide Modes by Making Use of Foster's Theorem." 1995 MTT-S International Microwave Symposium Digest 95.2 (1995 Vol. II [MWSYM]): 821-824.

Resonance and irrotational cavity modes as well as waveguide eigenmodes are usually determined numerically (except for a few structures whose solutions are analytically known). Most of the methods of analysis end up at a determinantal equation, the zeros of which characterize these modes. Numerically overlooking some of these zeros is one of the problems which greatly degrade the accuracy of a field expansion in terms of the corresponding modes. In this contribution it is shown that it is always possible to find a reactance (or susceptance) function having the same set of zeros as the original determinantal equation. This enables making use of Foster's theorem to systematically determine these zeros.

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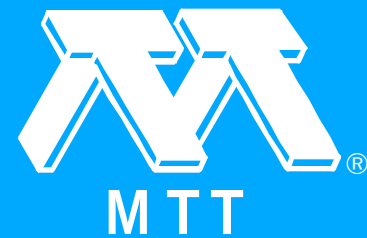


Abstracts

The Concept of Elementary Invariant Operand in Moment Method-Application to the Electromagnetic Optimization of Shielded Planar Discontinuities

R. Gillard and J. Citerne. "The Concept of Elementary Invariant Operand in Moment Method-Application to the Electromagnetic Optimization of Shielded Planar Discontinuities." 1995 MTT-S International Microwave Symposium Digest 95.2 (1995 Vol. II [MWSYM]): 825-828.

This paper presents a new concise way to run the numerical information required to solve an electromagnetic problem using the method of moment. As a consequence, it enables the rigorous analysis of large circuits and the introduction of electromagnetic optimization.



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Fast Wavelet Analysis of 3-D Dielectric Structures Using Sparse Matrix Techniques

K. Sabetfakhri and L.P.B. Katehi. "Fast Wavelet Analysis of 3-D Dielectric Structures Using Sparse Matrix Techniques." 1995 MTT-S International Microwave Symposium Digest 95.2 (1995 Vol. II [MWSYM]): 829-832.

This paper presents an efficient integral formulation based on the theory of orthonormal wavelets for the analysis of open three-dimensional dielectric structures used in microwave and optical applications. In this approach, the fields and currents are represented by a two-dimensional multiresolution expansion in a transverse plane and a sub-domain pulse expansion along the normal direction. The implementation of the method of moments is then combined with the highly efficient Fast Wavelet Algorithm (FWA). It is shown that the resulting moment matrices are very sparsely populated and easily render themselves to the sparse matrix techniques like the Bi-Conjugate Gradient method. Finally, to validate the formulation, a rectangular dielectric resonator is investigated.

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Abstracts

Hybridizing FD-TD Analysis with Unconditionally Stable FEM for Objects of Curved Boundary

R.-B. Wu and T. Itoh. "Hybridizing FD-TD Analysis with Unconditionally Stable FEM for Objects of Curved Boundary." 1995 MTT-S International Microwave Symposium Digest 95.2 (1995 Vol. II [MWSYM]): 833-836.

A novel unconditionally stable finite element scheme is incorporated to the conventional FD-TD analysis for solving the Maxwell's equations associated with objects with curved boundary. It is applied to electromagnetic scattering of two dimensional arbitrarily shaped dielectric cylinders to demonstrate its advantages in accuracy, stability, computational efficiency, and programming ease.



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Abstracts

Analysis of Microstrip Filters with a Combined Mode-Matching and Method-of-Lines Procedure

P. Meyer. "Analysis of Microstrip Filters with a Combined Mode-Matching and Method-of-Lines Procedure." 1995 MTT-S International Microwave Symposium Digest 95.2 (1995 Vol. II [MWSYM]): 837-840.

A combined Mode-Matching and Method-of-Lines technique is used to perform a full-wave analysis of a 5-pole interdigital shielded microstrip filter. The method offers significant memory savings over other full-wave methods. Predicted results show good correspondence with measured data.



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A Novel Design to Reduce Losses at Dielectric Waveguide Discontinuities

E.-B. El-Sharawy and P.A. Tirkas. "A Novel Design to Reduce Losses at Dielectric Waveguide Discontinuities." 1995 MTT-S International Microwave Symposium Digest 95.2 (1995 Vol. II [MWSYM]): 841-844.

A novel approach to reduce losses of dielectric waveguide bends and junctions is examined in this paper. Ceramic material is added at the bend or the junction. The ceramic's dielectric constant, its shape and size, and position relative to the bend, are several parameters that can be varied to minimize the losses at the junction. Finite-difference time-domain analysis of a representative case is presented.

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Characterization of a Dual-Plane Microstrip Interconnect with Reduced Pulse Distortion and Crosstalk

Y. Qian and E. Yamashita. "Characterization of a Dual-Plane Microstrip Interconnect with Reduced Pulse Distortion and Crosstalk." 1995 MTT-S International Microwave Symposium Digest 95.2 (1995 Vol. II [MWSYM]): 845-848.

Interconnects with low signal distortion and crosstalk are important for high-density, high-speed integrated circuits. In this paper we describe a dual-plane, multi-conductor interconnect which exhibits superior propagation characteristics over conventional coplanar structures. Distortion and crosstalk of picosecond pulses in a four-line structure are investigated by combining the full-wave spectral domain method with an FFT algorithm. For the special case of four coplanar microstrips, we obtain identical results with those in the literature. Meanwhile, for the newly proposed dual-plane structure, our simulation shows only slight distortion in the signal pulse, and a substantial reduction in crosstalk to the neighboring lines.

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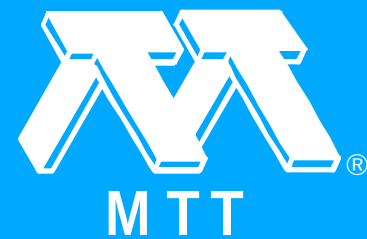


Abstracts

TE Wave Properties of Slab Dielectric Guide Bounded by Nonlinear Non-Kerr-Like Media (1995 Vol. II [MWSYM])

J.-G. Ma and I. Wolff. "TE Wave Properties of Slab Dielectric Guide Bounded by Nonlinear Non-Kerr-Like Media (1995 Vol. II [MWSYM])." 1995 MTT-S International Microwave Symposium Digest 95.2 (1995 Vol. II [MWSYM]): 849-852.

TE wave properties of slab dielectric waveguide with nonlinear non-Kerr-like substrate and cladding are presented. The guide can support even- and odd-symmetrical modes in asymmetrical substrate and cladding and asymmetrical modes in completely symmetrical cases. The dispersion relations, electric field profiles are illustrated and analytically discussed in detail.



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Low Crosstalk Characteristics of Buried Microstrip Lines

T. Ishikawa and E. Yamashita. "Low Crosstalk Characteristics of Buried Microstrip Lines." 1995 MTT-S International Microwave Symposium Digest 95.2 (1995 Vol. II [MWSYM]): 853-856.

This paper describes the extremely low crosstalk characteristics of a guided wave structure, Buried Microstrip Line. The analyses with the use of rectangular boundary division method and FDTD method have revealed that the line structure possesses much lower coupling coefficients than traditional microstrip lines, from -15 dB to -100 dB depending on their burial depth. This line structure is believed to be quite useful for realizing highly integrated microwave and millimeter-wave circuits.

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Abstracts

Leakage in Coplanar Waveguides with Finite Metallization Thickness and Conductivity

J.-Y. Ke and C.H. Chen. "Leakage in Coplanar Waveguides with Finite Metallization Thickness and Conductivity." 1995 MTT-S International Microwave Symposium Digest 95.2 (1995 Vol. II [MWSYM]): 857-860.

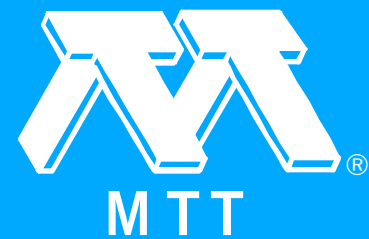
The interesting phenomenon of leakage in a practical coplanar waveguide structure with finite metallization thickness and conductivity is investigated. By applying the modified spectral-domain approach, its attenuation constants due to both leakage and conductor loss are compared and discussed. In particular, the effective dielectric constant and attenuation constant are carefully studied, together with the current distributions within the metallic signal strip and ground planes.



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Field Theory Analysis of Distributed Microwave Effects in High Speed Semiconductor Lasers and Their Interconnection with Passive Microwave Transmission Lines

R. Vahldieck, S. Chen, H. Jin and P. Russer. "Field Theory Analysis of Distributed Microwave Effects in High Speed Semiconductor Lasers and Their Interconnection with Passive Microwave Transmission Lines." 1995 MTT-S International Microwave Symposium Digest 95.2 (1995 Vol. II [MWSYM]): 861-864.

This paper presents a rigorous field theory analysis of the distributed microwave effects in high speed semiconductor lasers by using a combination of a self-consistent complex finite difference method with the frequency-domain TLM method (FDTLM). The semiconductor laser is treated as a lossy multilayer slow-wave microstrip transmission line. The conductivity profile in the active layer is obtained by a self-consistent solution of the nonlinear semiconductor device equations. The attenuation factor, phase velocity and characteristic impedance of the semiconductor laser is presented for the unbiased and forward-biased case and compared with experimental results. On the basis of this analysis we present the interconnection effects between passive microwave transmission lines and laser diodes using airbridge or flip-chip transitions.

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Abstracts

Analysis and Design of Multi-Octave MMIC Active Baluns Using a Distributed Amplifier Gate Line Termination Technique

A.H. Baree and I.D. Robertson. "Analysis and Design of Multi-Octave MMIC Active Baluns Using a Distributed Amplifier Gate Line Termination Technique." 1995 MTT-S International Microwave Symposium Digest 95.2 (1995 Vol. II [MWSYM]): 865-868.

The analysis and design of a multi-octave MMIC active balun is described in this paper. The technique employed uses the gate-line 'termination' of a distributed amplifier topology as a non-inverting output. Closed-form expressions for the two output signals have been derived. The MMIC prototype has achieved balun operation over 0.5 to 20 GHz with a 10-degree maximum phase error.



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MMIC SSB Frequency Translators with Image-Rejection for Satellite Transponder Applications (1995 Vol. II [MWSYM])

A.H. Baree, I.D. Robertson and J.S. Bharj. "MMIC SSB Frequency Translators with Image-Rejection for Satellite Transponder Applications (1995 Vol. II [MWSYM])." 1995 MTT-S International Microwave Symposium Digest 95.2 (1995 Vol. II [MWSYM]): 869-872.

A highly integrated design for advanced monolithic single side-band frequency translators are presented in this paper. Two monolithic chips have been realised which exhibit between 18-45dB of upper side-band rejection over C, X, and Ku-band. The chips are designed for small band-to-band frequency translations (such as uplink to downlink) in satellite communications transponders. Since the chips exhibit a wide-band response, image-rejection is also obtained for both chips.

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Abstracts

A Single-Chip W-Band Transceiver with Front-End Switching Receiver for FMCW Radar Applications

D.C.W. Lo, K.W. Chang, R. Lin, E.W. Lin, H. Wang, M. Biedenbender, G.S. Dow and B.R. Allen. "A Single-Chip W-Band Transceiver with Front-End Switching Receiver for FMCW Radar Applications." 1995 MTT-S International Microwave Symposium Digest 95.2 (1995 Vol. II [MWSYM]): 873-876.

We have demonstrated the first monolithic W-band transceiver with front-end switching receiver for FMCW radar application. The switching receiver utilizes a novel balanced switching low noise amplifier for switching function and has achieved a conversion gain of 5.4 dB and 10 dB isolation. By operating the MMIC as a heterodyne receiver, we achieved a noise figure at 1MHz IF of 8 dB which is lower than that of the previous reported single-chip W-band homodyne transceivers.



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Abstracts

New Types of MMIC Circulators (1995 Vol. II [MWSYM])

D. Kother, B. Hopf, T. Sporkmann, I. Wolff and S. Kosslowski. "New Types of MMIC Circulators (1995 Vol. II [MWSYM])." 1995 MTT-S International Microwave Symposium Digest 95.2 (1995 Vol. II [MWSYM]): 877-880.

Circulators can be used to separate transmit/receive (T/R) signals and for two-port tuners. Conventional ferrite devices are not applicable for MMICs. Two new types of electronical circulators are presented in this paper covering the frequency range from 1.8GHz up to 80GHz.



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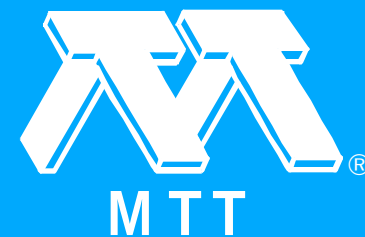
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Abstracts

Session WE4A -- Acoustic Filters: Performance and Applications

"Session WE4A -- Acoustic Filters: Performance and Applications." 1995 MTT-S International Microwave Symposium Digest 95.2 (1995 Vol. II [MWSYM]): 881-881.



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Development of Miniature Filters for Wireless Applications

K.M. Lakin, G.R. Kline and K.T. McCarron. "Development of Miniature Filters for Wireless Applications." 1995 MTT-S International Microwave Symposium Digest 95.2 (1995 Vol. II [MWSYM]): 883-886.

Miniature filters have been under development for wireless applications from 500 MHz to over 6 GHz using thin piezoelectric films on common substrates. Ladder filters have achieved insertion losses in the 3 dB range using aluminum nitride films for the piezoelectric and appropriate substrates such as silicon, sapphire, and glass. The ladder filters consist of interconnected series and shunt resonators forming a monolithic structure on a single die. This paper discusses recent results in the development of miniature filters with application to cellular phone, GPS, PCN, and other wireless systems.

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Thin-Film Resonator Ladder Filter

L. Mang, F. Hickernell, R. Pennell and T. Hickernell. "Thin-Film Resonator Ladder Filter." 1995 MTT-S International Microwave Symposium Digest 95.2 (1995 Vol. II [MWSYM]): 887-890.

Thin-film bulk acoustic wave resonator (BAWR) ladder filters have been realized with IL $\sim$ 2.2 dB, and selectivity $\sim$ 15 dB for a three resonator filter, IL $\sim$ 5 dB and selectivity $\sim$ 32 dB for a five resonator filter. Filters with seven and nine resonators have also been characterized. This performance corresponds to achieving a figure of merit $Q/r \sim 10$. The performance possibilities of ladder filters have been calculated with the Q/r figure of merit as a parameter. It is anticipated with improvements in processing and device designs, AlN or ZnO thin-film BAWR ladder filters should achieve IL $\sim$ 1.5 dB and selectivity $\sim$ 40 dB, corresponding to $Q/r \sim 40$ at 1.5 GHz.



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A New Balanced-Type RF-Band SAW Filter Using SAW Resonators

Y. Taguchi, S. Seki, K. Onishi and K. Eda. "A New Balanced-Type RF-Band SAW Filter Using SAW Resonators." 1995 MTT-S International Microwave Symposium Digest 95.2 (1995 Vol. II [MWSYM]): 891-894.

A new balanced-type RF-band (950MHz) surface acoustic wave (SAW) filter using SAW resonators for use in portable telephones is presented. This SAW filter has balanced input and output terminals. Based on the computer simulation, balanced-type SAW filters having a pass-band at 950MHz were fabricated. The obtained characteristics showed excellent characteristics such as low insertion loss, wide bandwidth, high attenuation at stopbands, and small VSWR. Using the SAW filter one can realize balanced-type RF circuits in portable telephones.

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Abstracts

An Efficient and Cost Effective SAW Device Measurement Method Based on an S-Parameter Estimation Technique

J. Johnson and R. Weigel. "An Efficient and Cost Effective SAW Device Measurement Method Based on an S-Parameter Estimation Technique." 1995 MTT-S International Microwave Symposium Digest 95.2 (1995 Vol. II [MWSYM]): 895-898.

Efficient and cost effective testing is an important part of the production process of SAW components. One aspect of testing is the measurement of the device transfer characteristic. In many cases expensive test fixtures containing matching networks are required. In order to reduce production costs and facilitate the measurement of transfer functions without matching networks, a different approach has been taken. Through use of estimation methods one can reduce the amount of information required to calculate a matched transfer function. Therefore, we developed a method by which a simulated match could be performed, but required only knowledge of the unmatched and uncalibrated S_{21} -parameter. The feasibility of our technique is demonstrated with a low loss IF SPUDT filter for mobile telephone applications.



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Abstracts

A SAW Matched Filter Based Spread Spectrum Technique for Indoor Multiple Access Systems

Z. Zhang, F. Seifert and R. Weigel. "A SAW Matched Filter Based Spread Spectrum Technique for Indoor Multiple Access Systems." 1995 MTT-S International Microwave Symposium Digest 95.2 (1995 Vol. II [MWSYM]): 899-902.

Surface Acoustic Wave (SAW) tapped delay lines and convolves functioning as Matched Filters (MFs) are of superior advantages in broadband spread spectrum communication systems in comparison to digital signal processors, SAW MFs allow indoor systems to have a bandwidth larger than the coherence bandwidth of the indoor radio channel. A multiple access technique called Time Code Division Multiple Access (TCDMA) based on SAW MFs is proposed. Using Gold codes of length 128 as spreading codes, our uplink performance simulation results reveal the capacity of TCDMA in a typical indoor cell.



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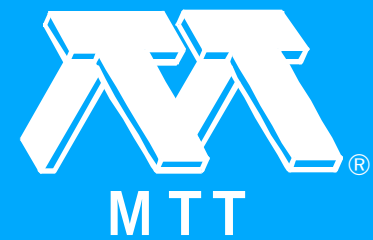
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Abstracts

Session WE4B -- Active and Quasi-Optic Antennas

"Session WE4B -- Active and Quasi-Optic Antennas." 1995 MTT-S International Microwave Symposium Digest 95.2 (1995 Vol. II [MWSYM]): 903-903.



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Abstracts

A Conformal Retrodirective Array for Radar Applications Using a Heterodyne Phased Scattering Element

C.W. Pobanz and T. Itoh. "A Conformal Retrodirective Array for Radar Applications Using a Heterodyne Phased Scattering Element." 1995 MTT-S International Microwave Symposium Digest 95.2 (1995 Vol. II [MWSYM]): 905-908.

A 6 GHz retrodirective antenna array has been developed for use in radar and backscatter-mode communication systems. The array is based on a novel microstrip mixer-antenna element that provides the conjugate phase shift necessary for retro-reflection of incident signals, and which responds to all polarizations.



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Abstracts

A High Power Two-Dimensional Coupled-Oscillator Array at X-Band

P. Liao and R.A. York. "A High Power Two-Dimensional Coupled-Oscillator Array at X-Band." 1995 MTT-S International Microwave Symposium Digest 95.2 (1995 Vol. II [MWSYM]): 909-912.

The design and construction of a high power X-band quasi-optical power combining array is described. This array extends our previous work to two dimensions using a coupled network of GaAs power MESFET oscillators. Preliminary measurements suggest that a 6 x 6 array produces a total power in excess of 30 Watts, with an effective radiated power (ERP) of greater than 2 kW.



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Abstracts

Use of the Moment Method and Dyadic Green's Functions in the Analysis of Quasi-Optical Structures

T.W. Nuteson, G.P. Monahan, M.B. Steer, K. Naishadham, J.W. Mink and F.K. Schwering. "Use of the Moment Method and Dyadic Green's Functions in the Analysis of Quasi-Optical Structures." 1995 MTT-S International Microwave Symposium Digest 95.2 (1995 Vol. II [MWSYM]): 913-916.

A moment method using a dyadic Green's function is developed for the analysis of quasi-optical systems. The dyadic Green's function used has separate terms for the paraxial and non-paraxial fields and is much easier to develop than a mixed potential Green's function. The method is applied to the analysis of antenna elements in a quasi-optical resonator.



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Demonstration of an Oscillating Quasi-Optical Slab Power Combiner

F. Poegel, S. Irrgang, S. Zeisberg, A. Schuenemann, G.P. Monahan, H. Hwang, M.B. Steer, J.W. Mink, F.K. Schwering, A. Paolletta and J. Harvey. "Demonstration of an Oscillating Quasi-Optical Slab Power Combiner." 1995 MTT-S International Microwave Symposium Digest 95.2 (1995 Vol. II [MWSYM]): 917-920.

Power combining in a hybrid dielectric slab beam waveguide resonator using a MESFET oscillator array is reported for the first time. Four MESFET oscillators lock via quasi-optical modes to produce a signal at 7.4 GHz with a 3 dB linewidth of less than 3 kHz.

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A Dielectric Slab Waveguide with Four Planar Power Amplifiers

H. Hwang, G.P. Monahan, M.B. Steer, J.W. Mink, J. Harvey, A. Paollea and F.K. Schwering. "A Dielectric Slab Waveguide with Four Planar Power Amplifiers." 1995 MTT-S International Microwave Symposium Digest 95.2 (1995 Vol. II [MWSYM]): 921-924.

A hybrid dielectric slab beam waveguide with four MESFET amplifiers employing quasi-optical power combining is reported for the first time. Up to 10 dB power gain is obtained at 7.4GHz. Measurements for power gain, amplifier gain, insertion loss and transverse power distribution are presented. The fabrication technique employed is suitable for planar MMIC circuits.

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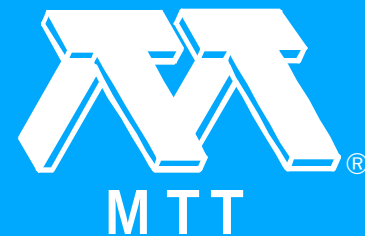


Abstracts

A 2x2 Beam-Switching Active Antenna Array

S.T. Chew and T. Itoh. "A 2x2 Beam-Switching Active Antenna Array." 1995 MTT-S International Microwave Symposium Digest 95.2 (1995 Vol. II [MWSYM]): 925-928.

An electronic beam-switching active antenna array is designed. The sum and difference patterns can be switched bi-directionally without additional switching devices. The required phase relationship is obtained through injection-locking. The transmitted power is combined quasi-optically. The measured patterns are in agreement with that of theory.



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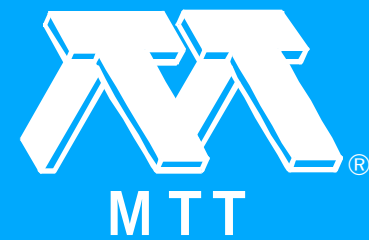
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Abstracts

Session WE4C -- Noise Modeling

"Session WE4C -- Noise Modeling." 1995 MTT-S International Microwave Symposium Digest 95.2 (1995 Vol. II [MWSYM]): 929-929.



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Simulation of Temperature Dependencies Using a New and CAD Suitable Physical GaAs-MESFET Model Including the Electron Preheating Effect

P. Nevermann and I. Wolff. "Simulation of Temperature Dependencies Using a New and CAD Suitable Physical GaAs-MESFET Model Including the Electron Preheating Effect." 1995 MTT-S International Microwave Symposium Digest 95.2 (1995 Vol. II [MWSYM]): 931-934.

A new physical model for a fast simulation of short channel MESFETS is presented. New analytical approximations for the description of the velocity-overshoot are the basis of a fast physical model named TRISTAN (Transistor modelling Including bias dependent saturation velocity, Temperature dependencies and Analysis of Noise). A description of Monte-Carlo results concerning transport and noise properties by means of new analytical formulas also enables an extreme fast access to the material properties. TRISTAN results agree well with experimental data for the noise and small signal equivalent circuit parameters in a wide temperature range down to 27 K. Furthermore it is explained how the electron preheating causes a drastically reduced overshoot effect in some real devices.

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Abstracts

Ultra-Low Noise HEMT Device Models: Application of On-Wafer Cryogenic Noise Analysis and Improved Parameter Extraction Techniques

J.J. Bautista, M. Hamai, M. Nishimoto, J. Laskar, P. Szydlik and R. Lai. "Ultra-Low Noise HEMT Device Models: Application of On-Wafer Cryogenic Noise Analysis and Improved Parameter Extraction Techniques." 1995 MTT-S International Microwave Symposium Digest 95.2 (1995 Vol. II [MWSYM]): 935-938.

Significant advances in the development of HEMT technology have resulted in high performance cryogenic, LNAs whose noise temperatures are within an order of magnitude of the quantum noise limit ($h\nu/k$). Key to the identification of optimum HEMT structures at cryogenic temperatures is the development of on-wafer noise and device parameter extraction techniques.



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Abstracts

A Novel Millimeter-Wave HEMT Noise Modeling Procedure

M.D. DuFault, J.Z. Lin and A.K. Sharma. "A Novel Millimeter-Wave HEMT Noise Modeling Procedure." 1995 MTT-S International Microwave Symposium Digest 95.2 (1995 Vol. II [MWSYM]): 939-942.

Significant improvements in the accuracy of noise models of millimeter-wave HEMT devices are obtained using on-wafer noise prematched structures and through enhanced accuracy of calibration. This procedure enables scaling of device noise models obtained at microwave frequencies to millimeter wave frequencies. Good correlation between noise parameters of scaled devices with experimental data at millimeter wave frequencies is obtained.



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Improved FET Noise Model Extraction Method for Statistical Model Development

S. Pritchett, A. Fernandez, D. Bridges and K. Whelan. "Improved FET Noise Model Extraction Method for Statistical Model Development." 1995 MTT-S International Microwave Symposium Digest 95.2 (1995 Vol. II [MWSYM]): 943-946.

An analytic method is presented for extracting gate-source leakage resistance, R_{gs} , from S-parameter measurements ≥ 500 MHz. Subsequent noise source parameter extraction is frequency independent. Consequently, model parameter optimization is eliminated and physical correlations between parameters preserved. Compact statistical noise models can then be developed using the Principal Component method. R_{gs} also improves modeled low-frequency stability characteristics.

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Analysis of g-r Noise Upconversion in Oscillators

T. Felgentreff, W. Anzill, G. Olbrich and P. Russer. "Analysis of g-r Noise Upconversion in Oscillators." 1995 MTT-S International Microwave Symposium Digest 95.2 (1995 Vol. II [MWSYM]): 947-950.

In this paper the upconversion of g-r noise to oscillator phase noise is analysed for the first time. The treatment of g-r noise sources showing a Lorentzian spectrum is implemented in a time domain noise calculation program using the perturbation method. Measurements and simulations show that the unconverted g-r noise dominates the phase noise characteristics of AlGaAs/GaAs-HEMT oscillators in the frequency range between 10 kHz and 8 MHz besides the carrier.

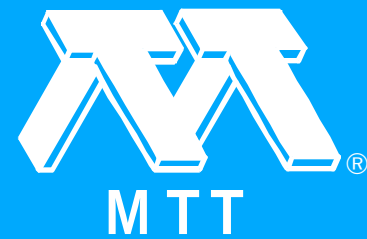
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Abstracts

Session WE4D -- Subsystems for Commercial Communications and Automotive Sensor Applications

"Session WE4D -- Subsystems for Commercial Communications and Automotive Sensor Applications." 1995 MTT-S International Microwave Symposium Digest 95.2 (1995 Vol. II [MWSYM]): 951-951.



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Abstracts

Low Cost and Compact Active Integrated Antenna Transceiver for System Applications (1995 Vol. II [MWSYM])

R. Flynt, L. Fan, J. Navarro and K. Chang. "Low Cost and Compact Active Integrated Antenna Transceiver for System Applications (1995 Vol. II [MWSYM])." 1995 MTT-S International Microwave Symposium Digest 95.2 (1995 Vol. II [MWSYM]): 953-956.

An FET transistor and a Schottky barrier mixer diode have been integrated within an inverted patch antenna for transceiver applications. Preliminary results exhibit a 5.5 dB isotropic mixer conversion loss at 6 GHz for an intermediate frequency of 200 MHz with the FET serving as both the transmitter and the local oscillator at 5.8 GHz. The low cost, compact circuit should be useful for communication, sensors, and radar applications.



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A Novel Uniplanar Bi-Phase(0° - 180°) Modulator/Mixer

K. Hettak, E. Rius, J.P. Coupez, S. Toutain, P. Legaud and E. Penard. "A Novel Uniplanar Bi-Phase(0° - 180°) Modulator/Mixer." 1995 MTT-S International Microwave Symposium Digest 95.2 (1995 Vol. II [MWSYM]): 957-960.

The overall goal of this paper is to design a new modulator/mixer at 38 GHz in uniplanar technology. The primary objective is to developing a theoretical and an experimental study of each elementary block in the millimeter frequency range allows us directly to design the device at 38 GHz. As part of this study, a uniplanar modulator/mixer was built in X band in order to aid in the verification of the design concept.



A Miniature 17/12 GHz MMIC Receiver for Satellite Communication

C. Yuen, E. Quiles, J.J. McFarland, M. Yung, R. Klibo and W. Findley. "A Miniature 17/12 GHz MMIC Receiver for Satellite Communication." 1995 MTT-S International Microwave Symposium Digest 95.2 (1995 Vol. II [MWSYM]): 961-964.

We have developed a novel high gain, low noise, miniature 17/12 GHz receiver with MMIC insertion for satellite communication. This receiver has a nominal conversion gain of 60+/-0.25 dB with gain adjustment range of 60 dB and noise figure of 1.6 dB. The third order intermodulation is 32 dBc @ -50 dBm input drive level, from 17.3 to 17.8 GHz at room temperature. It has a size of 5.7x1.8x0.3", a mass of 90 gm and a DC power consumption of 2.8 Watt.



Abstracts

Coded 24 GHz Doppler Radar Sensors: A New Approach to High-Precision Vehicle Position and Ground-Speed Sensing in Railway and Automobile Applications

P. Heide, V. Magori and R. Schwarte. "Coded 24 GHz Doppler Radar Sensors: A New Approach to High-Precision Vehicle Position and Ground-Speed Sensing in Railway and Automobile Applications." 1995 MTT-S International Microwave Symposium Digest 95.2 (1995 Vol. II [MWSYM]): 965-968.

Coded 24 GHz Doppler sensors have been realized to perform high-precision non-contact vehicle position and speed measurements. Encoding the radar signal with a spread-spectrum code is the key to a significantly enhanced sensitivity combined with a range selectivity of the sensor. The novel system concept establishes a high-performance low-cost vehicle Doppler radar system with very high measurement accuracy suitable for automotive and railway applications.



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Improvement of Angular Resolution of a Millimeterwave Imaging System by Transmitter Location Multiplexing

N. Kees, E. Schmidhammer and J. Detlefsen. "Improvement of Angular Resolution of a Millimeterwave Imaging System by Transmitter Location Multiplexing." 1995 MTT-S International Microwave Symposium Digest 95.2 (1995 Vol. II [MWSYM]): 969-972.

Angular resolution and the angular width of the field of view are in the frame of Autonomous Intelligent Cruise Control (AICC) critical system parameters. A promising solution which avoids conventional phased array techniques is to use an array of receivers and the methods of digital beam forming in order to extract the complete 2D radar information. Angular resolution is in this case closely related to the number of receiving antennas respectively downconverters. A complete AICC - systems working on these principles using four receivers has been built and published elsewhere. This paper shows that angular resolution can be improved at least by a factor of two without increasing the number of antennas and receivers by multiplexing the transmitter location. Two different configurations are compared. A very cost-effective way is to realize the necessary switching operations in the IF-band. Linear prediction algorithms are applied to fill the arising gap, leading to the full expected lateral resolution while maintaining sufficient side-lobe suppression.

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A Test Target Generator for Wideband Pulsed Doppler Radars

P. Phu, E. Adler, R. Innocenti and A. Paoletta. "A Test Target Generator for Wideband Pulsed Doppler Radars." 1995 MTT-S International Microwave Symposium Digest 95.2 (1995 Vol. II [MWSYM]): 973-975.

A test target simulator (TTS) based on a fiber-optic delay line (FODL) has been designed for realistic testing and characterizing of wideband pulsed Doppler radars. The TTS can simulate one or two targets at different radar cross sections (RCS's), different Doppler, and different ranges in the presence of uncorrelated noise or interference. With one target, clutter and multipath effects can also be simulated. In a closed-loop test of a pulsed Doppler radar transceiver, the variable control of the RCS can be used to test the radar's dynamic range. Simulating two targets and varying the range and Doppler of each target in the closed-loop test can evaluate the radar's range and Doppler resolution, respectively.

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Abstracts

Session WE4E -- Passive Waveguide Components

"Session WE4E -- Passive Waveguide Components." 1995 MTT-S International Microwave Symposium Digest 95.2 (1995 Vol. II [MWSYM]): 977-977.



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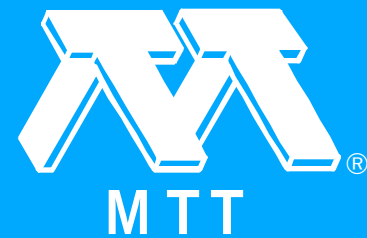


Abstracts

Modeling Generalized Coaxial Probes in Rectangular Waveguides

H.-W. Yao and K.A. Zaki. "Modeling Generalized Coaxial Probes in Rectangular Waveguides." 1995 MTT-S International Microwave Symposium Digest 95.2 (1995 Vol. II [MWSYM]): 979-982.

An new approach combining the orthogonal expansion method for modeling cylindrical posts in rectangular waveguides and the extension of the three short plane measurement technique is used to obtain the S-matrix for a general coaxial probe in a rectangular waveguide. The computed results are in excellent agreement with the measured results showing the usefulness of this method.



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Analysis and Design of Wide-Band Matched Waveguide Bends Including Discontinuities

M. Mongiardo, A. Morini and T. Rozzi. "Analysis and Design of Wide-Band Matched Waveguide Bends Including Discontinuities." 1995 MTT-S International Microwave Symposium Digest 95.2 (1995 Vol. II [MWSYM]): 983-986.

Waveguide bends with small radii of curvature are realized by using properly selected discontinuities which, placed inside the curve, allow low return losses to be achieved over large bandwidths. The component is designed by using an efficient computer code which employs the local modes approach to analyze curved sections, while discontinuities are rigorously accounted for by considering their accessible modes. Theoretical simulations are compared with experimental results showing very good accuracy.

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Rigorous Analysis of Compensated E-Plane Junctions in Rectangular Waveguide

F. Alessandri, M. Dionigi and R. Sorrentino. "Rigorous Analysis of Compensated E-Plane Junctions in Rectangular Waveguide." 1995 MTT-S International Microwave Symposium Digest 95.2 (1995 Vol. II [MWSYM]): 987-990.

A rigorous full wave analysis of compensated E-plane junctions has been developed using a segmentation technique associated with an admittance matrix representation. The structures are divided into rectangular and right-angled isosceles triangular regions for which the admittance matrix is expressed in closed form. The properties of compensated T-junctions, bifurcations and stubs are investigated showing significant improvements of the electrical performances over the uncompensated counterpart. The computer analysis of any structure requires less than one second per frequency point on 486-50 MHz IBM compatible personal computer.

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Field Theoretical Characterization of Microwave Cavities

S. Xiao, R. Vahldieck and M. Guglielmi. "Field Theoretical Characterization of Microwave Cavities." 1995 MTT-S International Microwave Symposium Digest 95.2 (1995 Vol. II [MWSYM]): 991-994.

A cylindrical method of lines (CMOL) has been developed to calculate waveguide cavities with homogeneous and inhomogeneous media. The advantage of the CMOL is that only two out of three space variables need to be discretized, while for the third direction the Helmholtz equation can be solved analytically. The CMOL is especially suitable for the analysis and design of cylindrical/rectangular cavities filled with dielectric blocks of arbitrary shape. Results are presented for a variety of resonator structures. Of particular interest is the resonant frequency calculation of a dielectric rod of varying diameter within a rectangular cavity.

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Filter-Like Design and Optimization of NRD-Guide Mode Suppressors

J. Huang, K. Wu, F. Kuroki and T. Yoneyama. "Filter-Like Design and Optimization of NRD-Guide Mode Suppressors." 1995 MTT-S International Microwave Symposium Digest 95.2 (1995 Vol. II [MWSYM]): 995-998.

A new compact NRD-guide mode suppressor is proposed in this paper for wideband applications in NRD integrated circuits. Rigorous field-theoretical analysis and optimum design are carried out to determine frequency response of the proposed mode suppressor using a filter-like scheme. It is found that the transmission loss of a three-section mode suppressor is better than -30dB over the frequency band of interest. In addition, the length of the whole resulting mode suppressor becomes shorter than its counterpart using the choke metallic pattern by 20%.

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Abstracts

Panel and Rump Sessions, Workshops, 1995 MW and MMW Monolithic Circuits Symposium, 1995 National Telesystems Conference, Author Index, Exhibitor List (1995 Vol. II [MWSYM])

"Panel and Rump Sessions, Workshops, 1995 MW and MMW Monolithic Circuits Symposium, 1995 National Telesystems Conference, Author Index, Exhibitor List (1995 Vol. II [MWSYM])."
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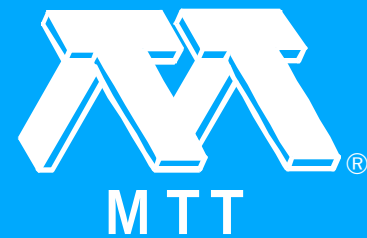
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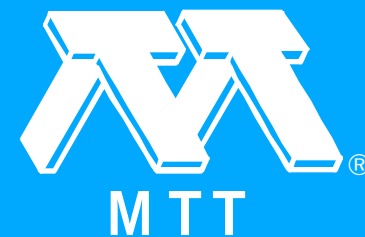
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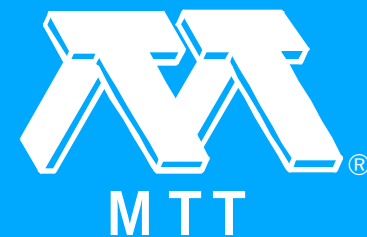
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Microwave Symposium Technical Program Schedule (1995 Vol. III [MWSYM])

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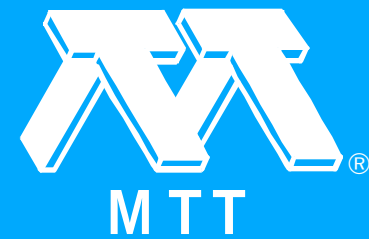
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Technical Sessions (1995 Vol. III [MWSYM])

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Session TH1B -- Digital Signal Processing

"Session TH1B -- Digital Signal Processing." 1995 MTT-S International Microwave Symposium Digest 95.3 (1995 Vol. III [MWSYM]): 1001-1001.



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2.8 Gbit/s Optical Interconnection Circuit Using D8B1C/D8B1M Coding Scheme

Y. Uematsu, K. Murata, Y. Yamabayashi and Y. Kobayashi. "2.8 Gbit/s Optical Interconnection Circuit Using D8B1C/D8B1M Coding Scheme." 1995 MTT-S International Microwave Symposium Digest 95.3 (1995 Vol. III [MWSYM]): 1003-1006.

We develop a 2.8 Gbit/s optical interconnection circuit using the D8B1C (Differential 8 Binary 1 Complement insertion) /D8B1M (Differential 8 Binary with 1 Mark insertion) coding scheme for multiplexed channel framing and synchronization and suppressing Direct Current level variation. The circuit multiplexes 16 parallel 156 Mbit/s input signals, and outputs a 2.8 Gbit/s serial signal. The coding scheme, named D8B1C/D8B1M, realizes large capacity interconnections with simple analog circuits, and offers high flexibility for extension to higher capacity interconnections.

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Abstracts

A New Direct Digital Receiver Performing Coherent PSK Reception

J. Li, R.G. Bosisio and K. Wu. "A New Direct Digital Receiver Performing Coherent PSK Reception." 1995 MTT-S International Microwave Symposium Digest 95.3 (1995 Vol. III [MWSYM]): 1007-1010.

Coherent reception provides better CNR performance over its differential counterpart. However, this is generally obtained at the expense of increasing complexity of the receiver and more stringent specifications of circuits. In this paper, we describe a new coherent PSK direct receiver, in which a 'soft' phase reference is established by DSP, while the detection is performed directly at mm-wave frequencies. Both measurements and computer simulations validate the proposed new approach.



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A GaAs Integrated Circuit for Wideband Digital Quadrature Demodulation

R.J. Inkol, V. Szwarc, L. Desormeaux, M. Esonu and D. Al-Khalili. "A GaAs Integrated Circuit for Wideband Digital Quadrature Demodulation." 1995 MTT-S International Microwave Symposium Digest 95.3 (1995 Vol. III [MWSYM]): 1011-1014.

An integrated circuit has been designed to perform signal processing functions including digital quadrature demodulation on a sampled intermediate frequency signal in electronic warfare receivers. A -3 dB bandwidth exceeding 80 MHz is achieved using a fully pipelined, parallel architecture implemented on a GaAs gate array.

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Abstracts

A Spectral Estimation Technique to Improve the Efficiency of FDTD Method for Narrow-Band Microwave Circuits

X.P. Lin and K. Naishadham. "A Spectral Estimation Technique to Improve the Efficiency of FDTD Method for Narrow-Band Microwave Circuits." 1995 MTT-S International Microwave Symposium Digest 95.3 (1995 Vol. III [MWSYM]): 1015-1018.

With the advances in computer technology, the finite-difference time-domain (FDTD) method is becoming increasingly popular in the analysis of microwave circuits. A major drawback of the conventional Yee FDTD implementation is the enormous time and memory required to characterize the resonant behavior of narrow-band circuits. In this paper, we introduce a technique which effectively employs a combination of Prony's extrapolation and adaptive sampling of the temporal data to reduce the number of FDTD iterations for resonant circuits. The new technique is applied to the characterization of a multilayered coplanar waveguide filter element.



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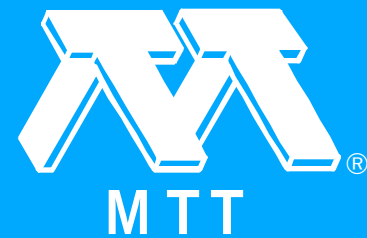


Abstracts

A Generalized Optimal Signal Processing Algorithm for Frequency-Stepped CW Data

S.M. Wu, G.A. Ybarra and W.E. Alexander. "A Generalized Optimal Signal Processing Algorithm for Frequency-Stepped CW Data." 1995 MTT-S International Microwave Symposium Digest 95.3 (1995 Vol. III [MWSYM]): 1019-1022.

We derive a complex non-linear optimal signal processing algorithm for estimating target reflection ranges from a set of frequency-stepped CW measurements. We demonstrate the performance of this algorithm using synthetic FSCW data through comparisons with the IFFT and the real version of the optimal signal processing algorithm.



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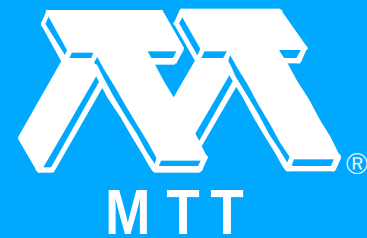


Abstracts

A Microwave Model for Moisture Determination in Bulk Materials and a Maximum Likelihood Estimation Algorithm

T. Boltze. "A Microwave Model for Moisture Determination in Bulk Materials and a Maximum Likelihood Estimation Algorithm." 1995 MTT-S International Microwave Symposium Digest 95.3 (1995 Vol. III [MWSYM]): 1023-1026.

A theoretical model for describing the dielectric constant of moist bulk materials such as tobacco, rape seed and similar materials and a robust algorithm based on this model for determining the moisture content of these materials will be presented. In contrast to established models, this method takes into account the different binding energies of water molecules in the capillaries of the material. The algorithm is based on maximum likelihood estimation.



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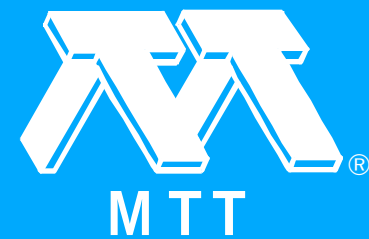
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Abstracts

Session TH1C -- On-Wafer Measurements

"Session TH1C -- On-Wafer Measurements." 1995 MTT-S International Microwave Symposium Digest 95.3 (1995 Vol. III [MWSYM]): 1027-1027.



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Accurate on Wafer Measurement of Phase and Amplitude of the Spectral Components of Incident and Scattered Voltage Waves at the Signal Ports of a Nonlinear Microwave Device

J. Verspecht, P. Debie, A. Barel and L. Martens. "Accurate on Wafer Measurement of Phase and Amplitude of the Spectral Components of Incident and Scattered Voltage Waves at the Signal Ports of a Nonlinear Microwave Device." 1995 MTT-S International Microwave Symposium Digest 95.3 (1995 Vol. III [MWSYM]): 1029-1032.

A measurement setup and calibration procedure are described allowing the accurate on wafer measurement of phases and amplitudes of the spectral components of incident and scattered voltage waves at the signal ports of a nonlinear microwave device. A comparison is made between measurements performed with the setup and simulations based on a Root-model.



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Fully Integrated Nonlinear Modeling and Characterization System of Microwave Transistors with On-Wafer Pulsed Measurements

J.P. Teyssier, J.P. Viaud, J.J. Raoux and R. Quere. "Fully Integrated Nonlinear Modeling and Characterization System of Microwave Transistors with On-Wafer Pulsed Measurements." 1995 MTT-S International Microwave Symposium Digest 95.3 (1995 Vol. III [MWSYM]): 1033-1036.

A novel approach for nonlinear characterization and modeling of microwave transistors has been developed. The whole process is organised as a set of methods contained in the transistor database. This implies that characterization and modeling are performed in an integrated manner. I(V) and S-parameters are measured on wafer under pulsed conditions, suitable for MESFETs, HEMTs or HBTs as illustrated by the proposed models.



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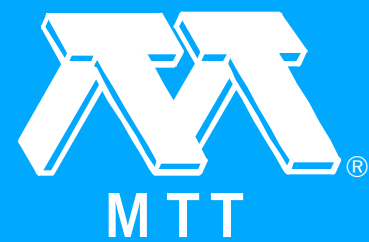
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A Novel Computerized Multiharmonic Active Load-Pull System for the Optimization of High Efficiency Operating Classes in Power Transistors

F. Blache, J.M. Nebus, P. Bouysse and J.P. Villotte. "A Novel Computerized Multiharmonic Active Load-Pull System for the Optimization of High Efficiency Operating Classes in Power Transistors." 1995 MTT-S International Microwave Symposium Digest 95.3 (1995 Vol. III [MWSYM]): 1037-1040.

A fully automated multiharmonic load-pull system allowing accurate measurement and control of the first three harmonic load terminations of RF and microwave transistors is presented in this paper. The technical originality of the proposed system lies in that the first, second and third harmonic load terminations can be independently and automatically monitored and fixed while varying the input power driving the transistor at the fundamental frequency. Appropriate hardware and software allow fast and automatic plots of power/efficiency performances of DUTs versus input power for different harmonic loadings. To demonstrate an attractive application of the system, measurements of a 1800 μm gate periphery MESFET at 1.8 GHz for mobile communication applications are presented. Both suitable harmonic load terminations and non-appropriate ones yielding respectively optimum and poor power added efficiency are given.

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A 0.5-50 GHz On-Wafer, Intermodulation, Load-Pull and Power Measurement System

M. Demmler, B. Hughes and A. Cognata. "A 0.5-50 GHz On-Wafer, Intermodulation, Load-Pull and Power Measurement System." 1995 MTT-S International Microwave Symposium Digest 95.3 (1995 Vol. III [MWSYM]): 1041-1044.

A novel on-wafer, intermodulation, load-pull and power measurement system for characterizing devices and circuits for frequencies up to 50 GHz has been developed. The two-tone intermodulation measurement capabilities were added to an existing power and harmonic load-pull measurement system using the 50 GHz spectrum analyzer HP8565. Fundamental power levels and all measured intermodulation (IM) products are vector corrected to the probe tips of the DUT. A key feature of the described system are the vector corrected IM measurements and the capability to study the effects of load impedance on intermodulation.

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On-Wafer Calibration Techniques for Measurement of Microwave Circuits and Devices on Thin Substrates

J. Pla, W. Struble and F. Colomb. "On-Wafer Calibration Techniques for Measurement of Microwave Circuits and Devices on Thin Substrates." 1995 MTT-S International Microwave Symposium Digest 95.3 (1995 Vol. III [MWSYM]): 1045-1048.

Two sets of on-wafer microstrip calibration standards were fabricated on 50 μm GaAs and 25 μm Polyimide substrates for the purpose of measuring microwave circuits and devices up to 50 GHz. The accuracies of one and two tier LRM and TRL calibration techniques were investigated on PHEMT devices. Substantial improvements were found with the use of a weight function in the averaging of two tier TRL and LRM-TRL calibrations. The dependence of the isolation on the spacing between the input and output probes was also determined for these thin substrates.

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2D Electro-Optic Probing Combined with Field Theory Based Multimode Wave Amplitude Extraction: A New Approach to On-Wafer Measurement

G. David, W. Schroeder, D. Jager and I. Wolff. "2D Electro-Optic Probing Combined with Field Theory Based Multimode Wave Amplitude Extraction: A New Approach to On-Wafer Measurement." 1995 MTT-S International Microwave Symposium Digest 95.3 (1995 Vol. III [MWSYM]): 1049-1052.

A novel approach to on-wafer measurement is proposed, which combines the direct electro-optic probing technique with a field theory based extraction technique for the modal voltages of all relevant modes at arbitrary internal ports of a (III-V) MMIC. The approach can be extended to obtain the complex modal amplitudes of forward and backward propagating waves on interconnecting transmission lines. This makes it a unique method for measurement of mode conversion in N-port components and their multimode s-parameter characterization.

Click on title for a complete paper.



Abstracts

High-Frequency On-Wafer Testing with Freely Positionable Silicon-on-Sapphire Photoconductive Probes

T. Pfeifer, H.-M. Heiliger, E.S. von Kamienski, H.G. Roskos and H. Kurz. "High-Frequency On-Wafer Testing with Freely Positionable Silicon-on-Sapphire Photoconductive Probes." 1995 MTT-S International Microwave Symposium Digest 95.3 (1995 Vol. III [MWSYM]): 1053-1056.

We describe the characterization of external photoconductive probes as both generators and detectors of picosecond electric transients. The probes are manufactured on transparent silicon-on-sapphire substrates and are suited for on-wafer testing in integrated circuits. We characterize the freely positionable probes concerning linearity, sensitivity, time resolution and invasiveness.



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Abstracts

Session TH1D -- Dual-Use and Defense Conversion: Technologies and Applications

*"Session TH1D -- Dual-Use and Defense Conversion: Technologies and Applications." 1995
MTT-S International Microwave Symposium Digest 95.3 (1995 Vol. III [MWSYM]): 1057-1057.*



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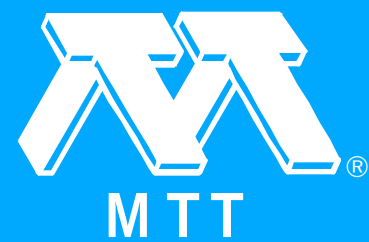
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Dual-Use and Defense Conversion: A View from the Second Tier

G.C. DiPiazza. "Dual-Use and Defense Conversion: A View from the Second Tier." 1995 MTT-S International Microwave Symposium Digest 95.3 (1995 Vol. III [MWSYM]): 1059-1062.

Since the ending of the cold war, the role of the traditional second-tier defense supplier has changed dramatically. The impact of the declining defense budget has created enormous financial stress for both the prime and the second-tier microwave suppliers. While the second tier is the most vulnerable to decreases in DoD spending, because of internalization of support within the primes, it can react quickly to modify its business value proposition to a dual-use strategy. Successful ventures in the commercial microwave marketplace by "converted" DoD suppliers offer an attractive spin-back scenario to the government as commercial practice begins to approach or exceed the measures of quality, reliability and affordability sought by DoD procurement offices. This paper addresses some of the market, business and technology factors that surround and challenge the second tier in this business conversion.

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MMIC Radar Transceivers for Industrial Sensors

S.F. Paik. "MMIC Radar Transceivers for Industrial Sensors." 1995 MTT-S International Microwave Symposium Digest 95.3 (1995 Vol. III [MWSYM]): 1063-1065.

Active microwave sensors perform radar functions to detect presence of objects and measure position and speed of those objects. With the benefit of MMIC technology, advanced radar techniques may be applied to expand sensor functions without increasing the cost of the microwave front-end significantly. One example of low-cost MMIC radar sensors is Hittite's FM-CW transceiver for proximity fuze integrated into a 1 mm square chip. Hittite has also demonstrated low-cost techniques for packaging and automated functional testing. These low-cost design and manufacturing techniques are applicable to a wide variety of industrial sensors. As an example of industrial applications, a radar sensor designed for liquid level measurements will be described.

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MSAG®-Lite: GaAs IC Process Technology Addressing Defense Conversion

C.E. Lindberg and D.G. Fisher. "MSAG®-Lite: GaAs IC Process Technology Addressing Defense Conversion." 1995 MTT-S International Microwave Symposium Digest 95.3 (1995 Vol. III [MWSYM]): 1067-1070.

In the mid 1980's the ITT Gallium Arsenide Technology Center (ITT GTC) developed a planar GaAs IC process based on ion implanted self aligned gate (SAG) FETs specifically for military applications. With only one additional implant mask for each device type, high speed enhancement/depletion (E/D) digital, low noise microwave and high efficiency power microwave FETs could be fabricated on a single chip. Hence, the process was denoted Multifunction Self-Aligned Gate or MSAG. Recognizing the growing importance of commercial applications, ITT GTC launched a major effort in 1989 to tailor the MSAG process for low frequency (<6 GHz) applications, by simplifying the process and lowering the costs associated with wafer fabrication and cycle time. This effort brought about the MSAG-Switch process and later, MSAG-Lite. This paper explains how the process conversion took place, the applications that were targeted, and the products that resulted.

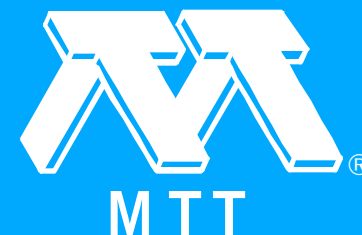
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Abstracts

Session TH1E -- Simulation and Design Techniques

"Session TH1E -- Simulation and Design Techniques." 1995 MTT-S International Microwave Symposium Digest 95.3 (1995 Vol. III [MWSYM]): 1071-1071.



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Accurate Prediction of the Small-Signal Gain of the HBT Dual-Fed Distributed Amplifier

I.A. Botterill and C.S. Aitchison. "Accurate Prediction of the Small-Signal Gain of the HBT Dual-Fed Distributed Amplifier." 1995 MTT-S International Microwave Symposium Digest 95.3 (1995 Vol. III [MWSYM]): 1073-1076.

The benefits of the MESFET dual-fed distributed amplifier over the conventional distributed amplifier (DA), both in small and large-signal operation, have previously been reported. Recent interest in the heterojunction bipolar transistor (HBT) DA has led to consideration of the HBT in the dual-fed configuration. It has been found that the previously proposed equation, developed to predict the small-signal gain of the MESFET dual-fed DA, is inaccurate when applied to the HBT dual-fed DA. This paper describes an expression which gives better agreement with the simulated performance of such an amplifier.

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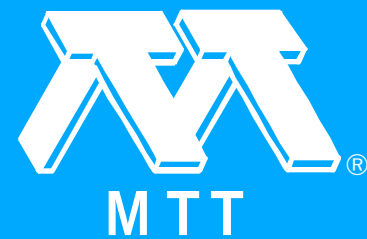


Abstracts

Modeling and Electrical Characterization of Parasitic Effects for GaAs Integrated Circuits - Experimental Validation and CAD Formulas

N. Hassaine, M. Lecours and G.Y. Delisle. "Modeling and Electrical Characterization of Parasitic Effects for GaAs Integrated Circuits - Experimental Validation and CAD Formulas." 1995 MTT-S International Microwave Symposium Digest 95.3 (1995 Vol. III [MWSYM]): 1077-1080.

This study investigates the computing of the inductance and capacitance coefficients of short links (gold wire connections, vias, interconnection crossing and coupled lines). The [L] and [C] matrix calculations are performed with the vector and scalar potential given in an integral form, taking into account the current density distribution on the conductors. Analytical formulas easy to use in CAD are derived from the numerical results using a least square method. The formulas have been shown to agree, with a precision in the order of 3%, with simulation results and with experimental results obtained on test boards in the frequency range 1-30 GHz.



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Abstracts

Modeling and Simulation of Switching Noise Including Power/Ground Plane Resonance for High Speed GaAs FET Logic (FL) Circuits

J.-M. Jong and V.K. Tripathi. "Modeling and Simulation of Switching Noise Including Power/Ground Plane Resonance for High Speed GaAs FET Logic (FL) Circuits." 1995 MTT-S International Microwave Symposium Digest 95.3 (1995 Vol. III [MWSYM]): 1081-1084.

Equivalent circuit models of power/ground plane structures in high speed/frequency electronic packages used for switching noise and ground bounce simulation are presented. As an example, the effect of package resonance on the switching noise due to edge and clock rates of the GaAs FET logic (FL) inverter is reported for a typical MLC package.



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Abstracts

Heterogeneous Parallel Yield-Driven Electromagnetic CAD

*J.W. Bandler, R.M. Biernacki, Q. Cai, S.H. Chen, P.A. Grobelny and D.G. Swanson, Jr..
"Heterogeneous Parallel Yield-Driven Electromagnetic CAD." 1995 MTT-S International
Microwave Symposium Digest 95.3 (1995 Vol. III [MWSYM]): 1085-1088.*

Within an integrated parallel optimization framework, we are able, for the first time, to apply electromagnetic (EM) optimization to the yield-driven design of microstrip circuits of arbitrary geometries. Parallel optimization handles the massive demand on computer resources, due to the large number of designable parameters describing an arbitrary geometry and the large number of simulations involved in yield optimization. Our parallel strategy can be implemented over local and wide area networks supporting heterogeneous workstations.



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Abstracts

The Use of Hopf Bifurcations LOCI for Spurious-Free Nonlinear Microwave Circuit Design

V. Rizzoli and A. Neri. "The Use of Hopf Bifurcations LOCI for Spurious-Free Nonlinear Microwave Circuit Design." 1995 MTT-S International Microwave Symposium Digest 95.3 (1995 Vol. III [MWSYM]): 1089-1092.

Bifurcation theory is coupled with harmonic-balance techniques into a powerful CAD tool for the design of stable nonlinear microwave circuits and subsystems. Automatically generated Hopf bifurcations loci provide detailed information on the role of selected circuit parameters in the generation of spurious tones, and are effectively used in support to ordinary optimization to produce spurious-free circuit topologies.



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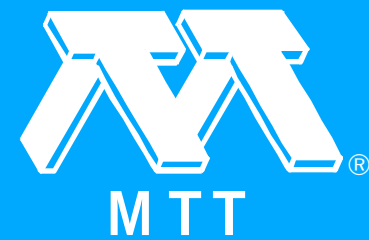
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Abstracts

Session TH2A -- Phased and Active Array Technologies

"Session TH2A -- Phased and Active Array Technologies." 1995 MTT-S International Microwave Symposium Digest 95.3 (1995 Vol. III [MWSYM]): 1093-1093.



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W-Band Active Transmit and Receive Phased Array Antennas

B.J. Edward, D.R. Helms, R.S. Webb and S. Weinreb. "W-Band Active Transmit and Receive Phased Array Antennas." 1995 MTT-S International Microwave Symposium Digest 95.3 (1995 Vol. III [MWSYM]): 1095-1098.

The design and fabrication details for 94 GHz active receive and transmit array-modules are presented. An innovative approach for fabricating the modules employing a multi-layer DC substrate onto which all other componentry are mounted is described. Receive and transmit arrays have been assembled and are shown to have excellent performance. To the best of our knowledge, these represent the first active arrays demonstrated at W-band.

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Abstracts

An 18 GHz Circularly Polarised Multilayer Active Microstrip Antenna Subarray Using MMIC Amplifiers

D. Sanchez-Hernandez, M. Gillick and I. Robertson. "An 18 GHz Circularly Polarised Multilayer Active Microstrip Antenna Subarray Using MMIC Amplifiers." 1995 MTT-S International Microwave Symposium Digest 95.3 (1995 Vol. III [MWSYM]): 1099-1102.

This paper presents an 18 GHz circularly polarised multilayer active antenna subarray using MMIC amplifiers. With the advantage of a multilayer structure, the radiation patterns from the antenna side are not affected by the radiation from circuit side. An extra gain of 15.46 dB has been measured in comparison to the passive array. This type of array can be the ideal building block for large microstrip phased array systems.



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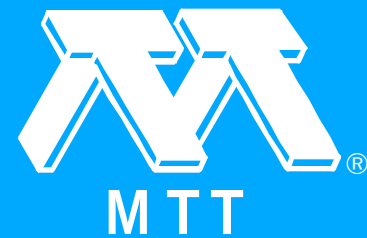


Abstracts

X-Band Receiver Protector Using Glass Technology

R. Keenan and E. Higham. "X-Band Receiver Protector Using Glass Technology." 1995 MTT-S International Microwave Symposium Digest 95.3 (1995 Vol. III [MWSYM]): 1103-1106.

This paper describes a receiver protector providing passive limiting and active switching for an X-band phased array radar. The 1650 μm x 4440 μm circuit uses a glass integrated circuit process and discrete PIN diodes to achieve: Loss: 1.0 dB VSWR 1.25:1 Isolation 40 dB Power Handling: 10W CW



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MMIC Antenna Front End for Optically Distributed MMW Antennas

D. Sturzebecher, X. Zhang and A.S. Daryoush. "MMIC Antenna Front End for Optically Distributed MMW Antennas." 1995 MTT-S International Microwave Symposium Digest 95.3 (1995 Vol. III [MWSYM]): 1107-1110.

It is well documented that fiber optic remoting of information to the millimeter wave distributed antennas is viable only when the modulated carrier is constructed at the antenna front end. The MMIC based antenna front is designed to perform three important functions of i) generation of phase and frequency stable local oscillator, ii) down-conversion (up-conversion) of the modulated RF (IF) carrier, iii) and 0-360° phase control of the modulated RF (IF) for beam steering. This paper presents design and experimental evaluation of a MMIC front end circuit designed for operation at Ka band. A P-HEMT based foundry service from TRW was selected to design this integrated front end.

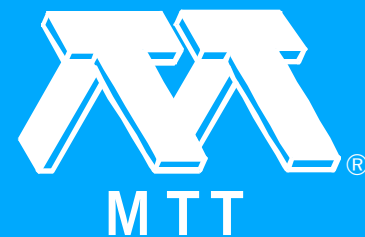
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True Time-Delay Fiber-Optic Control of a Phased-Array Transmitter with Three-Octave Bandwidth

R.D. Esman, M.Y. Frankel and M.G. Parent. "True Time-Delay Fiber-Optic Control of a Phased-Array Transmitter with Three-Octave Bandwidth." 1995 MTT-S International Microwave Symposium Digest 95.3 (1995 Vol. III [MWSYM]): 1111-1114.

We demonstrate a true time-delay fiber-optically controlled phased-array transmitter with eight broadband spiral elements in a sparsely-populated array. The transmitter band-width is microwave-component limited to 2-18 GHz frequency range. The transmitter shows plus/minus 50-degree azimuth steering with no observed squint over a complete frequency range.



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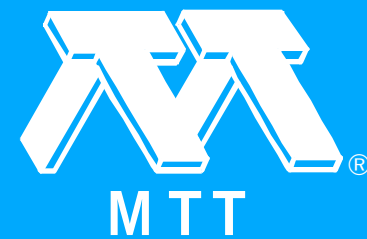
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Abstracts

Session TH2B -- Low Noise Receivers

"Session TH2B -- Low Noise Receivers." 1995 MTT-S International Microwave Symposium Digest 95.3 (1995 Vol. III [MWSYM]): 1115-1115.



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A Monolithic W-Band High-Gain LNA/Detector for Millimeter Wave Radiometric Imaging Applications

D.C.W. Lo, G.S. Dow, B.R. Allen, L. Yujiri, M. Mussetto, T.W. Huang, H. Wang and M. Biedenbender. "A Monolithic W-Band High-Gain LNA/Detector for Millimeter Wave Radiometric Imaging Applications." 1995 MTT-S International Microwave Symposium Digest 95.3 (1995 Vol. III [MWSYM]): 1117-1120.

We have demonstrated a monolithic W-band six-stage low noise amplifier/detector, using 0.1 μm passivated pseudomorphic $\text{Al}_{0.25}\text{Ga}_{0.75}\text{As}/\text{In}_{0.22}\text{Ga}_{0.78}\text{As}/\text{GaAs}$ HEMT technology. The front-end LNA, over the band from 85 to 96 GHz has achieved an average small signal gain of 40 dB which is the highest gain value ever reported for a MMIC operating in the W-band. The measured minimum resolvable temperature of the MMIC is about 1.6 degrees K, where the dominant noise source is attributed to be the $1/f$ noise of the monolithically integrated HEMT diode.

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Q- and E-Band Cryogenically-Coolable Amplifiers Using AlInAs/GaInAs/InP HEMT's

M.W. Pospieszalski, W.J. Lakatos, L.D. Nguyen, M. Lui, T. Liu, M. Le, M.A. Thompson and M.J. Delaney. "Q- and E-Band Cryogenically-Coolable Amplifiers Using AlInAs/GaInAs/InP HEMT's." 1995 MTT-S International Microwave Symposium Digest 95.3 (1995 Vol. III [MWSYM]): 1121-1124.

Design, construction and performance of several cryogenically-coolable millimeter-wave amplifiers for radio astronomy applications, using AlInAs/GaInAs/InP HEMT's, are presented. The examples include a 40-50 GHz amplifier with an average noise temperature of about 15 K and a 60-80 GHz amplifier yielding a laboratory receiver noise temperature of 37 K at 60 GHz and 50 K at 75 GHz.

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A C-Band 4-Stage Low Noise Miniaturized Amplifier Using Lumped Elements

Y. Tsukahara, S. Chaki, Y. Sasaki, K. Nakahara, N. Andoh, H. Matsubayasi, N. Tanino and O. Ishihara. "A C-Band 4-Stage Low Noise Miniaturized Amplifier Using Lumped Elements." 1995 MTT-S International Microwave Symposium Digest 95.3 (1995 Vol. III [MWSYM]): 1125-1128.

A C-band monolithic four-stage low noise miniaturized amplifier has been developed. It employs lumped elements for the matching circuit to reduce the chip size. In the design of the IC, an integrated CAD system was used to consider parasitic microwave components. The 1.65 mm x 2.30 mm amplifier achieved a gain of over 40 dB with a noise figure of less than 1.7 dB. The amplifier gives a minimum noise figure of 1.54 dB and a gain of 41 dB. A good agreement between measured and simulated data has been achieved.

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Low-Noise High-Power Heterojunction Bipolar Transistors for Mixed-Mode Applications

T. Jenkins, D. Barlage, J. Barrette, R. Lee, L. Liou, C. Bozada, R. Dettmer, R. Fitch, M. Mack and J. Sewell. "Low-Noise High-Power Heterojunction Bipolar Transistors for Mixed-Mode Applications." 1995 MTT-S International Microwave Symposium Digest 95.3 (1995 Vol. III [MWSYM]): 1129-1132.

A novel heterojunction bipolar transistor (HBT), which provides state-of-the-art noise and record power density through X-band, was developed. This performance is due to advanced design and fabrication techniques. This HBT is readily transferable to mixed-mode applications, such as portable telephones and radar transmit/receive modules.

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Q- and V-Band MMIC Chip Set Using 0.1 μm Millimeter-Wave Low Noise InP HEMTs

R. Isobe, C. Wong, A. Potter, L. Tran, M. Delaney, R. Rhodes, D. Jang, L. Nguyen and M. Le. "Q- and V-Band MMIC Chip Set Using 0.1 μm Millimeter-Wave Low Noise InP HEMTs." 1995 MTT-S International Microwave Symposium Digest 95.3 (1995 Vol. III [MWSYM]): 1133-1136.

A MMIC chip set for millimeter-wave (mmW) communication systems has been developed. The highlights are a 3-stage Q-band LNA with 2.0 dB NF/ 22 dB of gain and a 2-stage V-band LNA with 2.3 dB NF/ 15 dB of gain. Altogether, 7 MMIC chips (2 LNAs, 2 mixers, 2 downconverters, and 1 LO amplifier) make up this effort to develop low noise mmW building block functions in the InP HEMT technology.

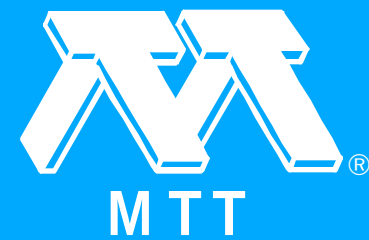
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Abstracts

Session TH2C -- Microwave Measurements (1995 Vol. III [MWSYM])

"Session TH2C -- Microwave Measurements (1995 Vol. III [MWSYM])." 1995 MTT-S International Microwave Symposium Digest 95.3 (1995 Vol. III [MWSYM]): 1137-1137.



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A Microwave Circuit Electric Field Imager

T.P. Budka and G.M. Rebeiz. "A Microwave Circuit Electric Field Imager." 1995 MTT-S International Microwave Symposium Digest 95.3 (1995 Vol. III [MWSYM]): 1139-1142.

We report on the theory of operation and the experimental results obtained from an electric field imaging system that employs the method of modulated scattering. The system is low cost and is capable of mapping the normal and tangential electric field magnitude and electrical phase delay at each position within 5 km above a microwave circuit in the frequency range of 0.5 GHz to 18 GHz. The electric field probes are fabricated on a very thin quartz substrate. The measured images of the normal and tangential electric fields over microstrip and coplanar waveguide transmission lines are presented and agree well with theory.

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GaAs MMIC Thermal Modeling for Calculation of Accurate Channel Temperatures

V.J. Ferrara, A. Garnett, S. Park and A.B. Solan. "GaAs MMIC Thermal Modeling for Calculation of Accurate Channel Temperatures." 1995 MTT-S International Microwave Symposium Digest 95.3 (1995 Vol. III [MWSYM]): 1143-1146.

To accurately determine GaAs MMIC channel temperatures, an automated model generation program has been developed. The results were correlated with IR Scanning techniques to verify the Finite Element Model. This model was used to generate a unique temperature profile for each device, which is used for higher level models, saving time while maintaining accuracy.

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Moisture Measurement in Walls Using Microwaves

F. Menke, R. Knochel, T. Boltze, C. Hauenschild and W. Leschnik. "Moisture Measurement in Walls Using Microwaves." 1995 MTT-S International Microwave Symposium Digest 95.3 (1995 Vol. III [MWSYM]): 1147-1150.

A novel measurement procedure and set-up is presented, which is suitable for moisture measurements in brick- and stone walls at places, where the wall is accessible only from one side. Local dielectric constant and hence spatial moisture content profile are determined by tracing the complex electric field using an electrically small field probe, which intrudes and is moved in a small bore-hole. Only one hole with a diameter of 8-15mm is needed. A prototype set-up and measurements are presented in order to demonstrate the practicability of the method.

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Characterization of Planar Resonators by Means of Integrated Schottky Diodes

A. Stiller, M. Singer, K.M. Strohm and E.M. Biebl. "Characterization of Planar Resonators by Means of Integrated Schottky Diodes." 1995 MTT-S International Microwave Symposium Digest 95.3 (1995 Vol. III [MWSYM]): 1151-1154.

In this paper a method is presented to examine the suitability of planar structures to work as a resonator for IMPATT diodes in a frequency range above 70 GHz. The IMPATT diode is replaced by a SCHOTTKY diode previously characterized by impedance. It is suggested to test the suitability of the resonator for an IMPATT diode by employing the radiation characteristics of the structure. This set-up allows the determination of the detector's sensitivity depending on the frequency. The sensitivity corresponds to the matching of the resonator and the SCHOTTKY diode. Thus, for maximum sensitivity the equation $Z_{\text{SCHOTTKY}} = -Z_{\text{IMPATT}}^*$ allows to assess the suitability of the planar structure to function as a resonator for an IMPATT diode.

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Calibrated Measurements of Nonlinearities in Narrowband Amplifiers Applied to Intermodulation and Cross Modulation Compensation

T. Van den Broeck. "Calibrated Measurements of Nonlinearities in Narrowband Amplifiers Applied to Intermodulation and Cross Modulation Compensation." 1995 MTT-S International Microwave Symposium Digest 95.3 (1995 Vol. III [MWSYM]): 1155-1158.

A vectorial nonlinear-network analyzer (VNNA) is absolutely calibrated in amplitude and phase for narrowband measurements of nonlinearities. Calibration is performed with a reference generator, characterized with a calibrated sampling oscilloscope. The reference signal, consisting of an unconverted baseband signal, is optimized for statistically efficient measurements. Using the calibrated VNNA, narrowband amplifiers can be measured, enabling compensation of intermodulation and cross-modulation.

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A Miniature Magnetic Field Probe for Measuring Fields in Planar High-Frequency Circuits

Y. Gao and I. Wolff. "A Miniature Magnetic Field Probe for Measuring Fields in Planar High-Frequency Circuits." 1995 MTT-S International Microwave Symposium Digest 95.3 (1995 Vol. III [MWSYM]): 1159-1162.

A new non-contacting miniature magnetic field probe for measuring the surface current distribution on high-frequency planar circuits in the 5-20 GHz band has been designed, fabricated and tested. This field probe has a very small dimension and needs no connection to the operating circuit under test, therefore there is almost no perturbation on the circuit properties. This simple and practical magnetic field probe can be used to assist the design of microwave circuits and to test products in industry.

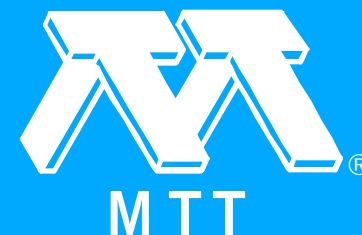
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Abstracts

Session TH2D -- Lightwave Systems and Subsystems

"Session TH2D -- Lightwave Systems and Subsystems." 1995 MTT-S International Microwave Symposium Digest 95.3 (1995 Vol. III [MWSYM]): 1163-1163.



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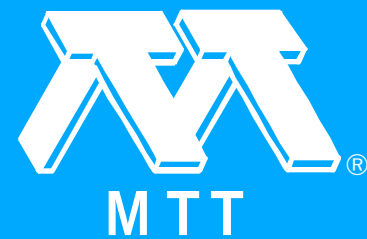


Abstracts

A Fiber-Optic Link Utilizing Subcarrier Transmission and Reception of Microwave Signals

G.K. Gopalakrishnan, K.J. Williams, R.P. Moeller, W.K. Burns and R.D. Esman. "A Fiber-Optic Link Utilizing Subcarrier Transmission and Reception of Microwave Signals." 1995 MTT-S International Microwave Symposium Digest 95.3 (1995 Vol. III [MWSYM]): 1165-1168.

A novel fiber-optic system utilizing subcarrier transmission and reception of microwave signals is demonstrated. Error free transmission of a 50 Mbit/s amplitude shift keyed signal over 9 and 16 GHz microwave subcarriers is demonstrated for received optical powers greater than or equal to -30.5 and -28.5 dBm, respectively.



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Characterization of Fiber Optic Microwave Link with Monolithic Integrated Optoelectronic Upconverter

Q.Z. Liu, R. Davies and R.I. MacDonald. "Characterization of Fiber Optic Microwave Link with Monolithic Integrated Optoelectronic Upconverter." 1995 MTT-S International Microwave Symposium Digest 95.3 (1995 Vol. III [MWSYM]): 1169-1172.

Transmission of microwave and millimeter wave signals over optical fiber has been the subject of intense research for the past few years, mainly due to the large bandwidth and low loss of the optical fibre. In a fiber optic microcellular system, the central and base stations are connected with optical fiber.

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Abstracts

Signal and Noise Analysis of External Modulation Fiber Optic Link with Optical Component and Arbitrary Lossless Matching Circuits

E.I. Ackerman, J.L. Prince and J.A. MacDonald. "Signal and Noise Analysis of External Modulation Fiber Optic Link with Optical Component and Arbitrary Lossless Matching Circuits." 1995 MTT-S International Microwave Symposium Digest 95.3 (1995 Vol. III [MWSYM]): 1173-1176.

We present and experimentally verify a general analytical signal and noise model for an external modulation fiber optic link that includes an optical component with gain or loss, and arbitrary lossless matching circuits at the input and output.



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Application of Semiconductor Optical Amplifiers to Microwave Signal Processing

H. Ogawa, K. Horikawa, H. Kamitsuna, O. Kobayashi, Y. Imaizumi and I. Ogawa. "Application of Semiconductor Optical Amplifiers to Microwave Signal Processing." 1995 MTT-S International Microwave Symposium Digest 95.3 (1995 Vol. III [MWSYM]): 1177-1180.

This paper amplifiers convertors, proposes an application of semiconductor optical (SOAs) to RF-to-optical and optical-to-RF microwave filters and microwave samplers. The SOA convertor can make it possible to realize a compact and cost-effective radio repeater for RF signal distribution. The SOA filtering and sampling expands application areas of fiber optics to microwave signal processing. The basic performance is experimentally investigated at micro wave frequencies and good performance is obtained.

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Design of Clock Recovery MMIC Using Large-Signal Computer-Aided Analysis

J.Y. Lin and A.S. Daryoush. "Design of Clock Recovery MMIC Using Large-Signal Computer-Aided Analysis." 1995 MTT-S International Microwave Symposium Digest 95.3 (1995 Vol. III [MWSYM]): 1181-1184.

Next generation of Gb/s local area distribution networks employed as optical interconnects are designed using OEIC technology for low power consumption, high reliability, and low cost. A hybrid optoelectronic integrated circuit (OEIC) integrated with MMIC circuits is described in this paper as a first step toward full monolithic integration. Si MMIC foundry services from Bipolarics was selected to design an optical receiver with an injection locked phase lock loop (ILPLL) clock recovery circuit at 1.25 Gb/s. The simulation has indicated that the input noise equivalent voltage density of the receiver is lower than 0.6 nV/radic Hz for frequency up to 1 GHz. The simulated minimum received optical power to extract the clock signal is -30 dBm. The output clock signal of this clock recovery circuit is about 400 mV/sub p-p. Simulated power consumption is 630 mW for the optical receiver and the ILPLL clock recovery circuit.

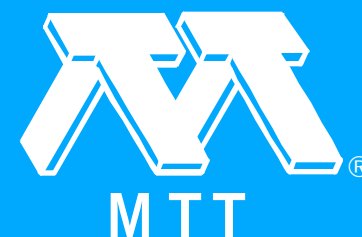
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Abstracts

Session TH2E -- Field Theory Based CAD (1995 Vol. III [MWSYM])

"Session TH2E -- Field Theory Based CAD (1995 Vol. III [MWSYM])." 1995 MTT-S International Microwave Symposium Digest 95.3 (1995 Vol. III [MWSYM]): 1185-1185.



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Modelling of Passive Elements for Coplanar SiGe MMIC's

R. Doerner, J. Gerdes, C. Rheinfelder, F.J. Schmuckle, W. Heinrich, K. Strohm, F. Schaffler and J.-F. Luy. "Modelling of Passive Elements for Coplanar SiGe MMIC's." 1995 MTT-S International Microwave Symposium Digest 95.3 (1995 Vol. III [MWSYM]): 1187-1190.

As the first step in the development of coplanar SiGe MMIC's, modelling and experimental results on passive components are presented. The investigations demonstrate that parasitic effects induced by passivation of high-resistivity silicon substrates play an important role. Efficient CAD tools are developed and verified by comparison to measurements.

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Abstracts

A Generalized Electromagnetic Optimization Procedure for the Design of Complex Interacting Structures in Hybrid and Monolithic Microwave Integrated Circuits

M.A. Schamberger and A.K. Sharma. "A Generalized Electromagnetic Optimization Procedure for the Design of Complex Interacting Structures in Hybrid and Monolithic Microwave Integrated Circuits." 1995 MTT-S International Microwave Symposium Digest 95.3 (1995 Vol. III [MWSYM]): 1191-1194.

An adaptive electromagnetic optimization procedure to facilitate field-theoretic design of hybrid and monolithic integrated circuits is presented. This approach provides full-wave characterization of complex MIC and MMIC geometries by including various effects such as coupling, spurious radiation, surface wave modes, and interactions with package modes. Application of this procedure utilizing commercially available electromagnetic simulators will be presented to demonstrate its versatility.



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Elliptic Filter Rigorous Design and Modelling Applying the Finite Element Method

D. Baillargeat, S. Verdeyme and P. Guillon. "Elliptic Filter Rigorous Design and Modelling Applying the Finite Element Method." 1995 MTT-S International Microwave Symposium Digest 95.3 (1995 Vol. III [MWSYM]): 1195-1198.

This paper describes a new dual mode coupling technique which permits to replace classical dielectric resonators, coupling and tuning screws commonly used in dual mode filters, by slotted dielectric resonators. The theoretical analysis is performed applying the three dimensional finite element method. For the first time, a synthesis method is developed to design rigorously a four and a eight pole dual mode slotted dielectric resonators filter. The theoretical responses show good agreement with the experimental ones.

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Electromagnetic Synthesis of Overlap-Gap-Coupled Microstrip Filters

O. Fordham, M.-J. Tsai and N.G. Alexopoulos. "Electromagnetic Synthesis of Overlap-Gap-Coupled Microstrip Filters." 1995 MTT-S International Microwave Symposium Digest 95.3 (1995 Vol. III [MWSYM]): 1199-1202.

This paper presents a technique for electromagnetic synthesis of microstrip overlap-gap-coupled filters. The algorithm uses a rigorous analysis, which solves an electric field integral equation in the spectral domain using the method of moments, inside an outer loop that optimizes the filter dimensions. A piecewise synthesis procedure generates initial dimensions that provide a good starting point for direct electromagnetic optimization of the complete filter. Measured results for a five-section filter are shown that verify the accuracy of this design method.

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Abstracts

An Alternative Way of Computing S-Parameters via Impulsive TLM Analysis without Using Absorbing Boundary Conditions

M. Righi, C. Eswarappa, W.J.R. Hoefer and P. Russer. "An Alternative Way of Computing S-Parameters via Impulsive TLM Analysis without Using Absorbing Boundary Conditions." 1995 MTT-S International Microwave Symposium Digest 95.3 (1995 Vol. III [MWSYM]): 1203-1206.

This paper presents a transmission line matrix (TLM) procedure to compute wideband scattering parameters of microwave structures from a single time domain simulation without using matched loads or absorbing boundary conditions (ABCS) in the main propagating direction. This is done by computing the admittance parameters in the time domain through an impulsive excitation and short-circuit boundary conditions (SBCS). Results presented for both lossy and lossless cases agree well with available data. Also, this procedure does not require the prior knowledge of the propagation characteristics (such as incidence angle or effective dielectric constant) of the guide.



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Abstracts

Analysis of Waveguide Components Using H -Curl Hexahedral Edge Elements in MSC/EMAS

J.F. DeFord and P. Saladin. "Analysis of Waveguide Components Using H -Curl Hexahedral Edge Elements in MSC/EMAS." 1995 MTT-S International Microwave Symposium Digest 95.3 (1995 Vol. III [MWSYM]): 1207-1210.

The finite element method (see Ref. for a compendium of papers on the applications of the finite element method to electromagnetic) is widely used in low-frequency electromagnetic, where nodal elements are commonly employed to represent the electromagnetic fields or potentials in the simulation volume.



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Abstracts

Simulation of Multi-Chip Module Package Resonance Using Commercial Finite Element Electromagnetic Software

R. Clark, A. Agrawal and S. Miller. "Simulation of Multi-Chip Module Package Resonance Using Commercial Finite Element Electromagnetic Software." 1995 MTT-S International Microwave Symposium Digest 95.3 (1995 Vol. III [MWSYM]): 1211-1214.

Techniques have been developed to predict package resonance frequencies in multiple cavity, MMIC based, T/R modules, using the HP High Frequency Structure Simulator package. This method accounts for partially filled waveguide modes, perturbations due to GaAs MMICS and their metal spacers, and the effects of imperfect cavity end walls. Calculated results are compared to measured package resonances and module performance data.



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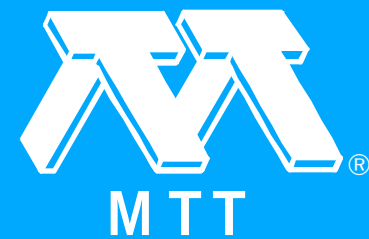
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Abstracts

Session TH3A -- Phased Array Antennas and Systems

"Session TH3A -- Phased Array Antennas and Systems." 1995 MTT-S International Microwave Symposium Digest 95.3 (1995 Vol. III [MWSYM]): 1215-1215.



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High-Resolution Adaptive Nulling Performance for a Lightweight Agile EHF Multiple Beam Antenna

A.J. Fenn. "High-Resolution Adaptive Nulling Performance for a Lightweight Agile EHF Multiple Beam Antenna." 1995 MTT-S International Microwave Symposium Digest 95.3 (1995 Vol. III [MWSYM]): 1217-1220.

The design fabrication and measured performance of a lightweight high-resolution adaptive nulling EHF multiple beam antenna (MBA) are addressed. A 127-beam MBA and a four-channel RF nulling network operating over the 43.5 to 45.5 GHz band are used to adaptively null a jammer in anechoic chamber measurements. Lightweight feed horns connected to waveguide transmission lines controlled by ferrite switches are used to select beam positions from the 127-beam MBA. The MBA is designed to provide independent coverage for three communications system users while providing pattern discrimination or nulling of multiple jammers located within 0.1 degree of the user. Cancellation greater than 30 dB when operating in a wide-band mode is experimentally demonstrated.

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Abstracts

Active Antenna Array with Optical Interaction for Application in Radar System

S.T. Chew, D.T.K. Tong, M.C. Wu and T. Itoh. "Active Antenna Array with Optical Interaction for Application in Radar System." 1995 MTT-S International Microwave Symposium Digest 95.3 (1995 Vol. III [MWSYM]): 1221-1224.

An active antenna array system, capable of switching between sum and difference patterns for radar applications, is explored. The desired phase relationship amongst antenna elements is synthesized via injection locking. Optical reference signal is transmitted from remote controller through optical fiber link. Measured patterns agree with theoretical results.



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A C-Band Beam-Forming Matrix for Phased-Array Antenna Applications

G. Estep, R. Gupta, T. Hampsch, M. Zaharovits, L. Pryor, C. Chen, A. Zaghloul and F. Assal. "A C-Band Beam-Forming Matrix for Phased-Array Antenna Applications." 1995 MTT-S International Microwave Symposium Digest 95.3 (1995 Vol. III [MWSYM]): 1225-1228.

A design description and measured performance of a modular beam-forming matrix (BFM) are presented. Advanced GaAs monolithic microwave integrated circuit (MMIC) phase shifter and attenuator designs ensure repeatable performance and small size. A novel BFM integration approach is used which ensures state-of-the-art performance, low mass, and high reliability, as well as low-risk/low-cost assembly. The 8 X 8 BFM shelf includes 192 GaAs MMICS, 200 silicon ICS, and 16 eight-way power dividers/combiners in an assembly measuring only 21 X 16 X 1.5 cm. While the design presented is for an eight-beam C-band phased array, the modular architecture easily accommodates other array configurations at different frequency bands with different numbers of beams and elements.

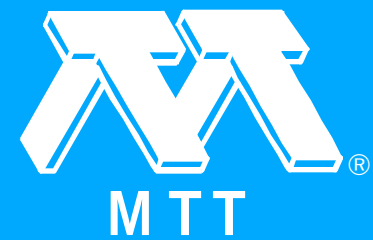
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Abstracts

Session TH3B -- Nonlinear Transistor Modeling

"Session TH3B -- Nonlinear Transistor Modeling." 1995 MTT-S International Microwave Symposium Digest 95.3 (1995 Vol. III [MWSYM]): 1229-1229.



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A Heterojunction Bipolar Transistor Large-Signal Model for High Power Microwave Applications

A. Samelis and D. Pavlidis. "A Heterojunction Bipolar Transistor Large-Signal Model for High Power Microwave Applications." 1995 MTT-S International Microwave Symposium Digest 95.3 (1995 Vol. III [MWSYM]): 1231-1234.

A large-signal model is presented for HBT's. The model accounts for self-heating effects and is based on the Gummel-Poon formulation. Full model compatibility with the commercially available software package LIBRA is ensured. The model incorporates temperature dependence for most of its parameters and has been employed for the analysis of the DC and microwave power characteristics of AlGaAs/GaAs HBT's. Good agreement between simulated and directly measured DC and microwave characteristics support the validity of the model.

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Abstracts

A Novel Extraction Method for Accurate Determination of HBT Large-Signal Model Parameters

D.-W. Wu, M. Fukuda and Y.-H. Yun. "A Novel Extraction Method for Accurate Determination of HBT Large-Signal Model Parameters." 1995 MTT-S International Microwave Symposium Digest 95.3 (1995 Vol. III [MWSYM]): 1235-1238.

A simple large-signal model, Extended Ebers-Moll (EEM) model, is successfully used to accurately describe the HBT nonlinear responses. A unique and efficient procedure that combines the DC, small-signal intrinsic, and parasitic extraction algorithms is developed to accurately determine the EEM parameters. This model shows excellent agreement with all experimental data and gives less than 1 dB discrepancy of measured 3rd-order intermodulation distortion with a wide range of input power drive.



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Waveform Characterization of Microwave Power Heterojunction Bipolar Transistors

C.J. Wei, Y. Lan, J.C.M. Hwang, W.J. Ho and J.A. Higgins. "Waveform Characterization of Microwave Power Heterojunction Bipolar Transistors." 1995 MTT-S International Microwave Symposium Digest 95.3 (1995 Vol. III [MWSYM]): 1239-1242.

Time-domain waveform characterization has been successfully applied to microwave power heterojunction bipolar transistors, for extraction and verification of their large-signal nonlinear characteristics. Compared to the conventional dc and small-signal techniques, this new technique is inherently more accurate and allows insight into the transistor operation.

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A Vector Corrected Waveform and Load Line Measurement System for Large Signal Transistor Characterisation

J.G. Leckey, A.D. Patterson and J.A.C. Stewart. "A Vector Corrected Waveform and Load Line Measurement System for Large Signal Transistor Characterisation." 1995 MTT-S International Microwave Symposium Digest 95.3 (1995 Vol. III [MWSYM]): 1243-1246.

A vector corrected large signal measurement setup based on a Microwave Transition Analyser has been developed to enable device output harmonic and waveform measurement with variable drive level, frequency, DC bias and fundamental load impedance. A novel capability of this system is the ability to plot the device dynamic load lines during measurement so that nonlinear effects can be investigated as a function of bias and load impedance in real time. Load line results are shown for a MESFET and an HBT device and the effect of load impedance on device behaviour is described.

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Modeling MESFETS for Intermodulation Analysis of Resistive FET Mixers

R.S. Virk and S.A. Maas. "Modeling MESFETS for Intermodulation Analysis of Resistive FET Mixers." 1995 MTT-S International Microwave Symposium Digest 95.3 (1995 Vol. III [MWSYM]): 1247-1250.

This paper describes a new method for calculating intermodulation distortion in resistive FET mixers. By utilizing an expression for the I/V characteristics of the MESFET device whose parameters are fit to the static I/V and its derivatives, this model accurately predicts distortion and is the first of its kind to be shown valid for resistive FET mixers.

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Resolving Capacitor Discrepancies Between Large and Small Signal FET Models

M.V. Calvo, A.D. Snider and L.P. Dunleavy. "Resolving Capacitor Discrepancies Between Large and Small Signal FET Models." 1995 MTT-S International Microwave Symposium Digest 95.3 (1995 Vol. III [MWSYM]): 1251-1254.

A novel solution is presented for the well known capacitor discrepancy problem between large and small signal FET models. The discrepancy arises due to the two-parameter bias voltage dependence of the intrinsic FET model capacitances. The resolution is enabled by the proper choice of partial-integration constants associated with the transformation of a charge source in the large signal model to a capacitor in the small signal model.

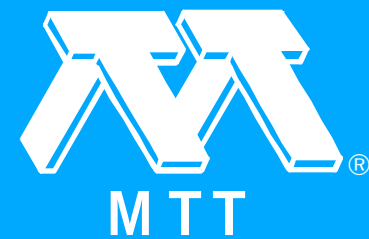
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Abstracts

Session TH3C -- Non-Linear and Lossy Mechanisms in Guided Waves

"Session TH3C -- Non-Linear and Lossy Mechanisms in Guided Waves." 1995 MTT-S International Microwave Symposium Digest 95.3 (1995 Vol. III [MWSYM]): 1255-1255.



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Electron-Wave Interaction in Submicrometer Gate Field-Effect Transistors

M.A. Alsunaidi and S.M. El-Ghazaly. "Electron-Wave Interaction in Submicrometer Gate Field-Effect Transistors." 1995 MTT-S International Microwave Symposium Digest 95.3 (1995 Vol. III [MWSYM]): 1257-1260.

The electromagnetic wave effects on the behavior of submicrometer gate Field-Effect Transistors is investigated by coupling a full wave solution of Maxwell's equations to the active device model. Three-dimensional simulations verify the expected device-wave interaction. According to simulation results, energy transfer between electrons and the EM wave takes place along the device width. This effect is represented by a build-up in the wave amplitude and an increase in the device gain.

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Finite Element Analysis of Microstrip Line on Ferroelectric (Ba - Sr)TiO/sub 3/ Substrate

Y. Sung, S. Choi and S. Nam. "Finite Element Analysis of Microstrip Line on Ferroelectric (Ba - Sr)TiO/sub 3/ Substrate." 1995 MTT-S International Microwave Symposium Digest 95.3 (1995 Vol. III [MWSYM]): 1261-1264.

The characteristics of microstrip line on ferroelectric (Ba - Sr)TiO/sub 3/ substrate is analyzed. The static field analysis is performed iteratively to obtain the position-dependent dielectric constant in BST substrate with DC bias voltage. On the assumption of small AC field compared to DC field, the propagation constant and the characteristic impedance of the microstrip line on such a biased BST substrate is found by edge-based finite element method. The results can be used for the accurate design of various devices using BST such as dielectric phase shifter, voltage controlled resonators, etc.

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Full-Wave Nonlinear Analysis of Microwave Superconductor Devices : Application to Filters

M.A. Megahed and S.M. El-Ghazaly. "Full-Wave Nonlinear Analysis of Microwave Superconductor Devices : Application to Filters." 1995 MTT-S International Microwave Symposium Digest 95.3 (1995 Vol. III [MWSYM]): 1265-1268.

A full-wave three-dimensional nonlinear HTS finite-difference time-domain electromagnetic simulator is developed. The HTS nonlinear model, based on the Ginzburg-Landau theory, is blended with Maxwell's equations. The analysis is performed in time domain, which is necessary for modeling the nonlinear aspects of microwave superconductor devices. The fields in the superconducting device are calculated. Interesting aspects of the nonlinearity in a superconducting material are observed. Applications to microstrip line and filters are presented.

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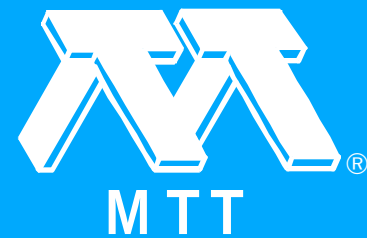


Abstracts

Field Analysis and Design Criteria for T-Gate TW-FET's with Positive Gain

M. Farina, L. Pierantoni and T. Rozzi. "Field Analysis and Design Criteria for T-Gate TW-FET's with Positive Gain." 1995 MTT-S International Microwave Symposium Digest 95.3 (1995 Vol. III [MWSYM]): 1269-1272.

We present an accurate e.m model of T-Gate TW-FET's and necessary conditions for obtaining exponentially growing waves. This model takes into detailed account device geometry, the effect of carrier velocity saturation in the high field region, conductor and dielectric losses and small signal channel current.



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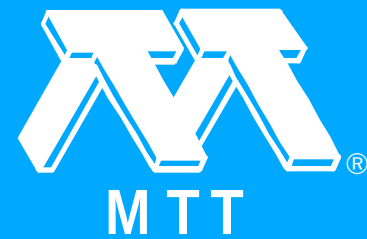


Abstracts

Full-Wave Analysis of the Influence of Conductor Shape and Structure Details on Losses in Coplanar Waveguide

W. Schroeder and I. Wolff. "Full-Wave Analysis of the Influence of Conductor Shape and Structure Details on Losses in Coplanar Waveguide." 1995 MTT-S International Microwave Symposium Digest 95.3 (1995 Vol. III [MWSYM]): 1273-1276.

The influence of technological details like two-layer structure of conducting strips, layer misalignment, non-rectangular conductor shape, dielectric cover or support layers on losses in CPW with small lateral dimensions is investigated by means of the hybrid-wave Boundary Integral Equation Method (BIEM). A short account of recent developments in this method, as required for this investigation, is given with focus on two concepts of general interest, the Method of Least Squares with Intermediate Projection (MLSIP) and a regularization approach.



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Non-Perturbative Fullwave Analysis of Lossy Planar Circuits

S. Amari and J. Bornemann. "Non-Perturbative Fullwave Analysis of Lossy Planar Circuits." 1995 MTT-S International Microwave Symposium Digest 95.3 (1995 Vol. III [MWSYM]): 1277-1280.

A non-perturbative analysis, including both metallic and dielectric losses, of planar circuits is presented. The Green's impedance dyadics are modified to account for metallic losses in the ground plane and the conducting surfaces. Dielectric constants are allowed complex values to describe their lossy properties. The complex resistive boundary condition is modified to take into account the fact that thin conductors distinguish between LSE and LSM modes. The theory describes lossy ground planes exactly and is exact for conductors of finite width in the limit of small thickness. Expression for the conductance, the resistance, the inductance and the capacitance matrices are presented as well as corresponding numerical results. Modal attenuation constants and dispersion curves are discussed.

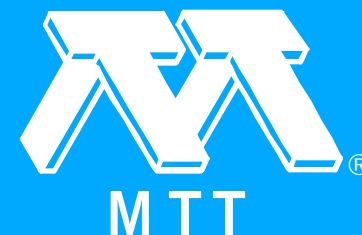
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Abstracts

Session TH3D -- Microwave-Optical Devices and Circuits

"Session TH3D -- Microwave-Optical Devices and Circuits." 1995 MTT-S International Microwave Symposium Digest 95.3 (1995 Vol. III [MWSYM]): 1281-1281.



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Demonstration of Photonically-Controlled GaAs Digital/MMIC for RF Optical Links

A. Brunel, S.-L.G. Chu, S.E. Davis, A. Kelsey, M. O'Connell, J.A. Ruiz, R.C. Sharp, I.W. Smith and K. Tabatabaie-Alavi. "Demonstration of Photonically-Controlled GaAs Digital/MMIC for RF Optical Links." 1995 MTT-S International Microwave Symposium Digest 95.3 (1995 Vol. III [MWSYM]): 1283-1285.

We report design, fabrication, and test of a monolithic GaAs IC implementing a broadband optically-driven digital/analog RF interface. The circuit operates in an asynchronous mode to detect AM digital and RF on a single optical fiber input, control RF level, and transmit the RF to the output.

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Optical Control of MMIC Oscillators and Model Parameter Analysis of an Illuminated FET at the Ka- and V-Band

S. Kawasaki, M. Kimura, H. Shiomi, T. Wakabayashi, M. Funabashi and K. Ohata. "Optical Control of MMIC Oscillators and Model Parameter Analysis of an Illuminated FET at the Ka- and V-Band." 1995 MTT-S International Microwave Symposium Digest 95.3 (1995 Vol. III [MWSYM]): 1287-1290.

This paper reports experimental results of optical control of millimeter-wave HJFET MMIC oscillators and FET model parameter analysis with illumination. Using a noncoherent optical source, the maximum optical tuning ranges of 32 MHz around 30 GHz and 260 MHz around 51 GHz were obtained. By means of parameter extraction, variation on Cgd with 46.67% increase and Cds with 19.1% decrease due to the illumination, and their frequency dependence were appreciated.

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Reduced Phase Noise in Microwave Oscillators Due to Optical Signal Injection

S.M. Genco and A.R. Mickelson. "Reduced Phase Noise in Microwave Oscillators Due to Optical Signal Injection." 1995 MTT-S International Microwave Symposium Digest 95.3 (1995 Vol. III [MWSYM]): 1291-1294.

Optical injection of MESFET oscillators shifts the circuit's operating frequency, locks the microwave frequency to the optical carrier, and reduces the frequency noise of the oscillator. The main result is the phase noise is decreased -110 dBc/Hz when locked to the modulated lasers. Phase noise is measured with no optical injection, with a single modulated laser injected and with a heterodyned injection locked laser signal.





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Dynamic Characterization of Optical-Microwave Transducers

T. Berceli, B. Cabon, A. Hilt, A.H. Quoc, E. Pic and S. Tedjini. "Dynamic Characterization of Optical-Microwave Transducers." 1995 MTT-S International Microwave Symposium Digest 95.3 (1995 Vol. III [MWSYM]): 1295-1298.

Optical-microwave transducers applying FET devices are investigated to determine their dynamic characteristics. It is observed that the result of the well known frequency response method is differing from the result of a combined test method applying simultaneously a microwave signal and a modulated lightwave for driving the transducer. Based on these investigations a more precise circuit model is established for illuminated FET devices. The new circuit model is well applicable to describe the operation of optical-microwave transducers like mixers, phase detectors, amplifiers, injection locked oscillators, modulators.

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Coherent Power Combining of Ultra-Wideband Pulsed Radiation in Free Space

E.E. Funk, S.E. Sadow, L.J. Jasper, Jr. and C.H. Lee. "Coherent Power Combining of Ultra-Wideband Pulsed Radiation in Free Space." 1995 MTT-S International Microwave Symposium Digest 95.3 (1995 Vol. III [MWSYM]): 1299-1302.

Photoconductive switches are used to trigger an array of three pulsed ultra-wideband antennas. The jitter-free pulses radiated by each antenna add together in free space to produce a radiated field pattern that is steerable via true optical time-delay techniques. This technique can be applied to an N-element phased array for increased radiated power and beam-steering capabilities.

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Microwave Phase Conjugation Using Antenna Coupled Nonlinear Optically Pumped Surfaces

Y. Chang, D.C. Scott and H.R. Fetterman. "Microwave Phase Conjugation Using Antenna Coupled Nonlinear Optically Pumped Surfaces." 1995 MTT-S International Microwave Symposium Digest 95.3 (1995 Vol. III [MWSYM]): 1303-1306.

An effort to extend phase conjugation techniques to microwave frequencies using optically injected active nonlinear elements is reported. Initial results were obtained using PIN diodes as detectors and microwave mixers as the nonlinear medium. Our current work is based upon optically injected HBTs as nonlinear mixing elements in conjunction with planar antenna arrays.

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Abstracts

Real Frequency Method Applied to Broad-Band Laser Command Circuit Design with Lumped and Distributed Elements

D. Le Berre, A. Perennec, N. Julien, S. Toutain, R. Lefevre, D. Lemaillet and R. Soares. "Real Frequency Method Applied to Broad-Band Laser Command Circuit Design with Lumped and Distributed Elements." 1995 MTT-S International Microwave Symposium Digest 95.3 (1995 Vol. III [MWSYM]): 1307-1310.

In view to improve the LASER response which presents an electrooptic resonance, we propose an original method for LASER command circuit design. Our small signal application for remote antenna link used a differential amplifier comprising the matching network synthesis of active load as well as a one stage amplifier. This synthesis is carried out with lumped elements or transmission lines.



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Abstracts

Session TH3E -- Frequency Conversion Circuits

"Session TH3E -- Frequency Conversion Circuits." 1995 MTT-S International Microwave Symposium Digest 95.3 (1995 Vol. III [MWSYM]): 1311-1311.



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Miniaturized Stripline Dual-Mode Ring Resonators and Their Application to Oscillating Devices

H. Yabuki, M. Matsuo, M. Sagawa and M. Makimoto. "Miniaturized Stripline Dual-Mode Ring Resonators and Their Application to Oscillating Devices." 1995 MTT-S International Microwave Symposium Digest 95.3 (1995 Vol. III [MWSYM]): 1313-1316.

Novel structures of miniaturized stripline /underbar d/ual-/underbar m/ode /underbar r/esonators (DMRs) have been proposed, and their fundamental properties related to orthogonal modes are analytically derived. DMRs have attractive features which will provide many distinctive oscillating circuits. Experimental oscillating devices such as oscipliers and low phase noise voltage controlled oscillators using miniaturized DMRs are expected to have a practical use for various kinds of radio equipment in the RF and microwave regions. Moreover, this design concept is applicable for millimeter wave oscillators or smaller.

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High Efficiency Free Running Class F Oscillator

M. Prigent, M. Camiade, G. Pataut, D. Reffet, J.M. Nebus and J. Obregon. "High Efficiency Free Running Class F Oscillator." 1995 MTT-S International Microwave Symposium Digest 95.3 (1995 Vol. III [MWSYM]): 1317-1320.

A free running 1.6 GHz oscillator yielding 67 % power efficiency with 24 dBm output power is proposed. It is based on the use of a transistor working in the an high efficiency class F associated to an appropriate feedback network. The transistor is a 2 mm gate periphery, 0.7 μ m gate length MESFET and it is built by THOMSON foundry. The main impact of the characteristics of the constitutive components on the overall oscillator performance is also discussed.

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A K-Band Monolithic CPW Oscillator Co-Integrated with a Buffer Amplifier

K. Maruhashi, M. Madihian, L. Desclos, K. Onda and M. Kuzuhara. "A K-Band Monolithic CPW Oscillator Co-Integrated with a Buffer Amplifier." 1995 MTT-S International Microwave Symposium Digest 95.3 (1995 Vol. III [MWSYM]): 1321-1324.

This paper describes the design approach, fabrication process, and performance of a monolithic CPW oscillator incorporating a buffer amplifier on the same chip, for K-band wireless network applications. At 21GHz, the output power of the oscillator recorded 17dBm with an overall de-RF efficiency of 22%. By changing the length of a source feedback line, the oscillation frequency was varied up to 26GHz. For all cases, the output power remained higher than 16dBm.

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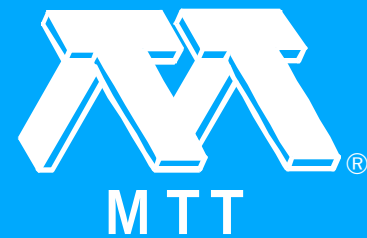


Abstracts

A MIC X7 DHBT Frequency Multiplier with Low Spurious Harmonics

D.F. Filipovic. "A MIC X7 DHBT Frequency Multiplier with Low Spurious Harmonics." 1995 MTT-S International Microwave Symposium Digest 95.3 (1995 Vol. III [MWSYM]): 1325-1328.

We report on the design and measurement of a MIC X7 DHBT active frequency multiplier. The DHBT devices were fitted to a Gummel-Poon SPICE model which was then used with a harmonic balance analysis to simulate the active frequency multiplier. An edge-coupled filter was implemented for selective amplification of the desired harmonic, and results in 30 dB rejection of spurious harmonics. The X7 active multiplier design demonstrates output powers in the range of 0-4 dBm for moderate input signals (4-8 dBm).



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Novel Design Topology for Ultra Low Power Down Converters with Broadband on Chip Matching Network (1995 Vol. III [MWSYM])

M.L. Schmatz. "Novel Design Topology for Ultra Low Power Down Converters with Broadband on Chip Matching Network (1995 Vol. III [MWSYM])." 1995 MTT-S International Microwave Symposium Digest 95.3 (1995 Vol. III [MWSYM]): 1329-1332.

A novel design topology for ultra low power receivers and down converters has been developed. Using this topology, a monolithic L-band down converter consisting of an input amplifier and a double balanced mixer has been implemented with a standard 0.7 μ m GaAs-MESFET process. The circuit has a single ended 50 Ω input and differential outputs offering totally more than 40 dB voltage conversion gain at 1 GHz and 30 dB at 2 GHz. It is supplied by a single lithium cell and has a DC power consumption of less than 2.0 mW at 2.7 V/sub DC/.

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A Single Chip Monolithic Integrated S-Band Frequency Discriminator

K.-E. Schmeger. "A Single Chip Monolithic Integrated S-Band Frequency Discriminator." 1995 MTT-S International Microwave Symposium Digest 95.3 (1995 Vol. III [MWSYM]): 1333-1336.

This paper describes a highly integrated MMIC frequency discriminator (3.3 mm x 5.5 mm) for S-band. The discriminator consists of two balanced mixers, three wilkinson power dividers (one of them has integrated a 90° phase shifting network) and one amplifier. To ensure a certain frequency resolution, several discriminators with different delay lines have to be connected into a parallel configuration. An into the discriminator integrated amplifier enables distributed amplification and reduces the specifications for the driving limiting amplifier, The high performance achieved and the small die size makes this discriminator suitable for integration into IFM systems.

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Abstracts

Session TH3F -- Open Forum II

"Session TH3F -- Open Forum II." 1995 MTT-S International Microwave Symposium Digest 95.3 (1995 Vol. III [MWSYM]): 1337-1337.



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Temperature Dependent Functional Small-Signal and Noise Model of GaAs FET

Z. Nosal. "Temperature Dependent Functional Small-Signal and Noise Model of GaAs FET." 1995 MTT-S International Microwave Symposium Digest 95.3 (1995 Vol. III [MWSYM]): 1339-1342.

A new CAD oriented noise model of the GaAs small signal FET is proposed. It introduces only $\frac{1}{\sqrt{f}}$ parameter to describe noise properties of the MESFET, contrary to previous models [1-4], which used more numbers. Model components are bias and temperature dependent. Temperature dependence of parameters is modelled by a numerical approximation to the physical behavior of carrier mobility and carrier saturation velocity in GaAs. Comparison with measured and published transistor parameters is presented.

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The Hot-Electron Microbolometer as an Ultrasensitive Detector for Millimeter Wavelengths

K. Farooqui, P.T. Timbie, G.W. Wilson, J.-W. Zhou and M. Nahum. "The Hot-Electron Microbolometer as an Ultrasensitive Detector for Millimeter Wavelengths." 1995 MTT-S International Microwave Symposium Digest 95.3 (1995 Vol. III [MWSYM]): 1343-1346.

The hot-electron microbolometer is a novel low-temperature thermal detector which has potential for very low-noise power measurements at millimeter wavelengths. We are investigating issues in the practical implementation of this detector for low-background applications. We present results from tests of an efficient scheme to couple the detector to waveguide, as well as the expected noise performance of a microbolometer optimized for balloon-borne measurements. The expected NEP of the microbolometer in such a measurement is 7×10^{-18} W/radical Hz which is nearly a factor of two better than bolometers currently in use.

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Monolithic Silicon Bolometers as Sensitive mm-Wave Detectors

J.-W. Zhou, K. Farooqui, P.T. Timbie, G.W. Wilson, C.A. Allen, S.H. Moseley and D.B. Mott. "Monolithic Silicon Bolometers as Sensitive mm-Wave Detectors." 1995 MTT-S International Microwave Symposium Digest 95.3 (1995 Vol. III [MWSYM]): 1347-1350.

We report the development of a waveguide-coupled monolithic Si bolometer for applications in low-background millimeter-wave astrophysical observations. In this device, the absorber of the bolometer is a narrow Bi-coated Si substrate oriented along the E-plane of the waveguide. This design allows efficient coupling of bolometers to waveguide. We measured these devices to have a high coupling efficiency, an electrical responsivity /about equal/ 2×10^9 V/W, and electrical noise equivalent power (NEP) /about equal/ 10^{-17} W/radical Hz at -100 mK.

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Abstracts

High Accuracy Digital Quadrature Demodulation

R.J. Inkol, M. Herzig and R. Saper. "High Accuracy Digital Quadrature Demodulation." 1995 MTT-S International Microwave Symposium Digest 95.3 (1995 Vol. III [MWSYM]): 1351-1354.

The accuracy of digital quadrature demodulation can be improved by optimizing the matching of the inphase and quadrature channel frequency responses. It is shown that an image rejection performance exceeding 100 dB can be achieved using Finite Impulse Response filters having as few as eleven nonzero coefficients.



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Rigorous Mode-Matching Method for the Modal Analysis of the T-Junction Circular to Sidecoupled Rectangular Waveguide

P. Krauss and F. Arndt. "Rigorous Mode-Matching Method for the Modal Analysis of the T-Junction Circular to Sidecoupled Rectangular Waveguide." 1995 MTT-S International Microwave Symposium Digest 95.3 (1995 Vol. III [MWSYM]): 1355-1358.

A rigorous field theoretical method is presented for the accurate modal analysis of the T-junction circular to sidecoupled rectangular waveguide which includes the so-called meniscus effect of the curved structure at the interface of the two different waveguide sections. The method is based on the mode-matching technique for the circular and rectangular waveguide portions of the structure in combination with the boundary-contour mode-matching (BCMM) principle for the intermediate waveguide section. In contrast to available approximate approaches, this method is rigorously valid also for large apertures, or for more than one aperture in the same plane, which are often required in typical filter, OMT or hybrid-T applications. The efficiency of the method is demonstrated by calculating a single T-junction with a large aperture and a double-aperture coupled T-junction. The theory is verified by excellent agreement with measurements.

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Modal Analysis of Arbitrarily Shaped Irises in Waveguides by a Hybrid Contour-Integral Mode-Matching Method

F. Giese, J.M. Reiter and F. Arndt. "Modal Analysis of Arbitrarily Shaped Irises in Waveguides by a Hybrid Contour-Integral Mode-Matching Method." 1995 MTT-S International Microwave Symposium Digest 95.3 (1995 Vol. III [MWSYM]): 1359-1362.

A hybrid contour-integral mode-matching (CIMM) technique is presented for the rigorous calculation of the modal scattering parameters of arbitrarily shaped irises in waveguides which combines the advantages of flexibility and high numerical efficiency. The fast contour-integral matching yields the eigen-modes in the iris cross-sections for calculating the generalized scattering matrix of the complete iris discontinuity by the efficient mode-matching technique. This combined method takes arbitrarily iris geometries, arbitrary rotation of the iris, and the effects of finite thickness or different waveguide ports rigorously into account. The method is verified by comparison with results calculated by the finite element method.

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Abstracts

Coupling Characteristics Between Dielectric Disk and Ring Located in an Eccentric Configuration

Q. Han, Y. Kogami, Y. Tomabechi and K. Matsumura. "Coupling Characteristics Between Dielectric Disk and Ring Located in an Eccentric Configuration." 1995 MTT-S International Microwave Symposium Digest 95.3 (1995 Vol. III [MWSYM]): 1363-1366.

Whispering Gallery (W.G.) mode coupling characteristics between a novel configuration of dielectric disk and ring waveguide, are analyzed and investigated. The theoretical results of coupling coefficients and field distributions are obtained by solving a mode-coupled equation which is derived from the Lorentz's reciprocity theorem and divergence theorem. Experimental result of field distribution is compared to the theoretical one, they agree with each other well.



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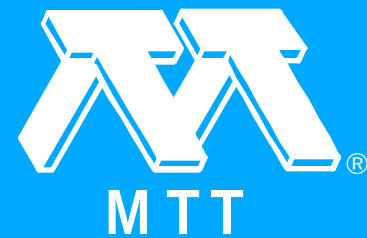


Abstracts

Multilayer Aperture-Coupled Broadside Microstrip Lines

S. Kunasani and C. Nguyen. "Multilayer Aperture-Coupled Broadside Microstrip Lines." 1995 MTT-S International Microwave Symposium Digest 95.3 (1995 Vol. III [MWSYM]): 1367-1369.

This paper describes new multilayer aperture-coupled broadside microstrip lines suitable for miniaturized microwave monolithic integrated circuits (MMICS). The new transmission line structure is applicable to both loose and tight coupling applications. The quasi-static spectral domain method is used to determine both the c- and pi-mode characteristic impedances and effective dielectric constants.



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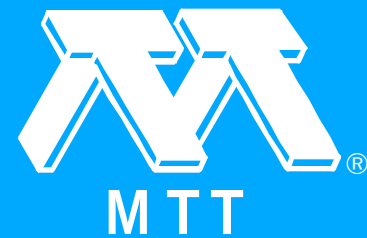


Abstracts

Analysis of End Effects in SAW IDTs Using the Finite Difference Method

D. Jatkari and B. Beker. "Analysis of End Effects in SAW IDTs Using the Finite Difference Method." 1995 MTT-S International Microwave Symposium Digest 95.3 (1995 Vol. III [MWSYM]): 1371-1374.

For high-performance SAW filter design the variation of charge distribution along the IDT fingers needs to be evaluated accurately. In this work, the finite difference method was used to study the effects of transverse (along the length of the fingers) and longitudinal (along the propagation direction) variation in charge distribution on the acoustic admittance of the IDT. A comparison was made between a full three-dimensional analysis of SAW IDTs, which includes the effects of bus bars, and the 2-D approximation to the same IDT.



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Analysis of GaAs MESFET Spectrum Regeneration Driven by a Pi/4-DQPSK Modulated Source

J.F. Sevic and M.B. Steer. "Analysis of GaAs MESFET Spectrum Regeneration Driven by a Pi/4-DQPSK Modulated Source." 1995 MTT-S International Microwave Symposium Digest 95.3 (1995 Vol. III [MWSYM]): 1375-1378.

A new method of analyzing transistor nonlinearity in the context of digital modulation is proposed. Classical methods of nonlinearity analysis, such as the third-order intercept point, are ill-suited for systems based on digitally modulated signals. The third-order intercept point ignores higher-order effects and latent out-of-channel power, both of which affect spectrum regeneration. Using a power spectral density description of the source, coupled with a simplified Volterra series model of a GaAs MESFET, it is shown that reactive nonlinearity significantly contributes to spectrum regeneration. Subsequently, insight is gained at the device level for doping/implant improvements and at the terminal level for optimal loading, resulting in improved linearity.

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Abstracts

Combined Monte Carlo Simulation and Ray Tracing Method of Indoor Radio Propagation Channel

T. Schoberl. "Combined Monte Carlo Simulation and Ray Tracing Method of Indoor Radio Propagation Channel." 1995 MTT-S International Microwave Symposium Digest 95.3 (1995 Vol. III [MWSYM]): 1379-1382.

This paper presents a simulation tool based on a combined Monte Carlo and Ray Tracing method for the prediction of power delay profiles within an indoor environment. The simulation tool and results for the CW-fading, time delay spread and low pass channel impulse response are discussed.



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Self-Consistent Multi-Mode Time Domain Analysis of Gyrotrons

A. Jostingmeier, C. Rieckmann and A.S. Omar. "Self-Consistent Multi-Mode Time Domain Analysis of Gyrotrons." 1995 MTT-S International Microwave Symposium Digest 95.3 (1995 Vol. III [MWSYM]): 1383-1386.

A self-consistent time domain analysis of gyrotrons is presented which allows studying multi-mode, multi-frequency operation. The electromagnetic field in the gyrotron cavity is expanded with respect to complete sets of eigenfunctions so that space charge effects are included in the analysis. It is demonstrated that the strong numerical requirements of this method can be met by using a vector computer. The simulations show that the assumption of a monofrequent steady state operation of gyrotrons, which is made by the commonly used frequency domain methods is not always fulfilled. For a low Q gyrotron, both oscillation build-up and steady state operation is investigated including mode competition and window reflections.

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Abstracts

Micromachined Conformal Packages for Microwave and Millimeter-Wave Applications

R.F. Drayton and L.P.B. Katehi. "Micromachined Conformal Packages for Microwave and Millimeter-Wave Applications." 1995 MTT-S International Microwave Symposium Digest 95.3 (1995 Vol. III [MWSYM]): 1387-1390.

High frequency circuit performance is significantly influenced by its RF package configuration. This paper presents the use of Si micromachining to develop a miniature package that conforms to the circuit geometry while providing physical and electromagnetic shielding. The advantages of a conformal package, other than reduced size, are control of package resonances, the capability to isolate individual circuit elements and improve circuit performance through elimination of parasitic radiation. In addition, the use of micromachining provides reduced fabrication tolerances and most importantly lower cost.



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An Advanced Co-Channel Operation Method for Multiple Wireless Gate

K.-I. Konno, T. Kojima and Y. Iitsuka. "An Advanced Co-Channel Operation Method for Multiple Wireless Gate." 1995 MTT-S International Microwave Symposium Digest 95.3 (1995 Vol. III [MWSYM]): 1391-1394.

An advanced co-channel allocation system for use 2.45 GHz multiple wireless gates in a train station has been developed. It is desirable to use a co-channel allocation system when designing a multiple gate system to effectively utilize frequency resources. The new co-channel allocation system doesn't need to phase lock. Each transmitter has a highly stable oscillator. The installation cost of this co-channel operation system is lower than old model which needs to phase lock. The interferences in a multiple wireless gate using this new co-channel system are discussed and compared with experimental results. The operation of advanced model has been successfully tested with the newly developed highly stable PLL DR oscillator.

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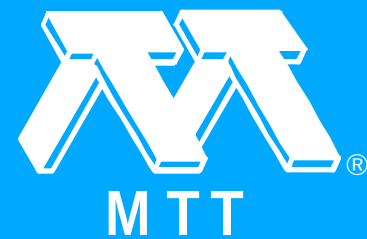


Abstracts

A Novel Clock Extraction Circuit Using a New NRZ-to-PRZ Converter and a Dielectric Resonator Filter for 10Gbit/s Optical Receiver

T.W. Yoo, J.H. Song, M.S. Park and C.S. Shim. "A Novel Clock Extraction Circuit Using a New NRZ-to-PRZ Converter and a Dielectric Resonator Filter for 10Gbit/s Optical Receiver." 1995 MTT-S International Microwave Symposium Digest 95.3 (1995 Vol. III [MWSYM]): 1395-1398.

We report a novel clock recovery circuit for 10Gbit/s lightwave transmission systems, which consists of a new NRZ-to-Pseudo-RZ converter for the generation of a clock signal from NRZ data. The new NRZ-to-PRZ converter generates both the differentiated and the phase-inverted differentiated signal of NRZ data and rectifies them, resulting in a discrete clock signal. The power of the clock signal obtained from a IVP-P 231-1 PRBS input data is -2 dBm, which is 90dB above the noise spectral density at the clock frequency. The timing jitter of the clock signal extracted with a DR filter of the Q-value 800 is estimated to be 1.2ps.



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Uniplanar De Ronde's CPW-Slot Directional Couplers

C.-H. Ho, L. Fan and K. Chang. "Uniplanar De Ronde's CPW-Slot Directional Couplers." 1995 MTT-S International Microwave Symposium Digest 95.3 (1995 Vol. III [MWSYM]): 1399-1402.

A new uniplanar de Ronde's CPW-slot directional coupler was developed with good amplitude characteristics and phase balance. The even-odd mode analysis of four-port networks with double symmetry was used to analyze the uniplanar de Ronde's couplers. A directional coupler with 5-dB coupling was designed and demonstrated over the frequency range of 2.4-3.4 GHz. The experimental results agree with the theoretical design.

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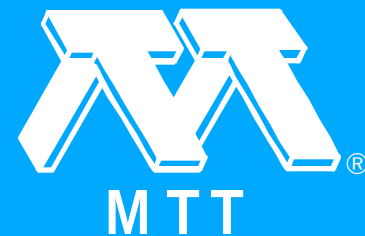


Abstracts

Active Low Noise Transition from Rectangular Waveguide to Microstrip Line

W. Grabherr and W. Menzel. "Active Low Noise Transition from Rectangular Waveguide to Microstrip Line." 1995 MTT-S International Microwave Symposium Digest 95.3 (1995 Vol. III [MWSYM]): 1403-1406.

An active transition from rectangular waveguide to microstrip line, operating in X-band with a GaAs MESFET as integral part of the transition is presented. The design allows for low noise amplification of the signal with improved bandwidth compared to the corresponding passive transition. Measured results of noise figure and power gain are given.



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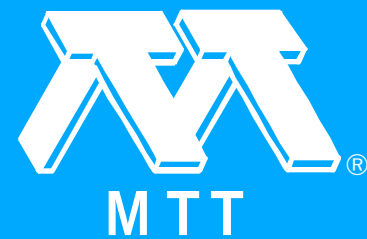


Abstracts

Investigation of Coupling Structures for Coplanar Bandpass Filters

W. Menzel, W. Schwab and G. Strauss. "Investigation of Coupling Structures for Coplanar Bandpass Filters." 1995 MTT-S International Microwave Symposium Digest 95.3 (1995 Vol. III [MWSYM]): 1407-1410.

Single side metallization is one of the big advantages of co-planar line (CPW) circuits. On the other hand, coupling in one plane only may lead to difficulties designing end or side coupled bandpass filters due to rather weak or multi-mode coupling of the filter resonators. A possible alternative is the introduction of two metallization layers separated by an additional dielectric sheet. In this paper, a number of possible coupling structures for bandpass filters based on standard CPW as well as on multilayer structures are investigated and compared, including some novel coupling arrangements.



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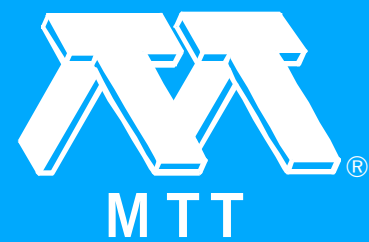
A Novel Single Device Balanced Resistive HEMT Mixer

K. Yhland, N. Rorsman and H. Zirath. "A Novel Single Device Balanced Resistive HEMT Mixer." 1995 MTT-S International Microwave Symposium Digest 95.3 (1995 Vol. III [MWSYM]): 1411-1414.

A novel single device balanced resistive HEMT mixer operating at 18 GHz has been designed and characterized. The mixer has 180 degree baluns at the RF and IF Ports. Measurements show a conversion loss of 6 to 7 dB and an LO to RF isolation of up to 37 dB. The main advantages of this type of mixer are that no device pairing is necessary, since only one HEMT is used and that no high frequency grounding is necessary. These advantages make this topology suitable for microstrip MICS, crossbar, fin-line and quasi optical mixers.

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New Simple Procedure for the Computation of the Multimode Admittance Matrix of Arbitrary Waveguide Junctions

A. Alvarez and M. Guglielmi. "New Simple Procedure for the Computation of the Multimode Admittance Matrix of Arbitrary Waveguide Junctions." 1995 MTT-S International Microwave Symposium Digest 95.3 (1995 Vol. III [MWSYM]): 1415-1418.

The description of the microwave properties of waveguide junctions is a subject that has been studied considerably in the past. Of particular interest, from the engineering point of view, have been equivalent network representations (single mode) because of their very good computational efficiency. However their efficiency was obtained taking into account only dominant mode interactions and such descriptions are no longer suitable for the design of modern microwave components. Higher order mode interactions have been subsequently accounted for using mode-matching procedures, however, the resulting codes, although accurate, can be computationally very heavy. It would therefore be desirable to develop equivalent network representations that could at the same time include higher-order interactions and lead to computationally efficient codes. In this paper a simple method is described for the evaluation of the multimode network representation in terms of admittance parameters. The key feature of the method is that it starts from the wanted final results, the equivalent network representation, in order to obtain an analytic expression for the evaluation of the admittance matrix elements. The procedure is based on general network theory and is equivalent to ideally measuring directly the value of the admittance elements. In this paper the evaluation procedure is fully described. Measurement results of actual hardware are then compared with simulations indicating that the codes developed are indeed very accurate as well as computationally very efficient.

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Abstracts

Stability Diagnosis of Microwave Recursive Structures Using the NDF Methodology

L. Billonnet, B. Jarry and P. Guillon. "Stability Diagnosis of Microwave Recursive Structures Using the NDF Methodology." 1995 MTT-S International Microwave Symposium Digest 95.3 (1995 Vol. III [MWSYM]): 1419-1422.

In this paper, we verify and validate the new important concepts developed by A. Platzker in [1], by comparing the NDF method to classical low frequency concepts which, under some assumptions, can be applied to microwave recursive structures. We proceed with the examples of a first-order and a second-order recursive filters and show how the NDF expression for this kind of filter can be easily identified.



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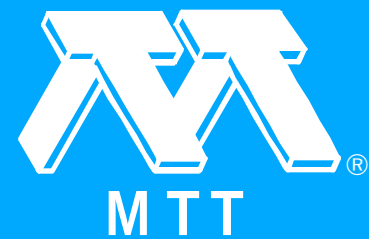
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On the Optimum Design of Microwave Active Frequency Doublers

P. Colantonio, F. Giannini, G. Leuzzi and E. Limiti. "On the Optimum Design of Microwave Active Frequency Doublers." 1995 MTT-S International Microwave Symposium Digest 95.3 (1995 Vol. III [MWSYM]): 1423-1426.

A design procedure for the optimum design of microwave active frequency doubler is presented. The proposed methodology is based on a nonlinear mixed analysis / optimisation algorithm giving simultaneous solution and first-step optimization of the active multiplier. Design charts relying on repeated analysis / optimization allow the designer to trade-off between conversion gain, output power and available input power.

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Adaptive Frequency Sampling Algorithm for Fast and Accurate S-Parameter Modeling of General Planar Structures

T. Dhaene, J. Ureel, N. Fache and D. De Zutter. "Adaptive Frequency Sampling Algorithm for Fast and Accurate S-Parameter Modeling of General Planar Structures." 1995 MTT-S International Microwave Symposium Digest 95.3 (1995 Vol. III [MWSYM]): 1427-1430.

A new adaptive technique is proposed to represent the spectral response of general planar structures over some frequency range of interest with a minimal number of frequency samples. Rational fitting functions are used to model and interpolate the S-parameters obtained through electromagnetic simulation. The adaptive algorithm doesn't require any a priori knowledge of the dynamics of the S-parameters in order to select an appropriate sampling distribution. This greatly improves the transparent use of any electromagnetic simulator, Keywords: adaptive frequency sampling, fitting technique, electromagnetic simulation.

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Low-Frequency Noise in Millimeter-Wave Si/SiGe Heterojunction Bipolar Transistors

R. Plana, B. Van Haaren, J.P. Roux, L. Escotte, A. Gruhle, H. Dietrich and J. Graffeuil. "Low-Frequency Noise in Millimeter-Wave Si/SiGe Heterojunction Bipolar Transistors." 1995 MTT-S International Microwave Symposium Digest 95.3 (1995 Vol. III [MWSYM]): 1431-1434.

In this paper we report on the low-frequency (L.F) noise properties of Si/SiGe HBT's. Our results indicate that these devices exhibit very interesting L.F noise performance which compares well with those obtained on BJT Si. However further improvements of the input referred noise current are still needed and our investigations show that they could be achieved through a reduction of the recombination processes at the Emitter-Base heterojunction and at the emitter periphery

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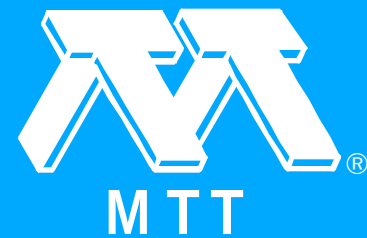


Abstracts

Order Recursive Gaussian Elimination and Efficient CAD of Microwave Circuits

K. Naishadham and P. Misra. "Order Recursive Gaussian Elimination and Efficient CAD of Microwave Circuits." 1995 MTT-S International Microwave Symposium Digest 95.3 (1995 Vol. III [MWSYM]): 1435-1438.

An order-recursive variant of Gaussian elimination has been presented for efficient solution of linear equations resulting from augmenting the feed line impedance matrix by block row and column vectors corresponding to reactions associated with discontinuities in the moment method simulation of MMIC elements. The potential utility of the solution technique in a CAD environment is demonstrated by applying it to the interactive design of microstrip low-pass filter.



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Abstracts

Model for a Novel CPW Phase Shifter

C.M. Jackson, T. Pham, Z. Zhang, A. Lee and C. Pettiette-Hall. "Model for a Novel CPW Phase Shifter." 1995 MTT-S International Microwave Symposium Digest 95.3 (1995 Vol. III [MWSYM]): 1439-1442.

A multilayer CPW phase shifter combining high temperature superconductor and ferroelectric thin films produces 150 degrees of phase shift per cm at 10 GHz with a 30 Volt bias at 60 K. A quasistatic model for the effective dielectric constant and loss tangent is presented and compared with data and commercial software.



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Abstracts

Cost-Driven Physics-Based Large-Signal Simultaneous Device and Circuit Design

J.W. Bandler, R.M. Biernacki, Q. Cai and S.H. Chen. "Cost-Driven Physics-Based Large-Signal Simultaneous Device and Circuit Design." 1995 MTT-S International Microwave Symposium Digest 95.3 (1995 Vol. III [MWSYM]): 1443-1446.

We present a cost-driven approach to the emerging demand for simultaneous device and circuit design. Here, an analytic physics-based Raytheon model facilitates fast large-signal simulation and optimization. A novel one-sided Huber approach is applied to design centering. The problem of cost-driven design is formulated as the minimization of the cost function while maintaining the required yield. Devices and matching circuits are optimized simultaneously, the advantages of which are demonstrated by a single-stage power amplifier design.



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Three-Dimensional Passive Circuit Technology for Ultra-Compact MMICs (1995 Vol. III [MWSYM])

M. Hirano, K. Nishikawa, I. Toyoda, S. Aoyama, S. Sugitani and K. Yamasaki. "Three-Dimensional Passive Circuit Technology for Ultra-Compact MMICs (1995 Vol. III [MWSYM])." 1995 MTT-S International Microwave Symposium Digest 95.3 (1995 Vol. III [MWSYM]): 1447-1450.

A novel passive circuit technology of a three-dimensional (3D) metal-insulator structure has been developed for ultra-compact MMICS. By combining vertical passive elements, such as a wall-like microwire for shielding or coupling and a pillar-like via connection, with multilayer passive circuits, highly dense and more functional MMICS can be implemented.

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A Novel Amplitude and Phase Linearizing Technique for Microwave Power Amplifiers

M. Nakayama, K. Mori, K. Yamauchi, Y. Itoh and T. Takagi. "A Novel Amplitude and Phase Linearizing Technique for Microwave Power Amplifiers." 1995 MTT-S International Microwave Symposium Digest 95.3 (1995 Vol. III [MWSYM]): 1451-1454.

A novel amplitude and phase linearizing technique for microwave power amplifiers has been developed. It employs a series feedback amplifier with a large source inductance as a predistortion linearizer, which provides positive amplitude and negative phase deviations for input power and can compensate for AM-AM and AM-PM distortions of power amplifiers. Applying this technique to a 1.9 GHz MMIC power amplifier for use in the Japanese Personal Handy-Phone System (PHS), an improvement of adjacent channel leakage power (ACP) up to 7 dB has been achieved when it is used for $\pi/14$ -shift QPSK signal.

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Aggressive Space Mapping for Electromagnetic Design

J.W. Bandler, R.M. Biernacki, S.H. Chen, R.H. Hemmers and K. Madsen. "Aggressive Space Mapping for Electromagnetic Design." 1995 MTT-S International Microwave Symposium Digest 95.3 (1995 Vol. III [MWSYM]): 1455-1458.

We propose a new aggressive Space Mapping strategy for electromagnetic (EM) optimization. Instead of waiting for upfront EM analyses at several base points, it exploits every available EM analysis using the classical Broyden update, producing dramatic results right from the first step. A high-temperature superconducting filter design solution emerges after fewer EM analyses than the number of designable parameters! For the first time, Space Mapping is extended to the parameter extraction phase, overcoming severely misaligned starting points induced by inadequate empirical models.

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Abstracts

A New Model of Step Recovery Diode for CAD

J. Zhang and A. Raisanen. "A New Model of Step Recovery Diode for CAD." 1995 MTT-S International Microwave Symposium Digest 95.3 (1995 Vol. III [MWSYM]): 1459-1462.

A new step recovery diode (SRD) model for CAD is developed by considering the voltage ramp in the SRD and using a DC measurement to extract a model parameter. This model can be directly used in commercial circuit simulators for designs of SRD circuits. Examples of using this model to analyse a comb generator and a frequency multiplier are given.



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Microwave Characterization of Flip-Chip MMIC Interconnections

R.B. Marks, J.A. Jargon, C.K. Pao and C.P. Wen. "Microwave Characterization of Flip-Chip MMIC Interconnections." 1995 MTT-S International Microwave Symposium Digest 95.3 (1995 Vol. III [MWSYM]): 1463-1466.

We report accurate on-wafer measurements of transmission lines on flip-chip coplanar-waveguide MMICS. The effects are difficult to predict theoretically, and, without custom standards and unique calibration software, measurements would be intractable. The results are applicable to the development of an accurate CAD database. We also report and apply a new technique for the measurement of transmission line capacitance.

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Abstracts

Microwave Measurement of Density Profiles in Fluidized Bed Reactors with Improved Spatial Resolution

T. Hauschild and R. Knochel. "Microwave Measurement of Density Profiles in Fluidized Bed Reactors with Improved Spatial Resolution." 1995 MTT-S International Microwave Symposium Digest 95.3 (1995 Vol. III [MWSYM]): 1467-1470.

A technique suitable for measuring density profiles of solids inside an ecologically friendly circulating fluidized bed coal combustor is introduced. Employing a microwave locating reflectometer it is possible to perform measurements in the dense phase of the reactor. Improvement of the spatial resolution by using a pole extraction algorithm is discussed.



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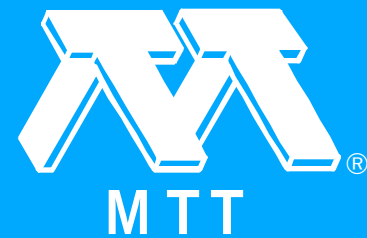


Abstracts

Development of Broadband Coaxial Components for a 0.04 to 110 GHz Measurement System

B. Oldfield. "Development of Broadband Coaxial Components for a 0.04 to 110 GHz Measurement System." 1995 MTT-S International Microwave Symposium Digest 95.3 (1995 Vol. III [MWSYM]): 1471-1473.

Coaxial components including a new connector system (the W connector), couplers, switches, terminations and Waveguide to coax adapters, were used to configure a VNA with continuous coverage from 0.04 to 110 GHz. Wafer probes covering the same range are also described.



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Abstracts

Comparison Between Beryllium-Copper and Tungsten High Frequency Air Coplanar Probes (1995 Vol. III [MWSYM])

J.L. Carbonero, G. Morin and B. Cabon. "Comparison Between Beryllium-Copper and Tungsten High Frequency Air Coplanar Probes (1995 Vol. III [MWSYM])." 1995 MTT-S International Microwave Symposium Digest 95.3 (1995 Vol. III [MWSYM]): 1475-1478.

High frequency air coplanar probes using tungsten tips are now available for silicon wafer probing with aluminum pads. A comparative study of the beryllium-copper and tungsten behavior is presented in terms of contact resistance values, stability and reproducibility. Finally, tungsten is demonstrated to be the best material for breaking the aluminum oxide over the pad to enable accurate high frequency probing.



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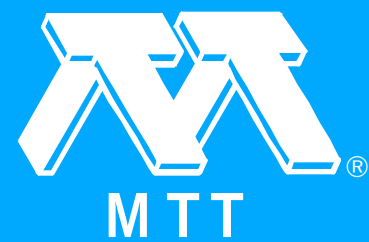
On-Wafer Testing of a W-Band HEMT Image-Rejection Downconverter MMIC

E.W. Lin, D.C.W. Lo, H. Wang, T.W. Huang, M. Biedenbender, G.S. Dow and B. Allen. "On-Wafer Testing of a W-Band HEMT Image-Rejection Downconverter MMIC." 1995 MTT-S International Microwave Symposium Digest 95.3 (1995 Vol. III [MWSYM]): 1479-1482.

This paper describes the first successful on-wafer conversion gain and noise figure measurements taken on a downconverter MMIC at W-band. On-wafer and in-fixture measured results are consistent for a 0.1 μm AlGaAs-InGaAsGaAs HEMT-based W-band image-rejection downconverter MMIC which has attained good RF yield. With an LO drive of 5 dBm at 94 GHz, the downconverter chip has achieved an USB conversion gain of 7.5-8.5 dB and noise figure of 6.5-7.5 dB for an IF signal in the range of 40 to 400 MHz.

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Dynamicm Measurement of the Temperature Characteristic of Dielectric Material for Microwave Application Using Photo Thermal Dielectric Microscope

Y. Cho, K. Yokoyama, T. Kumamaru and A. Kiriara. "Dynamicm Measurement of the Temperature Characteristic of Dielectric Material for Microwave Application Using Photo Thermal Dielectric Microscope." 1995 MTT-S International Microwave Symposium Digest 95.3 (1995 Vol. III [MWSYM]): 1483-1486.

A new photo thermal technique for measuring the temperature characteristic of dielectric material for microwave application is proposed. It is based on the temperature characteristic of the dielectric constant of light irradiated material. When a dielectric material is illuminated with chopped light, an alternating variation of capacitance is caused by the heat produced due to light absorption and this variation is detectable with enough dynamic range and sensitivity. First, quantitative derivations are presented for the alternating capacitance variation in terms of the optical, thermal, dielectric and geometric parameters of the system. Next, a very high sensitive type of PTDM using the coaxial cavity resonator with operating frequency of microwave range is developed. Using this microscope, the temperature characteristics of the binary-system TiO₂-Bi₂O₃ dielectric ceramics for microwave application are successfully measured.

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Abstracts

An Experimental and Theoretical Comparison of the Electric Fields Above a Coupled Line Bandpass Filter

T.P. Budka, E.M. Tentzeris, S.D. Wacławik, N.I. Dib, L.P.B. Katehi and G.M. Rebeiz. "An Experimental and Theoretical Comparison of the Electric Fields Above a Coupled Line Bandpass Filter." 1995 MTT-S International Microwave Symposium Digest 95.3 (1995 Vol. III [MWSYM]): 1487-1490.

We present an experimental and theoretical comparison of the tangential electric fields within 100 μm above a three stage coupled line bandpass filter (8.0 GHz- 10.5 GHz). Using the experimental technique of modulated scattering, complete electric field intensity images of the tangential electric field components are displayed and compared with the calculated electric fields obtained through the finite difference time domain (FDTD) method in both the passband (10 GHz) and the rejection band of the filter (12 GHz).



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Abstracts

Theoretical & Experimental Study of Single Mode Fiber Optical Ring Resonators for Microwave Applications

S. Tedjini and A. Ho-Quoc. "Theoretical & Experimental Study of Single Mode Fiber Optical Ring Resonators for Microwave Applications." 1995 MTT-S International Microwave Symposium Digest 95.3 (1995 Vol. III [MWSYM]): 1491-1494.

The propagation effects of a microwave intensity modulated light in a fiber based optical ring resonator are studied. Experimental and theoretical investigations on the microwave behavior of the device show the possibility of its use as a microwave filter. Significant changes on the microwave behavior are observed when using a coherent light source due to optical interferences of the light carrier. The concept of optical scattering parameters is applied in order to model the microwave behavior of the device.



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Microwave-Modulated Transmitter Design for Hybrid LIDAR-RADAR

L. Mullen, A. Vieira, P.R. Herczfeld and V.M. Contarino. "Microwave-Modulated Transmitter Design for Hybrid LIDAR-RADAR." 1995 MTT-S International Microwave Symposium Digest 95.3 (1995 Vol. III [MWSYM]): 1495-1498.

The application of well-established, coherent RADAR technology to aerial light detecting and ranging (LIDAR) systems has reduced incoherent backscatter clutter by 17 dB in laboratory experiments and computer simulations. The full-scale experimental realization of this hybrid LIDAR-RADAR system is hampered by the unavailability of a stable modulation source capable of providing high peak powers to overcome the large dynamic range required for the LIDAR backscatter measurement. Two methods being investigated for the microwave-modulation of a transmitted optical pulse to be utilized in the actual LIDAR environment are detailed.

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Abstracts

Bandwidth Improvements for Loaded-Line Traveling Wave Electro-Optic Modulators

C.L. Goldsmith and R. Magnusson. "Bandwidth Improvements for Loaded-Line Traveling Wave Electro-Optic Modulators." 1995 MTT-S International Microwave Symposium Digest 95.3 (1995 Vol. III [MWSYM]): 1499-1502.

A circuit theory approach is employed to analyze the factors and limitations affecting impedance, optical/electrical velocity matching, and bandwidth in loaded-line traveling-wave modulators. Design improvements are explored that show a potential 30- to 40-percent improvement in bandwidth over previous designs.



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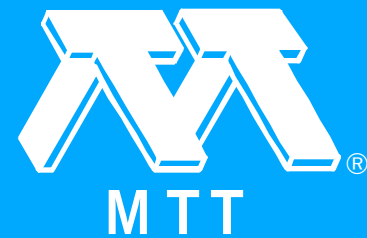


Abstracts

The Analysis of Photoparametric Amplifying Devices and Characteristics

A. Khanifar, R.J. Green, A. Khosrowbeygi, N.T. Ali and M. Milovanovic. "The Analysis of Photoparametric Amplifying Devices and Characteristics." 1995 MTT-S International Microwave Symposium Digest 95.3 (1995 Vol. III [MWSYM]): 1503-1506.

The photoparametric mode of operation involves optical detection and pre-amplification/frequency conversion within a single device (a photodetector). In this paper, we discuss the potential applications, the required device structure and characteristics and amplifier simulation techniques. Experimented results from implementation of a prototype receiver are presented and measured results are discussed.



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Phase Control of a Micropatch Antenna Element Designed for Monolithic Phased Arrays

R.M. Hsu and M.H. Thursby. "Phase Control of a Micropatch Antenna Element Designed for Monolithic Phased Arrays." 1995 MTT-S International Microwave Symposium Digest 95.3 (1995 Vol. III [MWSYM]): 1507-1510.

Our previous experimental work in the phase controlled micropatch antenna element has led us to pursue further the design and fabrication of an antenna element with greater phase shifting capability. Computer analysis of an antenna element with a new loading structure is described. Transmission phase shifts of up to 36 degrees in the model have been seen. Variations in the phase angle of the surface current with respect to the control capacitance are shown. Variations in the amplitude of the electric field measured in the far field region on bore sight are also shown.

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Predicting the Onset of Instabilities in Frequency Multipliers

S. Basu, S.A. Maas and T. Itoh. "Predicting the Onset of Instabilities in Frequency Multipliers." 1995 MTT-S International Microwave Symposium Digest 95.3 (1995 Vol. III [MWSYM]): 1511-1514.

Microwave multipliers are notoriously unstable with input power, bias and load variations. In this paper, we predict the onset of a chaotic type of instability using the Hopf bifurcation concept as the input power level is increased. The measurement and the predicted theoretical results are in agreement to within 1.5 dB.

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Temperature and Dispersion Effect Extensions of Chalmers Nonlinear HEMT and MESFET Model

I. Angelov, L. Bengtsson and M. Garcia. "Temperature and Dispersion Effect Extensions of Chalmers Nonlinear HEMT and MESFET Model." 1995 MTT-S International Microwave Symposium Digest 95.3 (1995 Vol. III [MWSYM]): 1515-1518.

Temperature and dispersion effects have been investigated and included in the Chalmers nonlinear model for HEMTs and MESFETS. DC, pulsed DC, low frequency (10Hz-10MHz), RF and small signal S-parameter measurements (1 -18GHz) have been made on a large number of HEMT and MESFET devices from different manufacturers in the temperature range 17-400K in order to evaluate the model.



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Simulation of the Accurate Near-Carrier Phase Noise in Microwave MESFET Oscillators

C.-L. Chen, X.-N. Hong and B.-X. Gao. "Simulation of the Accurate Near-Carrier Phase Noise in Microwave MESFET Oscillators." 1995 MTT-S International Microwave Symposium Digest 95.3 (1995 Vol. III [MWSYM]): 1519-1522.

The paper presents a new and efficient approach to the simulation of accurate near-carrier phase noise in free-running microwave MESFET oscillators. A kind of noise analysis model of the oscillators is introduced, in which a complete nonlinear noise model of the MESFET is included. An efficient algorithm is proposed to predict the accurate near-carrier phase noise in the microwave MESFET oscillators by nonlinear current method. Comparison between simulations and measurements proves that this approach is suitable for microwave CAD and is excellent in both efficiency and precision in predicting SSB phase noise of the microwave MESFET oscillators.

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Pulsed I-V and Temperature Measurement System for Characterisation of Microwave FETs

R.J. Donarski, A.K. Jastrzebski and J.E. Barnaby. "Pulsed I-V and Temperature Measurement System for Characterisation of Microwave FETs." 1995 MTT-S International Microwave Symposium Digest 95.3 (1995 Vol. III [MWSYM]): 1523-1526.

Systems for pulsed I-V characterisation of GaAs devices must meet specific requirements concerning not just accuracy and pulse width but also the way the measurements are performed and the definition of various quantities which need to be measured in order to acquire a full picture of the device behaviour. Over the last few years such a system has been iteratively developed and tested at the University of Kent at Canterbury. In the light of the experience gained, a number of new measuring concepts together with some vital observations are presented, raising doubts about the validity of currently existing interpretations of pulsed characteristics. Also the design of an inexpensive system incorporating the new concepts is briefly described.

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MESFET Linearity Improvement by Channel Doping Control

J.C. Pedro. "MESFET Linearity Improvement by Channel Doping Control." 1995 MTT-S International Microwave Symposium Digest 95.3 (1995 Vol. III [MWSYM]): 1527-1530.

The present work 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 proved that educated device and bias point selection, can approximate IMD performance of normal channel doping profiles, to the one that expected from a MESFET device with a specially tailored doping profile.

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A Low-Loss 20 GHz Micromachined Bandpass Filter

C.-Y. Chi and G.M. Rebeiz. "A Low-Loss 20 GHz Micromachined Bandpass Filter." 1995 MTT-S International Microwave Symposium Digest 95.3 (1995 Vol. III [MWSYM]): 1531-1534.

We report on the results of a state-of-the-art planar inter-digitated bandpass filter at K-band by using micromachining techniques. In this design, a microwave model was first built at 850 MHz to simulate the K-band filter, and the 20 GHz micromachined filter was fabricated based on the 850 MHz microwave model. Excellent agreement has been achieved between the microwave model and the 20 GHz filter. The micromachined filter exhibits a return loss better than -15 dB within the passband and a 1.7 dB port-to-port insertion loss at 20.3 GHz. A grounded coplanar waveguide with a micro-machined mouse-hole shielding structure has also been carefully examined. The grounded coplanar waveguide structure is used in the micromachined filter as the input/output feeding line and exhibits a return loss better than -20 dB up to 32 GHz.

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A High Q Factor Microwave Cavity

R. Comte, S. Gendraud, S. Verdeyme, P. Guillon, C. Boschet and B. Theron. "A High Q Factor Microwave Cavity." 1995 MTT-S International Microwave Symposium Digest 95.3 (1995 Vol. III [MWSYM]): 1535-1538.

A solution is proposed, using interfaces between low and high permittivity dielectric media to reduce considerably losses in classical metallic cavities, and so to obtain high performances microwave filters. An experimental confirmation of theoretical results is demonstrated by using two dielectric plates to increase the unloaded quality factor of a traditional metallic circular cavity excited on the TE/sub 011/ and TE/sub 111/ modes.

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A Miniaturized Dielectric Monoblock Duplexer Matched by the Buried Impedance Transforming Circuit

H. Matsumoto, T. Tsujiguchi and T. Nishikawa. "A Miniaturized Dielectric Monoblock Duplexer Matched by the Buried Impedance Transforming Circuit." 1995 MTT-S International Microwave Symposium Digest 95.3 (1995 Vol. III [MWSYM]): 1539-1542.

A dielectric monoblock duplexer as surface mount device is realized by using the stepped impedance resonators and the buried impedance transforming circuit. The RF leakage is suppressed because the whole outside wall of the filter is covered with plating electrode. The volume of the trial filter for 800MHz mobile telephone terminal is less than 3.9cm³. The insertion loss and attenuation of transmitting filter are 1.6dB and 53dB, and these of receiving filter are 2.3dB and 56dB.

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Micromachined Self-Packaged W-Band Bandpass Filters

S.V. Robertson, L.P.B. Katehi and G.M. Rebeiz. "Micromachined Self-Packaged W-Band Bandpass Filters." 1995 MTT-S International Microwave Symposium Digest 95.3 (1995 Vol. III [MWSYM]): 1543-1546.

Experimental and theoretical results are presented for membrane supported W-band bandpass filters which utilize silicon micromachining technology to create self-packaged, shielded circuits. A coupled line shielded microstrip implementation of a 5-element 0.5 dB equal ripple Chebyshev filter achieves a minimum insertion loss of 3.4 dB with a 6.1% bandwidth centered at 94.7 GHz. The measured filter performance shows very sharp cutoff with out of band attenuation better than 25 dB and input return loss better than 8 dB. Results are also presented for a 5-element filter that achieves a minimum insertion loss of 2.2 dB with an 11.3% bandwidth centered at 94.7 GHz, and a 3-element filter with 1.3 dB insertion loss and 16.4% bandwidth at 94.9 GHz. Efforts to model filter performance using commercially available software and FDTD techniques are discussed.

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A Two-Path Multimode Bandpass Filters Using the Nonradiative Dielectric (NRD) Waveguide Technology

J. Huang and K. Wu. "A Two-Path Multimode Bandpass Filters Using the Nonradiative Dielectric (NRD) Waveguide Technology." 1995 MTT-S International Microwave Symposium Digest 95.3 (1995 Vol. III [MWSYM]): 1547-1550.

A new class of two-path multimode bandpass filters are proposed in this paper for stringent requirement of NRD integrated circuits. Rigorous field-theoretical analysis and CAD procedure are developed to determine frequency response of the proposed structure. It is shown that the two-path multimode filter presents a better electrical performance over its one-path counterpart. In addition, the proposed geometry provides also more freedom of choosing filter parameters in the design and optimization of bandpass filters.

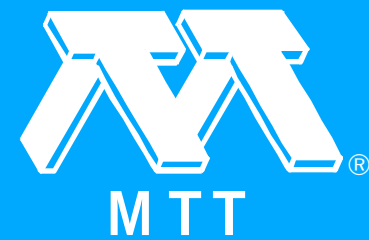
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Session TH4B -- Nonlinear Devices and Circuits

"Session TH4B -- Nonlinear Devices and Circuits." 1995 MTT-S International Microwave Symposium Digest 95.3 (1995 Vol. III [MWSYM]): 1551-1551.



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A New Large-Signal Model Based on Pulse Measurement Techniques for RF Power MOSFET

J.M. Collantes, J.J. Raoux, J.P. Villotte, R. Quere, G. Montoriol and F. Dupis. "A New Large-Signal Model Based on Pulse Measurement Techniques for RF Power MOSFET." 1995 MTT-S International Microwave Symposium Digest 95.3 (1995 Vol. III [MWSYM]): 1553-1556.

A large-signal model for RF power MOSFET has been obtained using a new characterization and extraction technique. This technique is based on pulsed I-V characteristics and pulsed S-parameters measurements, to take into account the thermal state of the device. A table-based model is used to represent the I-V drain current source. The complete large-signal model is implanted in an harmonic-balance commercial simulator and its accuracy is evidenced by a comparison with active load-pull measurements at L band.

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Abstracts

Empirical Modeling of Low-Frequency Dispersive Effects Due to Traps and Thermal Phenomena in III-V FETs (1995 Vol. III [MWSYM])

F. Filicori, G. Vannini, A. Santarelli, A. Mediavilla, A. Tazon and Y. Newport. "Empirical Modeling of Low-Frequency Dispersive Effects Due to Traps and Thermal Phenomena in III-V FETs (1995 Vol. III [MWSYM])." 1995 MTT-S International Microwave Symposium Digest 95.3 (1995 Vol. III [MWSYM]): 1557-1560.

An empirical approach is proposed which accounts for low-frequency dispersive phenomena due to surface state densities, deep level traps and device heating, in the modeling of the drain current response of III-V FETs. The model, which is based on mild assumptions justified both by theoretical considerations and experimental results, has been applied to GaAs MESFETs of different manufacturers. Experimental and simulation results that confirm the validity of the model are provided in the paper.



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Computer-Aided Noise Analysis of Integrated Microwave Front-Ends

V. Rizzoli, D. Masotti and F. Matri. "Computer-Aided Noise Analysis of Integrated Microwave Front-Ends." 1995 MTT-S International Microwave Symposium Digest 95.3 (1995 Vol. III [MWSYM]): 1561-1564.

The noise performance of autonomous nonlinear subsystems including mixer/LO subassemblies is computed by a perturbative analysis of the quasi-periodic regime generated by the intermodulation of the RF signal with the autonomous local oscillation. It is shown that classical analyses based on the perturbation of the time-periodic LO regime fail to correctly describe the LO contribution to the IF noise.

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Phase Noise Minimization of Microwave Oscillators by Optimal Design

W. Anzill, O. von Stryk, R. Bulirsch and P. Russer. "Phase Noise Minimization of Microwave Oscillators by Optimal Design." 1995 MTT-S International Microwave Symposium Digest 95.3 (1995 Vol. III [MWSYM]): 1565-1568.

A novel time domain phase noise analysis and minimization method (TDPNAM) is presented and applied to the design of a 15 GHz microstrip line oscillator. The new method determines the design, e.g., the linear network of oscillators with a minimized phase noise by solving an appropriate optimal control problem numerically. Starting from a design with standard CAD-tools the measured single-sideband phase noise is reduced by 10 dB over the whole offset frequency range to values as low as -100 dBc/Hz at an offset frequency of 100 kHz.

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Abstracts

Analysis of Chaotic Behaviour in Lumped-Distributed Circuits Applied to Practical Microwave Oscillators

E.A. Hosny, A.A.A. Nasser and M.I. Sobhy. "Analysis of Chaotic Behaviour in Lumped-Distributed Circuits Applied to Practical Microwave Oscillators." 1995 MTT-S International Microwave Symposium Digest 95.3 (1995 Vol. III [MWSYM]): 1569-1572.

A general method for the analysis of prechaotic and chaotic behaviors in lumped-distributed circuits has been developed. Examples of practical microwave oscillators, namely GUNN and IMPATT oscillators were designed. The simulation and measurement results showed that these oscillators possess regions of periodic, quasi-periodic, and chaotic spectra. The method could be used by circuit designers to design chaos free oscillators.



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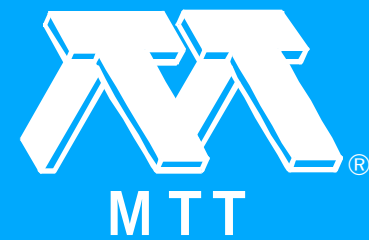
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Abstracts

Session TH4C -- Microwave Packaging and Interconnect Technology

"Session TH4C -- Microwave Packaging and Interconnect Technology." 1995 MTT-S International Microwave Symposium Digest 95.3 (1995 Vol. III [MWSYM]): 1573-1573.



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Aluminum Silicon Carbide for High Performance Microwave Packages

J.L. Bugeau, K.M. Heitkamp and D. Kellerman. "Aluminum Silicon Carbide for High Performance Microwave Packages." 1995 MTT-S International Microwave Symposium Digest 95.3 (1995 Vol. III [MWSYM]): 1575-1578.

Aluminum silicon carbide is rapidly becoming the material of choice for high performance microwave packages. This paper presents the results of extensive research performed to evaluate the integrity of aluminum silicon carbide for electronic packaging applications.

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A Study of Hermetic Transitions for Microwave Packages

J.-G. Yook, N.I. Dib, E. Yasan and L.P.B. Katehi. "A Study of Hermetic Transitions for Microwave Packages." 1995 MTT-S International Microwave Symposium Digest 95.3 (1995 Vol. III [MWSYM]): 1579-1582.

Two numerical techniques, the finite difference in time domain (FDTD) and the finite element method (FEM) in frequency domain, are employed to characterize microstrip hermetic transition geometries in an effort to investigate high frequency effects. Measurements performed on these transitions compare favorably with theory. It is shown that these hermetic wall transitions may suffer from parasitic parallel plate modes which however can be eliminated with the use of vias at appropriate locations. Two different transitions have been analyzed from 5 GHz to 25 GHz and have been found to be limited in performance by higher return loss as frequency increases. This indicates the need for very careful characterization of transitions intended for use in microwave and millimeter-wave applications.

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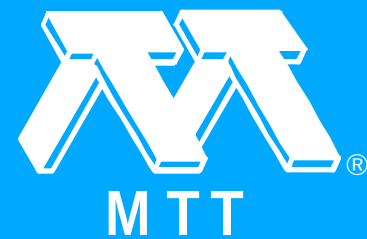


Abstracts

A Compact 8-14 GHz LTCC Stripline Coupler Network for High Efficiency Power Combining with Better Than 82% Combining Efficiency

J. Gipprich, L. Dickens, B. Hayes and F. Sacks. "A Compact 8-14 GHz LTCC Stripline Coupler Network for High Efficiency Power Combining with Better Than 82% Combining Efficiency." 1995 MTT-S International Microwave Symposium Digest 95.3 (1995 Vol. III [MWSYM]): 1583-1586.

A compact coupler network for combining six high efficiency HBT power MMICS has demonstrated an 82% minimum combining efficiency (0.85 dB), typically greater than 87% (0.6 dB), over an 8.0 to 14.0 GHz frequency band. The combining network is a two-tier "vertically stacked" multilayer Low Temperature Cofired Ceramic (LTCC) stripline assembly and was designed with the aid of electromagnetic simulation and circuit modeling. This paper describes the design, fabrication and test of this combiner assembly.



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3D FDTD Analysis of a SOT353 Package Containing a Bipolar Wideband Cascode Transistor Using the Compression Approach

M. Rittweger, M. Werthen, J. Kunisch, I. Wolff, P. Chall, B. Balm and P. Lok. "3D FDTD Analysis of a SOT353 Package Containing a Bipolar Wideband Cascode Transistor Using the Compression Approach." 1995 MTT-S International Microwave Symposium Digest 95.3 (1995 Vol. III [MWSYM]): 1587-1590.

A 3d electromagnetic simulation of an entire mold injected plastic package including its coplanar environment is presented. The active elements are substituted by inner ports. The resulting network is connected with measured transistor data using a circuit simulator. A comparison of the simulated data with measured results is shown. The influence of the package and therefore the meaning of such a simulation procedure is discussed.

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Reducing the Effects of the Mounting Substrate on the Performance of GaAs MMIC Flip Chips

R. Sturdivant. "Reducing the Effects of the Mounting Substrate on the Performance of GaAs MMIC Flip Chips." 1995 MTT-S International Microwave Symposium Digest 95.3 (1995 Vol. III [MWSYM]): 1591-1594.

Flip chip technology has been used in electronic equipment for 25 years or more. This is due to the benefits offered by flip chips such as improved interconnect performance, high reliability, and low cost. Increased packaging demands in wireless communications, and military electronics have led to the use of flip chips for r.f. and microwave components. For instance, GaAs MMIC flip chips at 15 GHz have been developed. There are a few key technology issues which allow the use of flip chip at microwave frequencies. The most important being the use of coplanar transmission lines. The impact of flipping a MMIC chip is examined using finite element simulations and test data is presented for a flipped microwave GaAs MMIC.

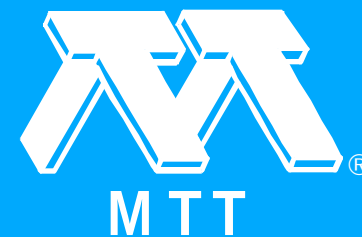
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Abstracts

Session TH4D -- High Power Sources and Control Components

"Session TH4D -- High Power Sources and Control Components." 1995 MTT-S International Microwave Symposium Digest 95.3 (1995 Vol. III [MWSYM]): 1595-1595.



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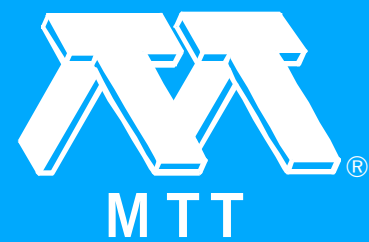
94 GHz Power Amplifier Using PHEMT Technology

L. Marosi, M. Sholley, J. Goel, A. Faris, M. Siddiqui, D.I. Stones and K. Tan. "94 GHz Power Amplifier Using PHEMT Technology." 1995 MTT-S International Microwave Symposium Digest 95.3 (1995 Vol. III [MWSYM]): 1597-1600.

A millimeter wave power amplifier has been developed using power MMICS based on 0.10 micron T-gate pseudomorphic HEMT technology. It uses four MMIC chips in parallel with a low loss 4-way power combiner with two cascaded driver amplifier stages. The amplifier module demonstrated 100 mW output power with more than 32 dB linear gain at 94 GHz. These results are attributed to the excellent device and combiner performance.

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22-kW Next Generation Low Cost S-Band Solid State Transmitter for Surveillance and Air Traffic Control Radars

M. Kumar, M. Hanczor, H. Voigt, G. Cambigianis, R. Sachs and C. Bonilla. "22-kW Next Generation Low Cost S-Band Solid State Transmitter for Surveillance and Air Traffic Control Radars." 1995 MTT-S International Microwave Symposium Digest 95.3 (1995 Vol. III [MWSYM]): 1601-1604.

This paper presents the development of a low-cost 22-kW Solid-State Transmitter (SST) operating over 2.7-2.9 GHz, for modern surveillance and air-traffic control radars. 22kW peak power with a pulse width of 50 ps and 5% duty cycle is achieved by combining fifty 500-W High Power Solid-State Amplifiers using a low-loss (0.2 dB) radial combiner. Other key performance parameters are: pulse-to-pulse stability (MTI improvement factor) >75 dBc, pulse droop < 0.6 dB, MTBCF >100,000 hours, instantaneous bandwidth of 200 MHz, extremely high pulse fidelity, and self pulsing low voltage operation for safety and high efficiency. The design has following additional features: modular, front accessibility of components, hot replacement of power supplies and high power amplifiers for easy maintenance, complete remote monitoring and maintenance system (RMMS), use of commercial off-the-shelf (COTS) components, fail-soft operation and redundancy of critical components such as power supplies, driver amplifiers and fans for cooling.





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400W X-Band GaAs MMIC CW Amplifier

M. Knox, R. Youmans, M. Kumar, L. Forker, H. Voigt, P. Brand, F. Marcotte and A.S. Hughes. "400W X-Band GaAs MMIC CW Amplifier." 1995 MTT-S International Microwave Symposium Digest 95.3 (1995 Vol. III [MWSYM]): 1605-1608.

This paper presents the development of a 400W CW solid-state amplifier operating over 10.0 to 10.7 GHz band. An output power of 400W is achieved by combining forty-seven 10W GaAs MMIC amplifier modules using a 47:1 low-loss waveguide combiner. Other key parameters are the measured AM noise level of -120 dBc/Hz at 1 KHz offset and -137 dBc/Hz at 10 KHz, and FM noise level of -128 dBc/Hz at 1 KHz offset and -142 dBc/Hz at 10 KHz. To the best of the authors' knowledge, 400W CW output power at X-band using GaAs MMICS is achieved for the first time.

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High Power Amplifier Harmonic Output Level Measurement

R.M. Perez, D.J. Hoppe and A.R. Khan. "High Power Amplifier Harmonic Output Level Measurement." 1995 MTT-S International Microwave Symposium Digest 95.3 (1995 Vol. III [MWSYM]): 1609-1611.

A method is presented for the measurement of the harmonic output power of high power klystron amplifiers, involving coherent hemispherical radiation pattern measurements of the radiated klystron output. Results are discussed for operation in saturated and unsaturated conditions, and with a waveguide harmonic filter included.

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TE/sub 11/ to TM/sub 11/ Compact Mode Converter for Circular Waveguide

T. ul Haq, K.J. Webb and N.C. Gallagher. "TE/sub 11/ to TM/sub 11/ Compact Mode Converter for Circular Waveguide." 1995 MTT-S International Microwave Symposium Digest 95.3 (1995 Vol. III [MWSYM]): 1613-1616.

A compact, low cost, circular waveguide TE/sub 11/ to TM/sub 11/ mode converter has been designed and built using a scattering optimization method. A far field radiation pattern measurement indicates 98.1% of the output power to be in TM/sub 11/, which is very close to the theoretical efficiency of 98.84% for the mode converter,

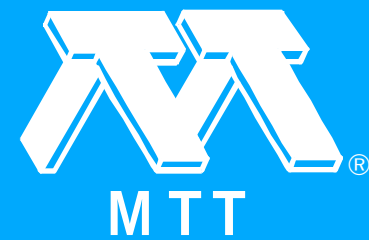
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Abstracts

Session TH4E -- Transmission Line, Amplifiers and Control Devices

"Session TH4E -- Transmission Line, Amplifiers and Control Devices." 1995 MTT-S International Microwave Symposium Digest 95.3 (1995 Vol. III [MWSYM]): 1617-1617.



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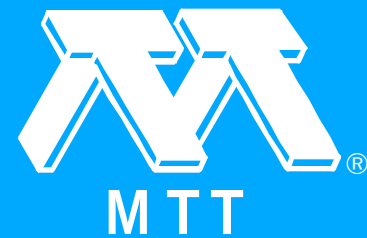


Abstracts

An MMIC Low-Distortion Variable-Gain Amplifier Using Active Feedback (1995 Vol. III [MWSYM])

K. Nishikawa and T. Tokumitsu. "An MMIC Low-Distortion Variable-Gain Amplifier Using Active Feedback (1995 Vol. III [MWSYM])." 1995 MTT-S International Microwave Symposium Digest 95.3 (1995 Vol. III [MWSYM]): 1619-1622.

A new low-distortion variable-gain amplifier (VGA) is proposed and analyzed. The gain of the VGA is controlled using the transconductance of a common-drain FET (CDF) in the negative feedback path. The analysis and prototype results indicate that the third-order intermodulation-distortion ratio is greatly improved at a high input power levels due to the CDF'S unilateral characteristic and a reduction in the VGA's input impedance.



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A Miniaturized Ka-Band MMIC High-Gain Medium Power Amplifier in Coplanar Line Technique by Using a Conventional 0.5 μm MESFET Technology

Y. Kalayci, R. Tempel, W. Lutke, M. Akpınar and I. Wolff. "A Miniaturized Ka-Band MMIC High-Gain Medium Power Amplifier in Coplanar Line Technique by Using a Conventional 0.5 μm MESFET Technology." 1995 MTT-S International Microwave Symposium Digest 95.3 (1995 Vol. III [MWSYM]): 1623-1626.

This paper presents a miniaturized Ka-band MMIC high-gain medium power amplifier in coplanar line technique by using a conventional 0.5 μm GaAs-MESFET technology. To our knowledge a MESFET amplifier with 7 dB gain at Ka-band has never been shown before. In the frequency band 26.3 GHz to 28.3 GHz, the input and output return losses are better than 10 dB. The 1 dB compression point $P_{\text{sub 1dB}}$ is higher than 23 dBm at 26.5 GHz. The single ended one-stage amplifier occupies a chip-size of 0.46 x 0.64 mm².

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Broadband, Low-Loss 5- and 6-Bit Digital Attenuators

D. Krafcsik, F. Ali and S. Bishop. "Broadband, Low-Loss 5- and 6-Bit Digital Attenuators." 1995 MTT-S International Microwave Symposium Digest 95.3 (1995 Vol. III [MWSYM]): 1627-1630.

Low-loss 5- and 6-bit MMIC digital attenuators covering DC-16 GHz have been designed, fabricated and tested. These attenuators provide exceptional performance, with reference state insertion loss of less than 5 dB at 16 GHz (for the 6-bit chip) and 28 dB of dynamic range attenuation. The input and output VSWRS of the attenuators are better than 1.6:1 over attenuation states and frequencies. These digital attenuators have an input third order intercept point of 37 dBm.

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77 GHz Monolithic MMIC Schottky- and PIN-Diode Switches Based on GaAs MESFET and Silicon SIMMWIC Technology

A. Klaassen and J.-M. Dieudonne. "77 GHz Monolithic MMIC Schottky- and PIN-Diode Switches Based on GaAs MESFET and Silicon SIMMWIC Technology." 1995 MTT-S International Microwave Symposium Digest 95.3 (1995 Vol. III [MWSYM]): 1631-1634.

We report on the design, fabrication and evaluation of 77 GHz monolithically integrated MMIC switches. Single-pole double-throw (SPDT) and single-pole three-throw (SP3T) switches were realized with Schottky diodes in a 0.25 μm GSAS MESFET technology. To our knowledge, this is the first fabrication of Schottky diodes as switching elements at W-band. In a silicon SIMMWIC technology SPDT switches were developed with PIN diodes. Insertion losses of 1.5-2.5 dB and isolations better than 20 dB were obtained at 77 GHz for the different switch types. A comparison between the GaAs MESFET and the SIMMWIC technology concerning switch RF-performance, power capability and switching speed is given in this paper.

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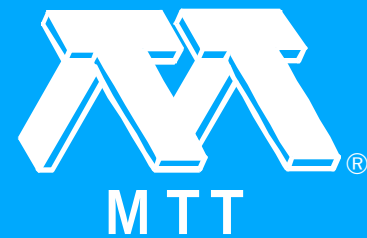


Abstracts

Design Methodology, Measurement and Application of MMIC Transmission Line Transformers

M. Engels, R.H. Jansen, W. Daumann, R.M. Bertenburg and F.J. Tegude. "Design Methodology, Measurement and Application of MMIC Transmission Line Transformers." 1995 MTT-S International Microwave Symposium Digest 95.3 (1995 Vol. III [MWSYM]): 1635-1638.

A design methodology is presented for MMIC transmission line transformers (TLTs) typically having three conductor levels. Several such structures on GaAs have been processed and measured showing good broadband performance. The usefulness of TLTs is demonstrated by an MMIC amplifier design.



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51 GHz Frontend with Flip Chip and Wire Bond Interconnections from GaAs MMICs to a Planar Patch Antenna

G. Baumann, H. Richter, A. Baumgartner, D. Ferling, R. Heilig, D. Hollmann, H. Muller, H. Nechansky and M. Schlechtweg. "51 GHz Frontend with Flip Chip and Wire Bond Interconnections from GaAs MMICs to a Planar Patch Antenna." 1995 MTT-S International Microwave Symposium Digest 95.3 (1995 Vol. III [MWSYM]): 1639-1642.

In this paper the difference between flip chip and wire bond technology is demonstrated. Test assemblies with coplanar waveguides have been attached in flip chip and wire bond technology and measured up to 75 GHz. Further the influence of a metallic lid to a coplanar waveguide structure is examined. To compare flip chip and wire bond interconnections, 51 GHz frontends with GaAs devices in coplanar waveguide technology have been realized. In one frontend the low noise amplifier (LNA) is connected to a planar patch antenna by wire bonding and in second by a flip chip attachment. RF evaluations show the clear advantage of the flip chip version due to the lower insertion loss of the flip chip interconnections and the higher flexibility of mounting the MMICs directly on the back structure of the planar patch antenna, leading to reduced losses of the feedline.

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An Inverted Microstrip Line IC Structure for Ultra High-Speed Applications

S. Yamaguchi, Y. Imai, T. Shibata, T. Otsuji, M. Hirano and E. Sano. "An Inverted Microstrip Line IC Structure for Ultra High-Speed Applications." 1995 MTT-S International Microwave Symposium Digest 95.3 (1995 Vol. III [MWSYM]): 1643-1646.

An inverted microstrip line IC structure for ultra high-speed applications is proposed. It allows a very low-parasitic impedance module with a flip chip bonding, a small IC size, and performance improvements for high-speed digital ICS.

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Late Papers (1995 Vol. III [MWSYM])

"Late Papers (1995 Vol. III [MWSYM])." 1995 MTT-S International Microwave Symposium Digest 95.3 (1995 Vol. III [MWSYM]): 1647-1647.



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Abstracts

A Family of Low Cost High Performance HEMT MMICs for Commercial DBS Applications (1995 Vol. III [MWSYM])

K. Hubbard, K. MacGowan, C. Kau, D. Smith and S. Maas. "A Family of Low Cost High Performance HEMT MMICs for Commercial DBS Applications (1995 Vol. III [MWSYM])." 1995 MTT-S International Microwave Symposium Digest 95.3 (1995 Vol. III [MWSYM]): 1649-1652.

A family of GaAs HEMT MMICS have been developed for use in Direct Broadcast Satellite TV (DBS) US, Japanese, and European markets. These designs are very compact, high performance, and self-biased. They are meant as building blocks for low noise block (LNB) downconverters. Described in this paper are the receiver chip, low noise amplifier, and self-biased single HEMT device (should a MIC LNA be preferred). The key design is the receiver chip with a nominal gain of 38 dB and NF of less than 3 dB for the US band. This paper presents a description of each design, a performance summary, as well as information describing their actual use in an LNB design.



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K-Band T/R-Converter Modules for the Iridium® Satellite Program (1995 Vol. III [MWSYM])

D.W. Corman, B.T. Agar, K.V. Buer and D.L. Cook. "K-Band T/R-Converter Modules for the Iridium® Satellite Program (1995 Vol. III [MWSYM])." 1995 MTT-S International Microwave Symposium Digest 95.3 (1995 Vol. III [MWSYM]): 1653-1656.

The paper describes two K-band multi-chip modules developed for the satellites on the IRIDIUM communication program. The modules employ a wide range of low noise and power 0.25 μ m PHEMT MMICS to provide all K-band transmit/receive functions aboard the spacecraft. The modules include over 500 active and passive components including LNAs, power amplifiers, mixers, frequency doublers, and associated support circuitry. Descriptions are provided of the MMIC and module development programs, module producibility features, and the associated MMIC reliability test program. Also described is a novel K-band interface method which eliminates RF alignment.

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Some Improvements to the FDTD Algorithm for the Analysis of Passive Circuits

R.C. Tupynamba and A.S. Omar. "Some Improvements to the FDTD Algorithm for the Analysis of Passive Circuits." 1995 MTT-S International Microwave Symposium Digest 95.3 (1995 Vol. III [MWSYM]): 1657-1660.

A new graded lattice mesh scheme for the FDTD is presented, in which the location of the different materials in the structure is taken into account. This makes it possible to maintain the efficiency of other graded lattice schemes without the big increasing of memory requirements they imply. A new compensated non-matched source is also presented which uses the results of a 2D-FDTD analysis to distinguish between the incident and the reflected parts of the signal on the excitation plane. This solution is time-saving as compared to the traditional method of using a long line at the input or with the 3D analysis for the matched source. The 2D-FDTD analysis is the same as from other authors, but at the first time with a rigorous description, without using complex numbers for real time-domain field components.

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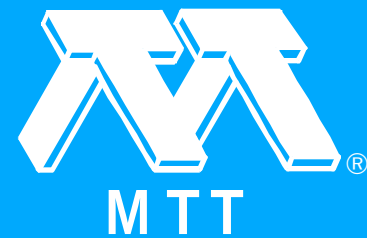


Abstracts

Capacitive-Division Traveling-Wave Amplifier with 340 GHz Gain-Bandwidth Product (1995 Vol. III [MWSYM])

J. Pusi, B. Agarwal, R. Pullela, L.D. Nguyen, M.V. Le, M.J.W. Rodwell, L. Larson, J.F. Jensen, R.Y. Yu and M.G. Case. "Capacitive-Division Traveling-Wave Amplifier with 340 GHz Gain-Bandwidth Product (1995 Vol. III [MWSYM])." 1995 MTT-S International Microwave Symposium Digest 95.3 (1995 Vol. III [MWSYM]): 1661-1664.

We report capacitive-division traveling-wave amplifiers having measured midband gains of 8 dB with a 1-98 GHz 3-dB-bandwidth, and 11 dB gain with a 1-96 GHz bandwidth. The capacitive-division topology raises the input Q of each cell, giving the amplifier increased bandwidth over conventional designs with the same active device technology; using 0.15- μ m gate length InGaAs/InAlAs HEMTs, bandwidths exceeding 150 GHz are feasible.



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Microwave, Millimeter Wave and Sub-Millimeter Wave Free-Space Faraday Rotators

G.M. Smith, S. Kang, C. Unsworth, E. Puplett, D. Franklin and J.C.G. Lesurf. "Microwave, Millimeter Wave and Sub-Millimeter Wave Free-Space Faraday Rotators." 1995 MTT-S International Microwave Symposium Digest 95.3 (1995 Vol. III [MWSYM]): 1665-1668.

We report new loss and dispersive measurements on SrM hexagonal ferrites both in sintered form and in a plastic matrix showing their potential for providing high performance, freespace Faraday Rotators over large frequency ranges. SrM polycrystalline ferrites show a strong dispersion at frequencies below 150GHz which helps to account for their wideband performance at W-band. These ferrites have the advantage that they operate in their remnant state and require no external magnetic field and can act as isolators over extremely huge apertures.

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Abstracts

Monolithic Millimeter-Wave Beam Control Array

X. Qin, W.-M. Zhang, C.W. Domier, N.C. Luhmann, Jr., W. Berk, S. Duncan and W. Tu.
"Monolithic Millimeter-Wave Beam Control Array." 1995 MTT-S International Microwave Symposium Digest 95.3 (1995 Vol. III [MWSYM]): 1669-1672.

A high performance V-band beam control array has been designed, developed and demonstrated. A transmission switch with 24 dB ON/OFF ratio for a single grid and 42 dB ON/OFF ratio (4 dB minimum loss) at ~62 GHz for a grid pair has been experimentally demonstrated. A 130-degree reflection phase shift with ~2.7 dB loss at 60 GHz for a single grid has been successfully obtained.



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Abstracts

The Role of MHDL in Microwave System and Subsystem Design

R.G. Hicks and D.L. Rhodes. "The Role of MHDL in Microwave System and Subsystem Design." 1995 MTT-S International Microwave Symposium Digest 95.3 (1995 Vol. III [MWSYM]): 1673-1676.

An introduction to MHDL is presented, from the perspective of a microwave system, subsystems and components engineer. Specifically, various pieces of the microwave applications design process are identified where MHDL can make a significant contribution. The constructs available in the language are also described and modeling examples are used to illustrate the descriptive power and ease of use of this language. Finally, the role of MHDL in both the U.S. DoD'S MAFET program and in the electronic marketplace are examined.



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A High Performance mm-Wave Electron Spin Resonance Spectrometer

G.M. Smith, J.C.G. Lesurf, R.H. Mitchell and P.C. Riedi. "A High Performance mm-Wave Electron Spin Resonance Spectrometer." 1995 MTT-S International Microwave Symposium Digest 95.3 (1995 Vol. III [MWSYM]): 1677-1680.

We describe a novel millimetre-wave electron spin resonance (ESR) spectrometer designed to operate in the frequency range 90-200GHz and in the temperature range 1.5K - 270K. The spectrometer uses a bmodal reflection cavity coupled to a circular corrugated guide and uses Gaussian quasi-optics are used for most of the front-end signal processing. This technique has very low insertion loss and allows a number of sophisticated measurement techniques to be employed including induction operation and illumination by both circular polarisation states.

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Composite Fan-Shaped SAW Transducers

E.V. Bausk and I.B. Yakovkin. "Composite Fan-Shaped SAW Transducers." 1995 MTT-S International Microwave Symposium Digest 95.3 (1995 Vol. III [MWSYM]): 1681-1684.

In a proposed surface acoustic wave (SAW) filter construction a signal processing is carried out in two parallel acoustic channels. Due to a slanted configuration of fan-shaped interdigital transducers, a delay time difference between two components of the output signal depends on a signal frequency, while a filter delay time is constant. This offers 7-10 dB improvement of an stopband rejection without any frequency response flatness deterioration in the filter passband.

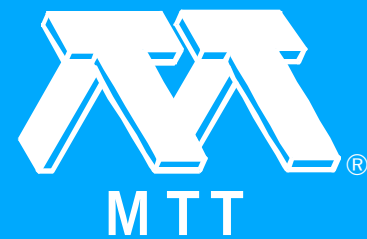
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Panel and Rump Sessions, Workshops, 1995 MW and MMW Monolithic Circuits Symposium, 1995 National Telesystems Conference, Author Index, Exhibitor List, Exhibition Guide (1995 Vol. III [MWSYM])

"Panel and Rump Sessions, Workshops, 1995 MW and MMW Monolithic Circuits Symposium, 1995 National Telesystems Conference, Author Index, Exhibitor List, Exhibition Guide (1995 Vol. III [MWSYM])." 1995 MTT-S International Microwave Symposium Digest 95.3 (1995 Vol. III [MWSYM]): I-I.



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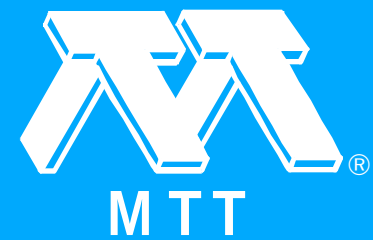
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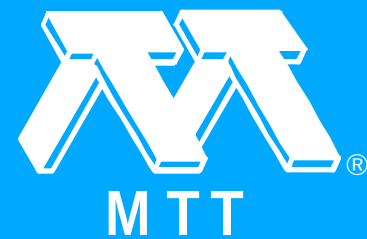


Abstracts

Welcome to the 1996 International Microwave Symposium - Bridging the Spectrum (1996 Vol. I [MWSYM])

E.J. Crescenzi, Jr. and J. Barrera. "Welcome to the 1996 International Microwave Symposium - Bridging the Spectrum (1996 Vol. I [MWSYM])." 1996 MTT-S International Microwave Symposium Digest 96.1 (1996 Vol. I [MWSYM]): vii-viii.

Thank you for participating in the 1996 IEEE MTT-Society International Microwave Symposium and Exhibition. The overwhelming response by engineers throughout the world to our Call for Papers, the robust industry expansion, and the creativity of contributors at all levels will make this event a record-breaking success! Two records have already been broken: the number of papers - 466, and the number of workshops - 26. We also anticipate challenging or breaking existing records for the number of registrants and the number of exhibitors!



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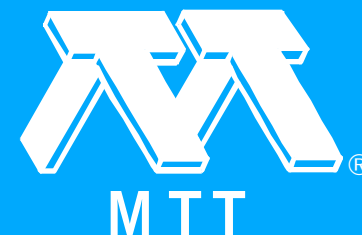
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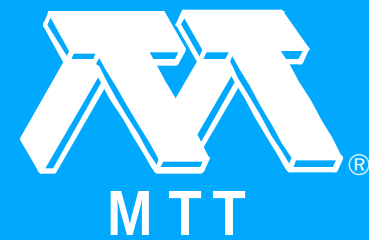
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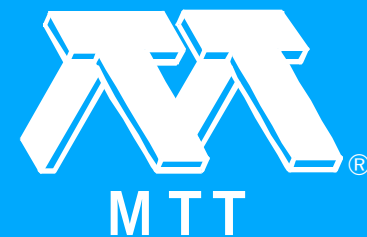
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Session TU1A -- Low Noise Millimeter Wave MMICs

"Session TU1A -- Low Noise Millimeter Wave MMICs." 1996 MTT-S International Microwave Symposium Digest 96.1 (1996 Vol. I [MWSYM]): 3-4.



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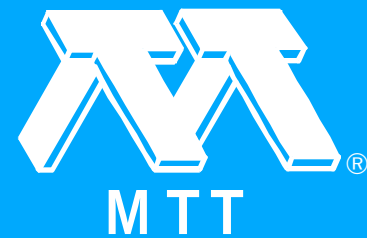


Abstracts

Status of InP HEMT Technology for Microwave Receiver Applications (1996 Vol. I [MWSYM])

P.M. Smith. "Status of InP HEMT Technology for Microwave Receiver Applications (1996 Vol. I [MWSYM])." 1996 MTT-S International Microwave Symposium Digest 96.1 (1996 Vol. I [MWSYM]): 5-8.

The current status of InP-based high electron mobility transistor (HEMT) technology for low noise amplification at frequencies up to more than 100 GHz is presented. Following a review of recent advances industry-wide in both device and circuit performance, two issues, which will pace the rate at which this new technology can be inserted into microwave systems material/process maturity and long-term reliability--are discussed.



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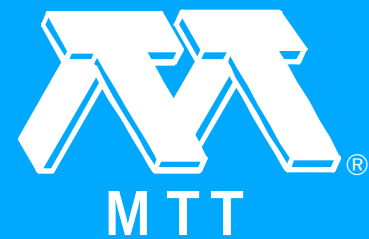
High Performance, High Yield Millimeter-Wave MMIC LNAs Using InP HEMTs

L. Tran, R. Isobe, M. Delaney, R. Rhodes, D. Jang, J. Brown, L. Nguyen, M. Le, M. Thompson and T. Liu. "High Performance, High Yield Millimeter-Wave MMIC LNAs Using InP HEMTs." 1996 MTT-S International Microwave Symposium Digest 96.1 (1996 Vol. I [MWSYM]): 9-Delaney, Michael.

A millimeter-wave MMIC low noise amplifier chip set has been developed. Based on the InP HEMT technology, these LNAs provide state-of-the-art performance as well as excellent yield and repeatability. With greater than 5090 chip yield, a three-stage Q-band LNA design achieved 26 to 31 dB of gain from 42 to 50 GHz and 1.8 dB average noise figure from 43.3 to 45.7 GHz. In addition, there we six other LNA designs including a four-stage V-band LNA with 28 dB of gain and 2.3 dB noise figure and a two-stage balanced Q-band LNA that provided 17 dB of gain and has greater than 61% yield.

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A 60 GHz-Band Low Noise HJFET Amplifier Module for Wireless LAN Applications

K. Maruhashi, M. Funabashi, T. Inoue, M. Madihian and M. Kuzuhara. "A 60 GHz-Band Low Noise HJFET Amplifier Module for Wireless LAN Applications." 1996 MTT-S International Microwave Symposium Digest 96.1 (1996 Vol. I [MWSYM]): 13-16.

A 60 GHz-band low noise amplifier (LNA) module has been developed based on 0.15 μ m AlGaAs/InGaAs heterojunction FET (HJFET) technologies. A two-stage MMIC amplifier was designed and fabricated, which exhibited a noise figure less than 3dB with a gain higher than 10dB over 59.5 to 61.5GHz range. For the module fabrication, two MMIC chips were mounted in a WR-15 waveguide housing. The four-stage amplifier module demonstrated a noise figure of 4dB and a gain higher than 24dB from 59 to 60GHz. To our knowledge, this is the best reported noise figure including a microstrip-to-waveguide transition loss, using GaAs-based MMICs operating at this frequency range. The measured output power for the module at 1dB gain compression point was 4dBm. Temperature test from -20 to 70° C revealed very small noise figure and gain variations of 0.35dB and 0.62dB, respectively.

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Abstracts

A Ka-Band GaInP/GaAs HBT Four-Stage LNA

A.P. Freundorfer, Y. Jamani and C. Falt. "A Ka-Band GaInP/GaAs HBT Four-Stage LNA." 1996 MTT-S International Microwave Symposium Digest 96.1 (1996 Vol. 1 [MWSYM]): 17-20.

A Ka-band GaInP/GaAs HBT four-stage LNA has been designed and fabricated. This circuit is to be used in a multifunction T/R module for local multipoint distribution systems (LMDS) which include both analog and digital transmission. An average noise figure of 6 dB from 27 GHz to 30 GHz, and a gain of greater than 15 dB were measured. These results are the best reported at Ka-band for a LNA using transistors from digital HBT library.



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Low Noise Heterodyne 89 GHz MMIC Module for the Multifrequency Imaging Microwave Radiometer (MIMR)

U. Guttich, J.-M. Dieudonne, A. Klaassen, H. Sledzik, K.-E. Schmegner, U. Goebel and M. Boheim. "Low Noise Heterodyne 89 GHz MMIC Module for the Multifrequency Imaging Microwave Radiometer (MIMR)." 1996 MTT-S International Microwave Symposium Digest 96.1 (1996 Vol. 1 [MWSYM]): 21-24.

The contribution describes the topology of the heterodyne 89 GHz channel of the Multifrequency Imaging Microwave Radiometer (MIMR). Several components such as double sideband 89 GHz mixer, 44.5 GHz local oscillator, frequency doubler, and IF low noise amplifier are realized using monolithic millimeter and microwave technology. Detector and band-defining low-pass filter are lumped element assemblies. The frontend concept yields a compact low power consuming module with a proposed overall noise figure of about 5.5 dB. A gain of 52 dB is expected between the 89.1 GHz $\pm$ 2.7 GHz RF input and the 0.1 GHz - 2.7 GHz IF output.

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A Technique for Deriving Noise-Parameters of Millimeter-Wave Low-Noise HEMTs and its Application to MMIC LNA Design

H. Yoshinaga, Y. Kashiwabara, B. Abe and K. Shibata. "A Technique for Deriving Noise-Parameters of Millimeter-Wave Low-Noise HEMTs and its Application to MMIC LNA Design." 1996 MTT-S International Microwave Symposium Digest 96.1 (1996 Vol. I [MWSYM]): 25-28.

An on-wafer tuning method has been applied to derive noise parameters of pseudomorphic HEMTs measured at W-Band and K-Band. As an application of the method, a K-Band MMIC LNA with 1.6 dB NF and greater than 32 dB gain has been successfully developed.

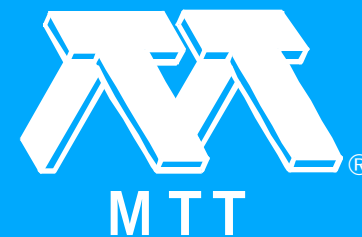
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Abstracts

Session TU1B -- Automotive Applications of Microwave and Millimeter Wave Techniques

*"Session TU1B -- Automotive Applications of Microwave and Millimeter Wave Techniques."
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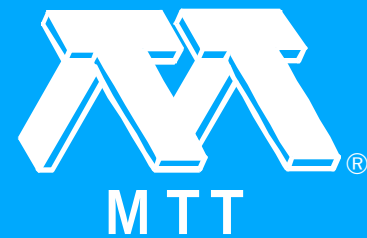


Abstracts

Microwave and Millimeter-Wave Applications in Automotive Electronics

R. Dixit. "Microwave and Millimeter-Wave Applications in Automotive Electronics." 1996 MTT-S International Microwave Symposium Digest 96.1 (1996 Vol. I [MWSYM]): 31-34.

This article will survey the issues and concepts related to microwave and millimeter wave product applications for Intelligent Transportation Systems. As the article will show, there is very significant worldwide opportunity and activity in improving transportation infrastructure by using capacity and safety enhancing products.



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Millimeter-Wave Automotive Radars and Related Technology

L. Raffaelli. "Millimeter-Wave Automotive Radars and Related Technology." 1996 MTT-S International Microwave Symposium Digest 96.1 (1996 Vol. I [MWSYM]): 35-38.

Automotive Radars are rapidly moving from R&D to the pre-production phase. The market opportunity is unprecedented. However, the cost targets require a transformation of the millimeter-wave industry from high performance, expensive prototype designers, to low-cost consumer product manufacturers. This paper will compare waveguide, hybrid and monolithic solutions based on performance and cost trade-offs.

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MMICS for Automotive Radar Applications

N.P. Morenc. "MMICS for Automotive Radar Applications." 1996 MTT-S International Microwave Symposium Digest 96.1 (1996 Vol. I [MWSYM]): 39-42.

The paper discusses trends in automotive radar applications and the use of MMICs in the transceiver design. Forward, rear, and side radar applications are discussed as a function of performance, size, cost, and Federal Communications Commission (FCC) radiation limits. Transceiver design options for each application are presented including choices for the active semiconductors required. GaAs, InP, and SiGe MMICs are design options for each application as are discrete semiconductor devices. Parameters used in device trade-offs, and advantages and disadvantages of each semiconductor technology relative to these parameters, are presented.

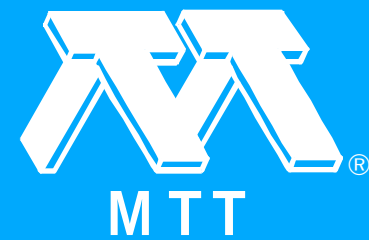
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Abstracts

Session TU1C -- High Power Sources and Control Components

"Session TU1C -- High Power Sources and Control Components." 1996 MTT-S International Microwave Symposium Digest 96.1 (1996 Vol. I [MWSYM]): 43-44.



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High Power V-Band Power Amplifier Using PHEMT Technology

J. Goel, G. Onak, D.I. Stones, D. Yamauchi, A. Sharma, K. Tan and J. Mancini. "High Power V-Band Power Amplifier Using PHEMT Technology." 1996 MTT-S International Microwave Symposium Digest 96.1 (1996 Vol. I [MWSYM]): 45-48.

A Millimeter wave power amplifier has been developed using power MMIC based on 0.15 Micron T gate pseudomorphic HEMT technology. A basic building block power module with 700 mW of output power has been demonstrated which covers 59.5 to 63.5 GHz. Eight such modules have been power combined using a novel Radial combiner to achieve 3.8 Watt output power level with more than 31 dB gain. This is the highest V-band power reported in the literature to date. With the demonstration of the low loss power combining schemes and the basic building block power module, levels of up to 10.0 Watts can be easily achieved by using higher order of combining.

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A High-Efficiency Single-Supply RFIC PHS Linear Power Amplifier with Low Adjacent Channel Power Leakage

B. Nelson, S. Cripps, J.S. Kenney and A.F. Podell. "A High-Efficiency Single-Supply RFIC PHS Linear Power Amplifier with Low Adjacent Channel Power Leakage." 1996 MTT-S International Microwave Symposium Digest 96.1 (1996 Vol. I [MWSYM]): 49-52.

We present the results and simulation for two 1.9GHz GaAs RFIC power amplifiers. Operated from a single 3.0V supply at a power added efficiency of 40%, these RFIC's produce +25 and +27 dBm output power, respectively, at -57 dBc adjacent channel power from a 384 kbps pi/4-DQPSK modulated carrier at 600 kHz offset. When operating in a saturated mode the same RFIC's have an output power greater than 26.5 and 28dBm respectively at over 45% PAE which makes them very attractive for the saturated output applications. We believe this is the best performance reported to date for PHS/PACS mode operation using a single supply RFIC monolithic power amplifier. The design technique, including simulation of spectral regrowth based on AM-AM and AM-PM characteristics, are presented for these amplifiers.

Click on title for a complete paper.



Abstracts

Millimeter Wave, Solid-State Amplifiers in Radar and Communication Systems

M. Russell, A. Marinilli and F. Sullivan. "Millimeter Wave, Solid-State Amplifiers in Radar and Communication Systems." 1996 MTT-S International Microwave Symposium Digest 96.1 (1996 Vol. 1 [MWSYM]): 53-56.

Two different designs of millimeter wave, high-power, solid-state amplifiers are presented here, one each for use in missile radar and satellite communication applications. Details of each design will be given along with the tradeoffs which led to the specific solid-state designs over other alternative solid-state and tube amplifier designs.



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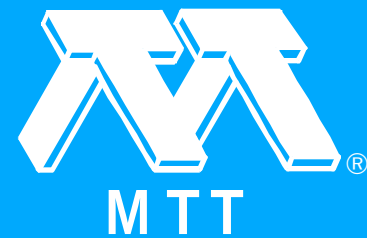


Abstracts

Compact, Reliable 70-Watt X-Band Power Module with Greater Than 30-Percent PAE

J. Sweder, G.A. Truitt, S.R. Nelson and J.S. Mason. "Compact, Reliable 70-Watt X-Band Power Module with Greater Than 30-Percent PAE." 1996 MTT-S International Microwave Symposium Digest 96.1 (1996 Vol. 1 [MWSYM]): 57-60.

A compact X-band solid state module with greater than 70 watts and over 30 percent PAE has been demonstrated over 9.5 to 9.9 GHz. A peak power level in excess of 77 watts with an associated PAE greater than 31 percent is reported. Minimum gain is greater than 13 dB over this frequency range. This was accomplished by combining six highly reliable 12-watt HFET MMIC amplifiers.



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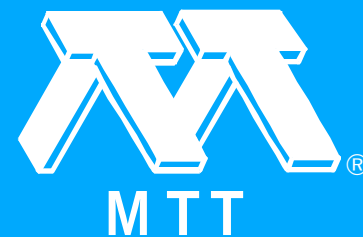


Abstracts

A New Microwave Power Source and Its Application

J. Liu, Z. Chen and Y. Zhong. "A New Microwave Power Source and Its Application." 1996 MTT-S International Microwave Symposium Digest 96.1 (1996 Vol. I [MWSYM]): 61-64.

We present here a new 2450 MHz power source in which the anode current of the magnetron can be linearly controlled. The tube is powered by a constant high voltage DC power supply and controlled by a current source circuit. Accurate control of the output power and the produced temperature in various medical applications can be realized by the modern control technologies, such as fuzzy control, robust control and adaptive control etc., through a computer system with a D/A converter. The applications to medical treatments and accurate moisture measurements are discussed.



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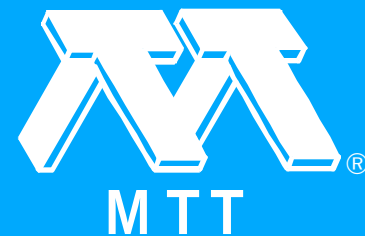
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New Devices for Processing of Powerful Short-Duration Single Microwave Pulses

B.D. Zaitsev, A.V. Ermolenko, V.A. Fedorenko and I.E. Kuznetsova. "New Devices for Processing of Powerful Short-Duration Single Microwave Pulses." 1996 MTT-S International Microwave Symposium Digest 96.1 (1996 Vol. I [MWSYM]): 65-68.

The problem of measuring of the single MW radiopulse parameters is actual. In this report new devices for processing of such signals based on the excitation and propagation surface or bulk acoustic waves (SAW and BAW) in nonlinear crystals are described.



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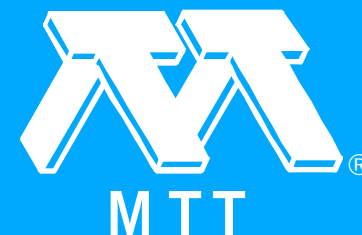
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Abstracts

Session TU1D -- Hybrid MCM Techniques and Applications

"Session TU1D -- Hybrid MCM Techniques and Applications." 1996 MTT-S International Microwave Symposium Digest 96.1 (1996 Vol. I [MWSYM]): 69-70.



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Abstracts

A Novel Microstrip Antenna Using Alumina-Ceramic/Polyimide Multilayer Dielectric Substrate

K. Kamogawa, T. Tokumitsu and M. Aikawa. "A Novel Microstrip Antenna Using Alumina-Ceramic/Polyimide Multilayer Dielectric Substrate." 1996 MTT-S International Microwave Symposium Digest 96.1 (1996 Vol. I [MWSYM]): 71-74.

A novel microstrip antenna using an alumina-ceramic/polyimide multilayer dielectric substrate is presented. This configuration in which two different multilayer materials with much different permittivities and thicknesses are stacked together, can be used for designing antenna with selective substrate thickness, thus providing the optimum substrate thickness for operation frequencies. We fabricated prototypes of a 10-GHz-band antenna and an 18-GHz-band antenna, that achieve good return loss of less than -30 dB and a general bandwidth of 2.8 %.



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Characterization of Metal on Elastomer Vertical Interconnections

F. Colomb, K. Eastman and J. Roman. "Characterization of Metal on Elastomer Vertical Interconnections." 1996 MTT-S International Microwave Symposium Digest 96.1 (1996 Vol. I [MWSYM]): 75-78.

A metal on elastomer vertical interconnection for multilayer microwave modules is presented. Measured insertion loss is 0.5 dB at 6 GHz. Layer to layer lateral misalignment of the substrates by as much as ± 0.006 inch causes only a 0.1 dB degradation in performance. A two-tier design approach is presented for first analyzing the vertical strips as a uniform multiconductor transmission line and then for including the interactions of all discontinuities in a 3D simulation using the finite element method.

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



Abstracts

New Multibeam Beamforming Networks for Phased Array Antennas Using Advanced MMCM Technology

F. Coromina, J. Ventura-Traveset, J.L. Corral, Y. Bonnaire and A. Dravet. "New Multibeam Beamforming Networks for Phased Array Antennas Using Advanced MMCM Technology." 1996 MTT-S International Microwave Symposium Digest 96.1 (1996 Vol. I [MWSYM]): 79-82.

A new concept for the implementation of complex RF beamforming networks (BFN) based on Microwave MultiChip Module (MMCM) technology, including MMICs and 3D multilayer structure is presented. Its validity is fully demonstrated by the fabrication and characterization of a S-Band 9x9 beamformer using low cost, low mass space qualifiable processes and exhibiting remarkable RF performances.



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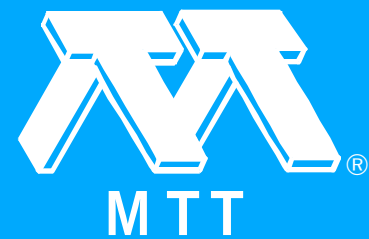
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Integration of Various Types of Compensated Dielectric Bridges for mm Coplanar Applications

L. Stephan, J.P. Coupez, E. Rius, C. Person and S. Toutain. "Integration of Various Types of Compensated Dielectric Bridges for mm Coplanar Applications." 1996 MTT-S International Microwave Symposium Digest 96.1 (1996 Vol. I [MWSYM]): 83-86.

This paper describes a new approach in the realization of integrated dielectric bridges for uniplanar technology. It shows how the electrical characteristics of a CPW are disturbed and how these parasitic effects may be compensated by simply modifying the strip width of the transmission line. Based on this approach several solutions are presented. Theoretical results (static analysis) and experimental results ("on wafer" measurements, 1 GHz - 50 GHz) are compared. In order to verify the efficiency of these dielectric bridges, filtering structures are tested.

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Temperature and Bias Effects in High Resistivity Silicon Substrates

A.C. Reyes, S.M. El-Ghazaly, S. Dorn and M. Dydyk. "Temperature and Bias Effects in High Resistivity Silicon Substrates." 1996 MTT-S International Microwave Symposium Digest 96.1 (1996 Vol. I [MWSYM]): 87-90.

The purpose of this paper is to report the results of studies dealing with the impact of temperature and DC bias on low-cost low loss high resistivity (HR) Si substrate. Measured results show that microwave performance of a coplanar transmission lines and a meander inductive structure realized on HR Si are not affected by applied DC bias from -10 V to 10 V in the temperature range from -50 °C to 50 °C. Furthermore, measured results demonstrate that the losses of the structures under study on HR Si are comparable to the losses of similar structures on semi-insulating (SI) GaAs up to 100°C.

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Abstracts

The Hybrid Integrated Planar/NRD-Guide Technology: A New Concept for Low-Cost Application of Microwave and Millimeter-Wave Circuits

K. Wu and L. Han. "The Hybrid Integrated Planar/NRD-Guide Technology: A New Concept for Low-Cost Application of Microwave and Millimeter-Wave Circuits." 1996 MTT-S International Microwave Symposium Digest 96.1 (1996 Vol. I [MWSYM]): 91-94.

A novel hybrid integrated planar/NRD-guide architecture is proposed. This technology offers a unique feature of exploiting inherent advantages of planar structures and NRD waveguide for low-cost wireless applications. Experimental results show that the hybrid technology promises to be useful in the design of future microwave and millimeter-wave circuits and systems.



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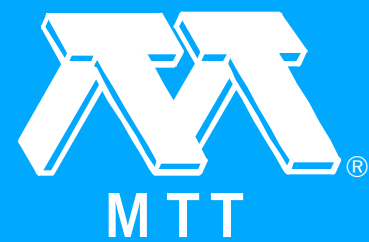
Temperature Stability for Microstrip Delay Lines on High Permittivity Substrates

T. Ashour, L. Fan, Z. Ding and K. Chang. "Temperature Stability for Microstrip Delay Lines on High Permittivity Substrates." 1996 MTT-S International Microwave Symposium Digest 96.1 (1996 Vol. I [MWSYM]): 95-98.

A constant time delay over temperature for miniaturized microstrip delay lines on high permittivity substrates is of great importance for many applications, particularly for space systems. A simple design formula helpful for the selection of a highly temperature stable substrate is presented. Moreover, a 274 ps delay line on CB substrate with a 0.40 % variation in time delay over the temperature range of -52°C to +50°C has been developed.

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High Purity Ferroelectric Materials by Sol-Gel Process for Microwave Applications

F. De Flaviis, D. Chang, N.G. Alexopoulos and O.M. Stafsudd. "High Purity Ferroelectric Materials by Sol-Gel Process for Microwave Applications." 1996 MTT-S International Microwave Symposium Digest 96.1 (1996 Vol. I [MWSYM]): 99-102.

Ferroelectric materials (FEM) have a dielectric constant which can be modulated at high frequencies (up to the optical range), under the effect of an electric field bias. The bias is perpendicular to the direction of propagation of the signal. This property is very attractive and can be used to develop a new family of devices operating in the microwave and millimeter range. Among these devices, tunable delay phase shifters for electronically scanned arrays, tunable filters, variable power dividers, are the most promising. The reason FEM materials haven't been used at high frequencies is due to the large bias voltage required to change their dielectric constant, and due to the high losses of the materials. In this paper a new chemical process for the synthesis of high quality low loss thin film and thin ceramics of BaTiO/sub 3/(BTO), Ba/sub x/Sr/sub 1-x/TiO/sub 3/(BST) and PbTiO/sub 3/(PTO) is presented. The high quality of these materials and the use of strontium as a dopant for BTO, or calcium for the PTO helps to reduce the losses. Also use of the Sol-Gel process for deposition of thin film of FEM having thickness below 0.1mm, reduces the required bias voltage below 10V, making these devices fully compatible with analog circuits. Thin film and thin ceramic devices operating up to 3 GHz are presented and characterized as examples.

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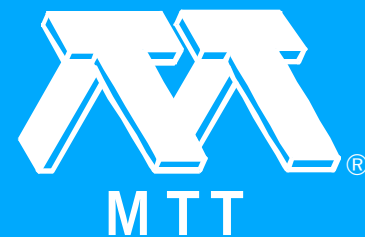


Abstracts

A New Technology for Si Microwave Power Transistor Manufacturing

P. Li and T. Boles. "A New Technology for Si Microwave Power Transistor Manufacturing." 1996 MTT-S International Microwave Symposium Digest 96.1 (1996 Vol. I [MWSYM]): 103-106.

We, for the first time, demonstrate a new process for Si power transistor manufacturing. The new process, combining the HMIC process and flip-chip process, completely changes the Si power transistor internal matching circuits design and manufacturing. S-band Si power transistor was used as a testing vehicle and under pulse operation condition $P_{out}=23$ W with 7.9 dB of gain and 39% of efficiency were obtained at $f=3.05$ GHz and $V_{cc}=36$ V.



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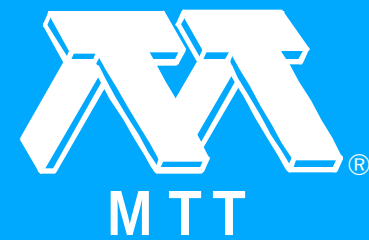
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Abstracts

Session TU1E -- Non-Reciprocal Ferrite and Semiconductor Devices

"Session TU1E -- Non-Reciprocal Ferrite and Semiconductor Devices." 1996 MTT-S International Microwave Symposium Digest 96.1 (1996 Vol. I [MWSYM]): 107-108.



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Broadband Millimetric Semiconductor Junction Circulators at 77K

R. Sloan, C.K. Yong and L.E. Davis. "Broadband Millimetric Semiconductor Junction Circulators at 77K." 1996 MTT-S International Microwave Symposium Digest 96.1 (1996 Vol. I [MWSYM]): 109-112.

Broadband circulation at millimetric frequencies is currently unavailable. However on utilising the gyrotropic behaviour of the magnetised semiconductor this appears possible. Low-loss theoretical results are presented which suggest GaAs and InSb circulators are feasible with bandwidths greater than an octave and operating up to 125 GHz at a temperature of 77K.

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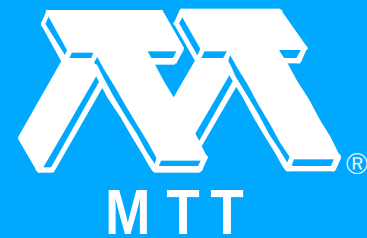


Abstracts

K-Band Circulators on Semiconductor Wafers

*J.D. Adam, H. Buhay, M.R. Daniel, G.W. Eldridge, M.H. Hanes, R.L. Messham and T.J. Smith.
"K-Band Circulators on Semiconductor Wafers." 1996 MTT-S International Microwave
Symposium Digest 96.1 (1996 Vol. I [MWSYM]): 113-116.*

We report on the development of K-Band circulators operating at 20 and 35 GHz which have been monolithically integrated with both GaAs and epitaxial GaAs-on-Si wafers. They demonstrate the potential for a fully integrated T/R module application.



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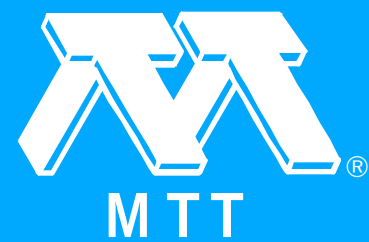
Optimization of a Lumped Element Circulator Based on Eigen Inductance Evaluation and Structural Improvement

T. Miura, M. Kobayashi, H. Nagata and Y. Konishi. "Optimization of a Lumped Element Circulator Based on Eigen Inductance Evaluation and Structural Improvement." 1996 MTT-S International Microwave Symposium Digest 96.1 (1996 Vol. I [MWSYM]): 117-120.

An optimization technique for a lumped element circulators has been established from the point of view of structure and characteristic design. Structural optimization was achieved by the application of multilayer ceramic technology and a novel conductor formation method to decrease the insertion loss of the circulator. A theoretical design based on an evaluation of eigen inductance made it possible to broaden the isolation bandwidth of a structurally improved circulator. The 20dB isolation bandwidth of 5.89% and the insertion loss of 0.55dB at 800MHz obtained by this circulator have significantly exceeded the characteristics of conventional circulators of the same size.

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3D Dyadic Green's Function for Radially Inhomogeneous Circular Ferrite Circulator

C.M. Krowne. "3D Dyadic Green's Function for Radially Inhomogeneous Circular Ferrite Circulator." 1996 MTT-S International Microwave Symposium Digest 96.1 (1996 Vol. I [MWSYM]): 121-124.

Here we develop a three dimensional (3D) dyadic recursive Green's function with elements G_{sv} over ij suitable for determining the electric field components (E_z , E_r , E_ϕ) and magnetic field components (H_z , H_r , H_ϕ) anywhere within a circular, planar (microstrip or stripline) circulator. All of the components are present, although the E_z , H_r , and H_ϕ components may still be dominant as long as the thickness h of the substrate is small. The recursive nature of G_{sv} over ij is a reflection of the inhomogeneous region being broken up into one inner disk containing a singularity and N annuli, G_{sv} over ij , (r, ϕ, z) is found for any arbitrary point (r, ϕ, z) within the disk region and within any i th annulus. Specification of G_{sv} over ij , $i = E$ or H , $j = H$, $s = z$, $v = \phi$ or r , at the circulator diameter $r = R$ leads to the determination of the circulator s -parameters. The ports have been separated into discretized ports with elements (subports) and continuous ports. It is shown how G_{zv} over ij (r, ϕ, z) enables s -parameters to be found for three and six port ferrite circulators. Because of the z -variation present in the finite thickness model, TEM, TM, and TE modal decompositions are not allowed for the 3D analysis, and instead it is found that new coupled governing equations describe the field behavior in the circulator. The theory is readily acceptable to constructing a computer code for numerical evaluation of finite thickness devices. Also, symmetric port disposition and metallic losses are covered.

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Abstracts

Finite Element Modeling of Ferrite Phase Shifters

S.N. Stitzer. "Finite Element Modeling of Ferrite Phase Shifters." 1996 MTT-S International Microwave Symposium Digest 96.1 (1996 Vol. I [MWSYM]): 125-128.

New full 3-D finite element modeling software has been used to analyze transmission modes in ferrite-based stripline and waveguide devices. Computed results are presented for phase shifters made in twin slab, toroid, microstrip and planar forms. Geometry features such as corner effects and domain magnetization have been analyzed.



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Abstracts

Full Wave Analysis of Edge-Guided Mode Microstrip Isolator (1996 Vol. I [MWSYM])

T.F. Elshafiey, J.T. Aberle and E.-B. El-Sharawy. "Full Wave Analysis of Edge-Guided Mode Microstrip Isolator (1996 Vol. I [MWSYM])." 1996 MTT-S International Microwave Symposium Digest 96.1 (1996 Vol. I [MWSYM]): 129-132.

This paper presents a full-wave analysis of three Edge-Guided Mode microstrip isolator structures. Galerkin's technique in the spectral domain is used to calculate the insertion loss and the isolation of the structures. The paper presents figures of merit of different multilayer structures. A multilayer structure resulted in increased isolation and lower insertion loss.



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Plenary Session TU2A (1996 Vol. I [MWSYM])

"Plenary Session TU2A (1996 Vol. I [MWSYM])." 1996 MTT-S International Microwave Symposium Digest 96.1 (1996 Vol. I [MWSYM]): 133-134.



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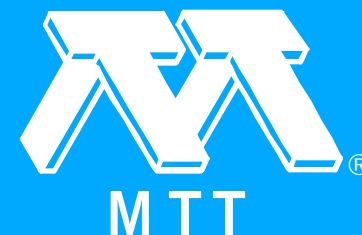
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Abstracts

Session TU3A -- Large Signal Generation and Amplification

"Session TU3A -- Large Signal Generation and Amplification." 1996 MTT-S International Microwave Symposium Digest 96.1 (1996 Vol. I [MWSYM]): 135-136.



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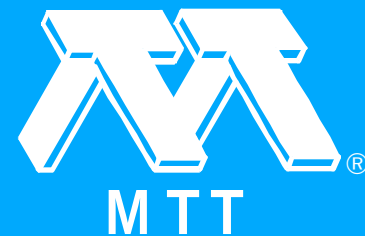


Abstracts

Monolithic VCO Using a Novel Active Inductor

Y. Cho, S. Hong and Y. Kwon. "Monolithic VCO Using a Novel Active Inductor." 1996 MTT-S International Microwave Symposium Digest 96.1 (1996 Vol. I [MWSYM]): 137-140.

A novel high-Q tunable active inductor utilizing a common-source cascode FET with a lossy active inductor feedback is described. Using this active inductor, we propose a monolithic VCO with a frequency tuning range from 1.66 GHz to 2.2 GHz in a compact area of 0.7 x 1.2 mm².



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A High-Performance and Miniaturized Dual-Use (Antenna/Local) GaAs SPDT Switch IC Operating at +3V/0V

H. Uda, K. Nogawa, T. Hirai, T. Sawai, T. Higashino and Y. Harada. "A High-Performance and Miniaturized Dual-Use (Antenna/Local) GaAs SPDT Switch IC Operating at +3V/0V." 1996 MTT-S International Microwave Symposium Digest 96.1 (1996 Vol. I [MWSYM]): 141-144.

We have developed an ultra-compact dual-use (antenna/local) switch IC for PHS operating at +3/0 V. This IC has a circuit configuration which utilizes MESFETS with two kinds of pinch-off voltages. Additional applied techniques include a circuit design method that employed electromagnetic field analysis, a pull-up method which utilizes forward current flowing in order through the gates of MESFETS, and high isolation characteristic obtained by use of a chip inductor. The insertion loss and isolation characteristics of this IC are, respectively, 0.54 dB and 28.4 dB at 1.9 GHz and 0.48 dB and 30.0 dB at 1.65 GHz. Furthermore, we were able to suppress adjacent channel leakage power to 61.5 dBc at 600-kHz offset during input power of 22 dBm QPSK modulated signals.



Abstracts

High Efficiency X-Ku Band MMIC Power Amplifiers

M. Cardullo, C. Page, D. Teeter and A. Platzker. "High Efficiency X-Ku Band MMIC Power Amplifiers." 1996 MTT-S International Microwave Symposium Digest 96.1 (1996 Vol. I [MWSYM]): 145-148.

MMIC power amplifiers with 3.5 W nominal output power and 49.5% peak power added efficiency over the 8-14 GHz band are described. Efficiency in excess of 40% is obtained over much of the band. The amplifiers utilize Raytheon's power PHEMT technology. Details of the device performance, circuit design, and evaluation are given. The results presented represent state of the art performance for MMIC circuits over X-KU band.



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Fully-Matched, High-Efficiency Q-Band 1 Watt MMIC Solid State Power Amplifier

Y. Hwang, P.D. Chow, J. Lester, J. Chi, D. Garske, M. Biedenbender and R. Lai. "Fully-Matched, High-Efficiency Q-Band 1 Watt MMIC Solid State Power Amplifier." 1996 MTT-S International Microwave Symposium Digest 96.1 (1996 Vol. I [MWSYM]): 149-152.

A fully-matched, high-efficiency Q-band 1 watt MMIC power amplifier has been developed. This chip utilized 2 mil-thick GaAs substrate to improve amplifier gain, power added efficiency and heat dissipation. 1 watt output power and 30% efficiency was achieved at 44 GHz.

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Abstracts

Highly Efficient Compact Q-Band MMIC Power Amplifier Using 2-MIL Substrate and Partially-Matched Output

J.A. Lester, Y. Hwang, J. Chi, R. Lai, M. Biedenbender and P.D. Chow. "Highly Efficient Compact Q-Band MMIC Power Amplifier Using 2-MIL Substrate and Partially-Matched Output." 1996 MTT-S International Microwave Symposium Digest 96.1 (1996 Vol. I [MWSYM]): 153-156.

Presented is an 850 mW Q-Band PHEMT MMIC power amplifier with a peak efficiency of 34% at 45.5 GHz, believed to be the highest reported at this power level and frequency. The compact amplifier (3.6 mm by 1.6 mm) features the use of a thinned 2-mil GaAs substrate and off-chip output matching and combining on a 5-mil alumina substrate.



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A Practical MMIC Negative Resistance Structure for X and Ku Band Applications

M.R. Moazzam and M. Darvishzadeh. "A Practical MMIC Negative Resistance Structure for X and Ku Band Applications." 1996 MTT-S International Microwave Symposium Digest 96.1 (1996 Vol. 1 [MWSYM]): 157-160.

This paper presents the mathematical analysis and measured results of a novel practical MMIC negative resistance structure. This structure operates at X and Ku bands. The measured results show a negative resistance (down to -50 Ω) over a 6 GHz bandwidth centered at 11 GHz.



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GaAs Monolithic Integrated Microwave Power Sensor in Coplanar Waveguide Technology

A. Dehe, H. Klingbeil, V. Krozer, K. Fricke, K. Beilenhoff and H.L. Hartnagel. "GaAs Monolithic Integrated Microwave Power Sensor in Coplanar Waveguide Technology." 1996 MTT-S International Microwave Symposium Digest 96.1 (1996 Vol. I [MWSYM]): 161-164.

We present the fabrication technology, theoretical and experimental results of a novel MMIC compatible broadband power sensor. With a 50 Ohm coplanar waveguide design, integrated AlGaAs thermoelectric sensor and GaAs bulk micromachined membrane for increased sensitivity this sensor is capable of detecting RF power with a sensitivity of 1.1V/W without any waveguide coupling structure.

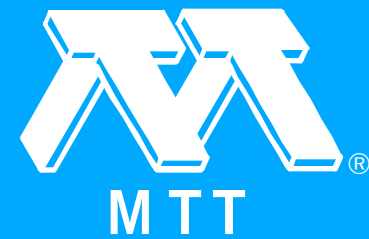
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Session TU3B -- New Guiding and Radiative Effects on Planar Circuit

"Session TU3B -- New Guiding and Radiative Effects on Planar Circuit." 1996 MTT-S International Microwave Symposium Digest 96.1 (1996 Vol. I [MWSYM]): 165-166.



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Abstracts

Utilization of the Matrix Pencil Technique for Determining Modal Propagation Characteristics of Printed Circuits

T.K. Sarkar, R.S. Adve, Z.A. Maricevic and M.S. Palma. "Utilization of the Matrix Pencil Technique for Determining Modal Propagation Characteristics of Printed Circuits." 1996 MTT-S International Microwave Symposium Digest 96.1 (1996 Vol. I [MWSYM]): 167-170.

First the surface current distributions on finite microstrip structures of arbitrary shape are solved for by the method of moments utilizing a conventional delta gap excitation. The Matrix Pencil Techniques is then used to decompose the currents along the feed and terminating lines into forward and backward traveling waves, yielding scattering parameters of device. This approach has been utilized to predict the input parameters of leaky wave antennas and for predicting scattering parameters of printed circuits. Experimental verification has been carried out to validate the theory.



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Excitation of Leaky Modes on Multilayer Stripline

C. Di Nallo, F. Mesa and D.R. Jackson. "Excitation of Leaky Modes on Multilayer Stripline." 1996 MTT-S International Microwave Symposium Digest 96.1 (1996 Vol. I [MWSYM]): 171-174.

The practical issue of excitation of leaky modes on multilayered stripline structures is analyzed. The excitation is studied by calculating the current on the strip conductor due to a source. The GPOF method is used to investigate the physical meaning of the leaky modes.

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Abstracts

A Simple Formulation for Complex Modes of Image Lines

S.T. Peng and J.J. Wu. "A Simple Formulation for Complex Modes of Image Lines." 1996 MTT-S International Microwave Symposium Digest 96.1 (1996 Vol. I [MWSYM]): 175-178.

We present here an analysis of a shielded image line by the simple method of effective dielectric constant. The concept of negative effective dielectric constant is utilized for a below-cutoff mode, so that the occurrence of backward flow of energy and the existence of complex modes in such a class of waveguides become physically transparent via the familiar physical phenomena associated with the class of dielectric-plasma structures. The merits of this method is its simplicity and general applicability to a large class of structures. Numerical results are shown to illustrate the accuracy obtainable from the present approach.



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A New Type of the Narrow-Pulse Distortion Caused by the Simultaneous-Propagation Effect of Both Bound and Leaky Modes on Printed-Circuit Transmission Lines

M. Tsuji, H. Takayama and H. Shigesawa. "A New Type of the Narrow-Pulse Distortion Caused by the Simultaneous-Propagation Effect of Both Bound and Leaky Modes on Printed-Circuit Transmission Lines." 1996 MTT-S International Microwave Symposium Digest 96.1 (1996 Vol. I [MWSYM]): 179-182.

We report here a new type of the narrow-pulse distortion. Our first two papers reported for the first time that the power-leakage effect on most of printed-circuit transmission lines, which was discovered by us, caused a serious narrow-pulse distortion. Our investigation then discovered also the surprising presence of the simultaneous-propagation effect of both bound and leaky dominant modes on printed-circuit transmission lines. We present here that this effect causes a new type of the narrow-pulse distortion. An important result revealed here is that a narrow pulse inevitably changes into a wide pulse attended with a serious problem relating to the interconnects, even as such a pulse travels along a uniform line.



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Leakage Fields from Planar Semi-Infinite Transmission Lines

F.J. Villegas, D.R. Jackson and J.T. Williams. "Leakage Fields from Planar Semi-Infinite Transmission Lines." 1996 MTT-S International Microwave Symposium Digest 96.1 (1996 Vol. I [MWSYM]): 183-186.

The leakage fields radiated by planar semi-infinite transmission line currents are studied for two canonical structures, the air-gap stripline and a strip in free space. The exact leakage fields are compared with the following two asymptotic approximations: a stationary-phase (geometrical optics or GO) evaluation and a uniform asymptotic expansion.

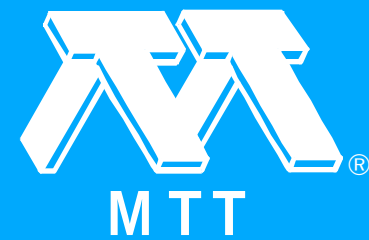
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Abstracts

Session TU3C -- Frequency-Domain Modeling of Microwave Structures

"Session TU3C -- Frequency-Domain Modeling of Microwave Structures." 1996 MTT-S International Microwave Symposium Digest 96.1 (1996 Vol. I [MWSYM]): 187-188.



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Optimum Port Numbering in the Electromagnetic Simulation of Complex Networks

M. Dionigi, A. Esposito, L. Tarricone and R. Sorrentino. "Optimum Port Numbering in the Electromagnetic Simulation of Complex Networks." 1996 MTT-S International Microwave Symposium Digest 96.1 (1996 Vol. I [MWSYM]): 189-192.

A new strategy based on combinatorial optimization of the port numbering in combination with the Mode Matching method has been developed for the fullwave analysis of complex networks. The approach has been implemented on both serial and parallel platforms and is shown to provide excellent efficiency (more than 20 times of speed-up) overcoming the limitations of previous approaches based on graph theory.



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Discrete Mode Matching for the Full-Wave Analysis of Planar Waveguide Structures

A. Dreher. "Discrete Mode Matching for the Full-Wave Analysis of Planar Waveguide Structures." 1996 MTT-S International Microwave Symposium Digest 96.1 (1996 Vol. 1 [MWSYM]): 193-196.

A new spectral domain method is proposed for the exact, efficient numerical full-wave analysis of planar multilayer, multiconductor optical, microwave waveguide structures. It includes a systematic procedure with very less analytical, computational effort. The propagation constants are calculated for some examples, compared to existing results.

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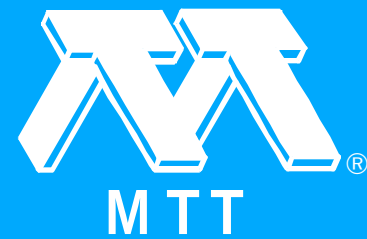


Abstracts

Hybrid Dynamic-Static Finite-Difference Approach for MMIC Design

S. Lindenmeier, P. Russer and W. Heinrich. "Hybrid Dynamic-Static Finite-Difference Approach for MMIC Design." 1996 MTT-S International Microwave Symposium Digest 96.1 (1996 Vol. I [MWSYM]): 197-200.

The efficiency of the Finite-Difference method is improved by combining the full-wave analysis with a quasi-static approach: Those regions of a structure which require a spatial resolution far below the wavelength are described by a quasistatic analysis. As a consequence, the mesh size of the dynamic problem and hence the numerical efforts can be reduced significantly. The savings are particularly high for miniaturized geometries such as used in coplanar MMIC geometries.



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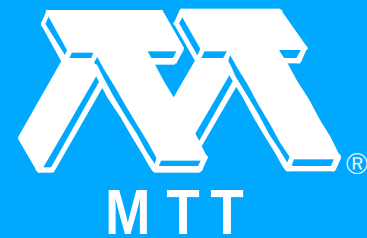


Abstracts

Efficient Implementation of Higher Order Expansion Functions Into the Spectral Domain Analysis of Planar Circuits

T. Vaupel and V. Hansen. "Efficient Implementation of Higher Order Expansion Functions Into the Spectral Domain Analysis of Planar Circuits." 1996 MTT-S International Microwave Symposium Digest 96.1 (1996 Vol. I [MWSYM]): 201-204.

This contribution deals with a spectral domain analysis of planar circuits with a very flexible nonuniform mesh strategy using different kinds of expansion functions. Accelerating schemes to improve the evaluation of the spectral domain integrals and special matrix fill techniques are presented.



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On the Accuracy of Perfectly Matched Layers Using a Finite Element Formulation

M.R. Lyons, A.C. Polycarpou and C.A. Balanis. "On the Accuracy of Perfectly Matched Layers Using a Finite Element Formulation." 1996 MTT-S International Microwave Symposium Digest 96.1 (1996 Vol. 1 [MWSYM]): 205-208.

A Perfectly Matched Layer (PML) is applied to a three-dimensional edge-based finite element formulation to calculate the S-parameters of waveguide structures. The PML region is implemented in the finite element code as a non-physical uniaxial anisotropic lossy material. Numerical results demonstrate the accuracy and future potential of such an absorber.

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



Abstracts

Application and Design Guidelines of the PML Absorber for Finite Element Simulations of Microwave Packages

J. Gong, S. Legault, Y. Botros, J.L. Volakis and P. Petre. "Application and Design Guidelines of the PML Absorber for Finite Element Simulations of Microwave Packages." 1996 MTT-S International Microwave Symposium Digest 96.1 (1996 Vol. I [MWSYM]): 209-212.

The recently introduced perfectly matched layer (PML) uniaxial absorber for frequency domain finite element simulations has several advantages. In this paper we present the application of PML for microwave circuit simulations along with design guidelines to obtain a desired level of absorption. Different feeding techniques are also investigated for improved accuracy.



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Abstracts

Session TU3D -- Historical Perspectives on Microwaves in the San Francisco Bay Area

*"Session TU3D -- Historical Perspectives on Microwaves in the San Francisco Bay Area." 1996
MTT-S International Microwave Symposium Digest 96.1 (1996 Vol. I [MWSYM]): 213-214.*



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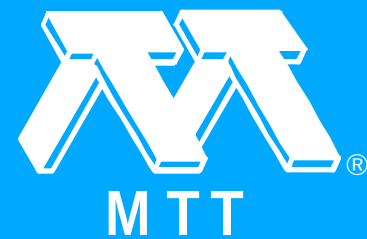


Abstracts

Microwave Technology and Industry Dynamics from WWII to 1970

D.A. Watkins. "Microwave Technology and Industry Dynamics from WWII to 1970." 1996 MTT-S International Microwave Symposium Digest 96.1 (1996 Vol. I [MWSYM]): 215-215.

Useful applications of microwaves (all military) were first developed in the East during World War II. Some of the principal pioneers in that work came (or came back) to the Bay Area following the war to establish research programs at Stanford and at the University of California-Berkeley and to found new enterprises such as Varian Associates and Litton Industries. Hewlett-Packard, which was housed in a small wooden building on Page Mill road near the Southern Pacific tracks, began to add microwave test instruments to its product line. This presentation traces the work of the Bay Area pioneers and their offspring from the beginning to about 1970 when solid-state microwave devices and strip lines began to replace microwave tubes and waveguides at low power levels.



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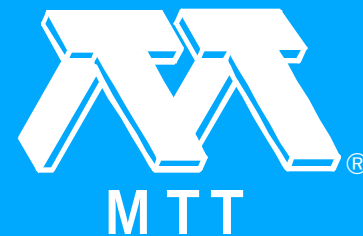


Abstracts

Early History of Radar and Countermeasures

B.B. May. "Early History of Radar and Countermeasures." 1996 MTT-S International Microwave Symposium Digest 96.1 (1996 Vol. I [MWSYM]): 215-215.

Applications of microwaves to the World War II effort will be traced from the inception of radar prior to the war through the expansion to higher frequencies and broader bandwidths during the war. System considerations that drove these changes will be discussed including countermeasures and counter-countermeasures.



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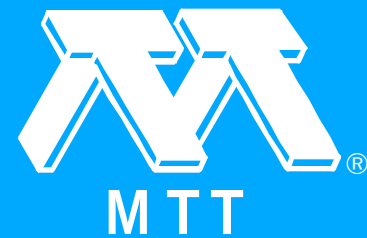


Abstracts

Microwave Satellite Communications/Navigation Contributions in the San Francisco Bay Area - A Historical Perspective

J.J. Spilker, Jr.. "Microwave Satellite Communications/Navigation Contributions in the San Francisco Bay Area - A Historical Perspective." 1996 MTT-S International Microwave Symposium Digest 96.1 (1996 Vol. I [MWSYM]): 215-215.

Microwave satellite communications and GPS satellite navigation are proving to be of great value. Much of the new advancements in wireless digital communications being made now had their foundations years ago in digital satellite communication for the military. Likewise, probably the most important commercial product of the Cold War is the US GPS navigation system.



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Abstracts

Microwave Instruments: The Past and the Future

R.W. Anderson. "Microwave Instruments: The Past and the Future." 1996 MTT-S International Microwave Symposium Digest 96.1 (1996 Vol. I [MWSYM]): 216-216.



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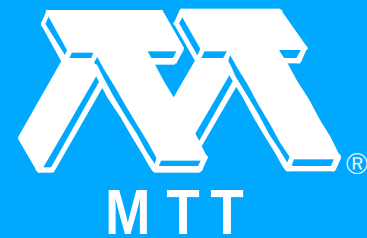


Abstracts

Early Contributions to Microwave Components at SRI

S.B. Cohn. "Early Contributions to Microwave Components at SRI." 1996 MTT-S International Microwave Symposium Digest 96.1 (1996 Vol. I [MWSYM]): 216-216.

In 1953, I joined a small group of engineers at Stanford Research Institute working on novel kinds of microwave antennas.



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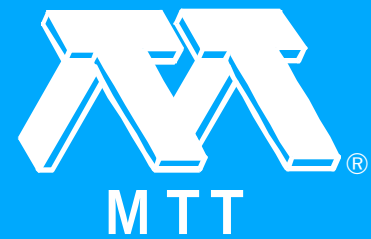


Abstracts

Some Early Passive Microwave Circuit Contributions in the Bay Area

G.L. Matthaei. "Some Early Passive Microwave Circuit Contributions in the Bay Area." 1996 MTT-S International Microwave Symposium Digest 96.1 (1996 Vol. I [MWSYM]): 216-216.

In the middle of this century considerable creative microwave activity was taking place at companies and universities in the Bay Area.



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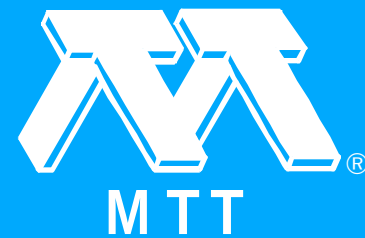


Abstracts

Bay Area's Solid State Microwave Device Heritage

J.S. Barrera. "Bay Area's Solid State Microwave Device Heritage." 1996 MTT-S International Microwave Symposium Digest 96.1 (1996 Vol. I [MWSYM]): 216-216.

While it is well-known that much of the progress in microwave power generation from tubes has occurred over the years in the California Bay Area, it should also be known that much significant activity in the solid state microwave device field has its roots here as well.



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Electron Beam Devices

C. Loeb. "Electron Beam Devices." 1996 MTT-S International Microwave Symposium Digest 96.1 (1996 Vol. I [MWSYM]): 216-216.



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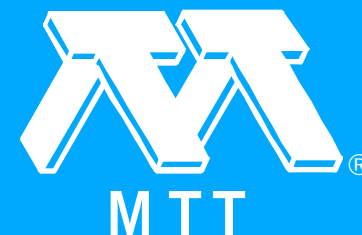
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Abstracts

Session TU3E -- Packaging and Interconnect Technologies

"Session TU3E -- Packaging and Interconnect Technologies." 1996 MTT-S International Microwave Symposium Digest 96.1 (1996 Vol. I [MWSYM]): 217-218.



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Abstracts

Multichip-on-Flex Plastic Encapsulated MHDI - Low Cost Substrateless Manufacturing for Microwave and Millimeterwave Modules

P.D. Cooper, P.A. Piacente and R.J. Street. "Multichip-on-Flex Plastic Encapsulated MHDI - Low Cost Substrateless Manufacturing for Microwave and Millimeterwave Modules." 1996 MTT-S International Microwave Symposium Digest 96.1 (1996 Vol. I [MWSYM]): 219-222.

This paper describes Chip-on-Flex (COF) technology developed by Lockheed Martin/GE as a low cost derivative of the LM/GE Microwave High Density Interconnect (MHDI) technology. Cost take-out is being achieved by directly mounting MMIC chips onto a pre-fabricated polyimide flex circuit eliminating the need to procure expensive ceramic or metal substrates. Structural rigidity is provided by molded plastic to encapsulate the back of the chips. A C-Band T/R module is reported as the proof-of-concept demonstration vehicle, with up to 3.5 watts RF output having been measured over 5 to 6 GHz.



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Experimental and Theoretical Study of Parasitic Leakage/Resonance in a K/Ka-Band MMIC Package (1996 Vol. I [MWSYM])

J.-G. Yook, L.P.B. Katehi, R.N. Simons and K. Shalkhauser. "Experimental and Theoretical Study of Parasitic Leakage/Resonance in a K/Ka-Band MMIC Package (1996 Vol. I [MWSYM])." 1996 MTT-S International Microwave Symposium Digest 96.1 (1996 Vol. I [MWSYM]): 223-226.

In this paper, electromagnetic leakage and spurious resonances in a K/Ka-band (18 - 40 GHz) MMIC hermetic package designed for a phase shifter chip are studied using the finite element method (FEM) and the numerical simulation results are compared with measured data. Both in measured and calculated data several spurious resonances are observed in the 18 to 24 GHz region and the origin of this phenomenon is identified by virtue of the modeling capability of the FEM.

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Thermally Enhanced Plastic Packages Using Diamond for Microwave Applications

M. Gomes-Casseres and P.M. Fabis. "Thermally Enhanced Plastic Packages Using Diamond for Microwave Applications." 1996 MTT-S International Microwave Symposium Digest 96.1 (1996 Vol. 1 [MWSYM]): 227-230.

The superior material properties of CVD diamond combined with the economics of plastic provide an improved thermal management solution for microwave packages. The thermomechanical issues of attaching Gallium Arsenide devices to diamond have been investigated. Results indicate that a 43% decrease in maximum junction temperature and a 106 increase in mean time between failure has been achieved. In addition, an insertion loss of <1.5 dB and a VSWR of 1.5:1 was achieved for a 1 inch long 50 Ohm coplanar transmission line up to 20 GHz.

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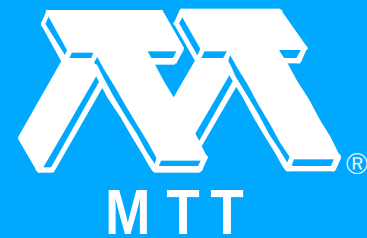


Abstracts

Solder Free Interconnects for Mixed Signal (DC/Microwave) Systems

D. Strack, H. Fudem, F. Kuss, W. Marsh and J. Costello. "Solder Free Interconnects for Mixed Signal (DC/Microwave) Systems." 1996 MTT-S International Microwave Symposium Digest 96.1 (1996 Vol. I [MWSYM]): 231-234.

A method of achieving high density interconnections is demonstrated through the use of solder free interconnects, between multilayer substrates in which a common technology can be used for both microwave and DC interconnects of large electronic systems.



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Abstracts

Transitions and Interconnects Using Coplanar Waveguide and Other Three Conductor Transmission Lines

R. Sturdivant, C. Quan and J. Wooldridge. "Transitions and Interconnects Using Coplanar Waveguide and Other Three Conductor Transmission Lines." 1996 MTT-S International Microwave Symposium Digest 96.1 (1996 Vol. I [MWSYM]): 235-238.

Multilayer substrates allow high density packaging of microwave components. Because of this, microwave products are being developed using technologies such as cofired AlN, LTCC, polyimide, soft substrates and various multilayer thin film methods. These multilayer boards often require the use of vertical interconnects and transitions to and from various transmission line types. By using three conductor lines such as CPW, it is possible to develop a packaging technique which permits operation up to 20 GHz. A packaging approach tailored for airborne radar is described along with the interconnects and transitions used in the module. This includes the use of 3-wire line. Transitions to/from CBCPW, stripline, 3-wire line, and microstrip are described along with modeling and test data. In addition, test data is presented on solderless interconnects using button connectors.



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Investigation of MMIC Flip Chips with Sealants for Improved Reliability without Hermeticity

R. Sturdivant, C. Quan and J. Wooldridge. "Investigation of MMIC Flip Chips with Sealants for Improved Reliability without Hermeticity." 1996 MTT-S International Microwave Symposium Digest 96.1 (1996 Vol. 1 [MWSYM]): 239-242.

As a result of the advantages they offer, MMIC flip chips are being developed for airborne radar applications. Some of the benefits of this technology are lower wafer processing cost when Coplanar Waveguide (CPW) is used as the transmission line, surface mount compatibility, repeatable low inductance interconnect, self alignment due to solder surface tension, very high reliability, and robust 25 mil thick chips. These benefits result in lower manufacturing cost at the chip and module level, higher quality, and increased reliability. A series of recent experiments indicate that this technology may also allow for the use of sealants which provide chip protection at a fraction of the cost of welding or seam sealing at the module level. We have investigated the use of flip chips with sealants and show measured results for GaAs MMIC flip chips operating in the 5-15 GHz range which use sealants for environmental protection.

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New Module Structure Using Flip-Chip Technology for High-Speed Optical Communication ICs

S. Yamaguchi, Y. Imai, S. Kimura and H. Tsunetsugu. "New Module Structure Using Flip-Chip Technology for High-Speed Optical Communication ICs." 1996 MTT-S International Microwave Symposium Digest 96.1 (1996 Vol. 1 [MWSYM]): 243-246.

This paper describes a new module structure for 40-Gbit/s class ICs. This structure can eliminate cavity resonance in the package and excitation of parasitic propagation modes in RF feedthroughs. Additionally the design makes use of flip-chip technology to minimize the parasitic reactance that can occur at interconnections between chips and substrates. These features make module operation stable at frequencies beyond 40 GHz. We also demonstrate a DC-to-40-GHz distributed amplifier IC module that uses this new technology.

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Millimeter-Wave Performance of Chip Interconnections Using Wire Bonding and Flip Chip

T. Krems, W. Haydl, H. Massler and J. Rudiger. "Millimeter-Wave Performance of Chip Interconnections Using Wire Bonding and Flip Chip." 1996 MTT-S International Microwave Symposium Digest 96.1 (1996 Vol. 1 [MWSYM]): 247-250.

The performances of two different interconnection techniques for coplanar MMICs, wire bonding and flip chip, are investigated at Millimeter-Wave frequencies. By developing an accurate model for the interconnections, which is validated with experimental data up to 120 GHz, the limitations with respect to frequency and interconnection distance of either technique are pointed out, yielding useful data for the design of hybrid MMW-subsystems.

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Abstracts

Session TU4A -- MMIC System Components

"Session TU4A -- MMIC System Components." 1996 MTT-S International Microwave Symposium Digest 96.1 (1996 Vol. I [MWSYM]): 251-252.



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A MMIC Radar Chip for Use in Air-to-Air Missile Fuzing Applications

M.D. Pollman, P. Katzin, B. Bedard, V. Aparin, W. Grammer and R. Orgusaar. "A MMIC Radar Chip for Use in Air-to-Air Missile Fuzing Applications." 1996 MTT-S International Microwave Symposium Digest 96.1 (1996 Vol. I [MWSYM]): 253-256.

The next generation of air-to-air missiles will require Target Detecting Devices (TDD) that must utilize directional target sensing to optimize weapon effectiveness. Conventionally, a centralized radar proximity sensor is switched sequentially between fixed directional antennas elements to provide the required directionality. This implementation involves expensive and bulky RF cabling and switching circuits to connect the TDD to each antenna element. By utilizing Microwave Monolithic Integrated Circuit (MMIC) technology, a single radar chip has been developed which allows for the simultaneous operation of ultra-miniature, low-cost fuze sensors which are mounted onto the backside of each antenna element, obviating the need for RF switches and cabling. The MMIC described includes all the RF circuitry required to operate each radar sensor synchronously (phased-locked) to a common low frequency clock signal. This allows all directional fuze sensors to be operated simultaneously without mutual interference, and results in an attractive, low-cost, miniaturized TDD electronic package.

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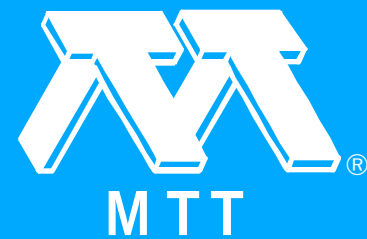


Abstracts

A Silicon MOS Process for Integrated RF Power Amplifiers

C. Dragon, J. Costa, D. Lamey, D. Ngo, W. Burger and N. Camilleri. "A Silicon MOS Process for Integrated RF Power Amplifiers." 1996 MTT-S International Microwave Symposium Digest 96.1 (1996 Vol. I [MWSYM]): 257-260.

A silicon-based technology is presented which integrates passive components with a silicon Power MOSFET for use in Integrated Power Amplifiers at UHF, VHF, and RF frequencies. This low-cost process incorporates capacitors, inductors, resistors, ground vias, transmission lines, and an ESD protection diode. A design library containing models and layouts for the active and passive components was compiled.



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Frequency Translation MMICs Using InP HEMT Technology

L. Tran, M. Delaney, R. Isobe, D. Jang and J. Brown. "Frequency Translation MMICs Using InP HEMT Technology." 1996 MTT-S International Microwave Symposium Digest 96.1 (1996 Vol. I [MWSYM]): 261-264.

Frequency translation circuits are key elements in communication systems. This paper presents three different frequency multipliers and a frequency mixer designed using the InP HEMT technology. These successful first iteration MMICS are highlighted by a V-band frequency quadruple that has 14.25 dB conversion gain with +3.25 dBm output power and a V-band mixer that has 10dB conversion loss over a 12 GHz bandwidth.





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A Novel Type of Constant Impedance Traveling Wave Phase Shifter for InP-Based MMICs

R. Kremer, S. Redlich, L. Brings and D. Jager. "A Novel Type of Constant Impedance Traveling Wave Phase Shifter for InP-Based MMICs." 1996 MTT-S International Microwave Symposium Digest 96.1 (1996 Vol. 1 [MWSYM]): 265-268.

The paper presents a novel type of externally controllable phase shifter based on periodic coplanar transmission lines consisting of Schottky contact (SCCPL) and coplanar sections on passive substrate. The modeling of the devices is carried out by utilizing a four-pole representation of the underlying pi-sections. An optimized InP/InGaAs/InAlAs layer structure for the SCCPL is developed providing an external electronic control. Measured phase shifts up to 60°/mm at 20GHz with a line impedance of $48 \pm 1.2\Omega$ agree well with theoretical calculations.

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Active Coplanar Up-Converter for High Gain V-Band Applications

R. Kulke, T. Sporkmann, I. Wolff, M.J. Rosario and F. Fortes. "Active Coplanar Up-Converter for High Gain V-Band Applications." 1996 MTT-S International Microwave Symposium Digest 96.1 (1996 Vol. 1 [MWSYM]): 269-272.

This paper reports on the design of a coplanar up-converter from C- to V-band on GaAs. An optimum conversion gain (62-64 GHz: $G_{\text{sub c}} > 4$ dB) has been achieved from a non-linear optimisation, utilising a modified Tajima model for the PM-HFETs and an accurate library for the coplanar elements integrated into the CAD tool Libra. Due to the use of coplanar lumped elements, a very compact circuit size of 2.1 mm² has been obtained. The evaluation of the circuit demonstrates the excellent agreement of the linear and non-linear measured and simulated mixer behaviour up to 64 GHz.

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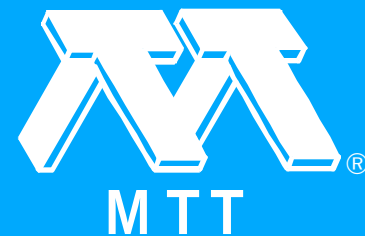


Abstracts

26 GHz Coplanar SiGe MMICs

C. Rheinfelder, K. Strohm, F. Beisswanger, J. Gerdes, F.J. Schmuckle, J.F. Luy and W. Heinrich. "26 GHz Coplanar SiGe MMICs." 1996 MTT-S International Microwave Symposium Digest 96.1 (1996 Vol. 1 [MWSYM]): 273-276.

First results on coplanar MMICs with SiGe HBTs are presented. The circuits are fabricated on high-resistivity Si substrates using a double-mesa HBT process. In the Ka-band, an oscillator output power of 1 dBm and 4.4 dB gain for a one-stage amplifier are achieved. This demonstrates the potential of SiGe transistors for applications in the higher microwave range.



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Abstracts

MMICs for Sensor Applications

R. Tempel, W. Lutke, J. Herrmann and I. Wolff. "MMICs for Sensor Applications." 1996 MTT-S International Microwave Symposium Digest 96.1 (1996 Vol. I [MWSYM]): 277-280.

A set of three commercial MMICs in coplanar environment have been developed, realized and tested successfully as cost effective basis for application in 25 GHz sensors. The circuits are designed using a coplanar component library which has been developed at the IMST and was seamless integrated into a commercially available circuit design program (HP-EEsof LIBRA).



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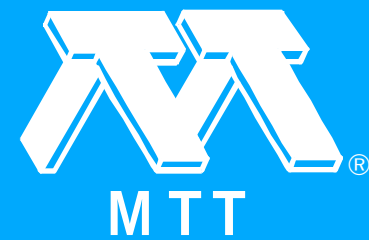
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Abstracts

Session TU4B -- Wave Interactions with Gyromagnetic and Semiconductor Media

"Session TU4B -- Wave Interactions with Gyromagnetic and Semiconductor Media." 1996 MTT-S International Microwave Symposium Digest 96.1 (1996 Vol. I [MWSYM]): 281-282.



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Anomalous Propagation, Loss and Radiation Effects in Open Waveguides with Gyrotropic Media

P. Baccarelli, C. Di Nallo, F. Frezza, A. Galli and P. Lampariello. "Anomalous Propagation, Loss and Radiation Effects in Open Waveguides with Gyrotropic Media." 1996 MTT-S International Microwave Symposium Digest 96.1 (1996 Vol. I [MWSYM]): 283-286.

A complete investigation of the electromagnetic behavioral features is presented for a class of open waveguides employing gyrotropic substrates, which find applications in various microwave and millimeter-wave devices. Referring to a representative nonreciprocal open structure with transversely-magnetized ferrite, a rigorous analysis is led first to derive the dispersion properties for the modal spectrum in the lossless case, emphasizing particular propagation properties. Losses in the anisotropic medium are then taken into account, and the consequent important modifications are illustrated. Moreover, different kinds of complex solutions are studied as concerns their physical nature. Interesting practical implications are thus derived by evaluating, in connection with proper sources, the effective contributions of such complex waves to radiation phenomena.



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Leaky Wave Behaviour in the Silicon H-Guide with Optically Induced Plasma Region

Y. Satomura, S. Sumida and M. Tsutsumi. "Leaky Wave Behaviour in the Silicon H-Guide with Optically Induced Plasma Region." 1996 MTT-S International Microwave Symposium Digest 96.1 (1996 Vol. 1 [MWSYM]): 287-290.

The propagation properties of leaky millimeter waves in the silicon H-guide containing optically induced plasma region have been investigated at Q band including NRD-guide behaviour. The possible optical control devices, such as switching devices from guided to leaky waves, have been examined by utilizing the transition characteristics from guided waves into leaky waves due to optical illumination.

Click on title for a complete paper.



Abstracts

Field Theory Analysis of Slow-Wave Propagation on Silicon Based Coplanar MIS Transmission Lines

S. Chen, R. Vahldieck, J. Huang and M. Kim. "Field Theory Analysis of Slow-Wave Propagation on Silicon Based Coplanar MIS Transmission Lines." 1996 MTT-S International Microwave Symposium Digest 96.1 (1996 Vol. I [MWSYM]): 291-294.

This paper presents a rigorous field theory analysis of the slow-wave propagation characteristics on semiconductor based coplanar waveguide MIS transmission lines with ion-implantation doping profile by using the frequency-domain TLM method (FDTLM). Two types of coplanar MIS transmission line structures, namely bulk silicon and semiconductor-on-insulator (SOI) with a Gaussian profile of the doping depth and optimized lateral width of the doping region have been investigated. It was found that both structures exhibit much better slow-wave characteristics at lower losses than traditional thin-film MIS transmission lines.



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Analysis of Electromagnetic Wave Propagation on Coplanar Waveguides on Doped Semiconductor Substrates

T.R. LaRocca, A.C. Reyes and S.M. El-Ghazaly. "Analysis of Electromagnetic Wave Propagation on Coplanar Waveguides on Doped Semiconductor Substrates." 1996 MTT-S International Microwave Symposium Digest 96.1 (1996 Vol. I [MWSYM]): 295-298.

High resistivity silicon substrates demonstrated strong potential for applications as a microwave and millimeter wave substrate. A method to simulate a coplanar waveguide (CPW) on a doped semiconductor substrate is presented. Its salient point is the inclusion of a voltage dependent depletion width and built-in voltage due to the metal-semiconductor (Schottky) contact. The attenuation, effective dielectric constant, and characteristic impedance are determined for different modes and applied biases.





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Contact Effects on HF Loss of CPW High Resistivity Silicon Lines

Z.R. Hu, V.F. Fusco, Y. Wu, H.G. Gamble, B.M. Armstrong and J.A.C. Stewart. "Contact Effects on HF Loss of CPW High Resistivity Silicon Lines." 1996 MTT-S International Microwave Symposium Digest 96.1 (1996 Vol. 1 [MWSYM]): 299-302.

This paper shows that the HF losses of CPW lines realized on 5-10 K Ω cm HRS (High Resistivity Silicon) substrates are strongly affected by the derivative of the I-V curves, ie. HF losses are higher where the I- V characteristic changes most rapidly. As a result the excess HF loss due to choice of quiescent bias voltage can be as high as 0.3-0.4 dB/cm. The implication of the effect is that by proper de biasing of a CPW line on HRS substrate minimum HF loss can be achieved. This is of importance when active devices are to be biased through line interconnects.

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Dispersive Effects of a Thin Metal-Insulating Layer in MMIC Structures

A.C. Polycarpou, M.R. Lyons and C.A. Balanis. "Dispersive Effects of a Thin Metal-Insulating Layer in MMIC Structures." 1996 MTT-S International Microwave Symposium Digest 96.1 (1996 Vol. 1 [MWSYM]): 303-306.

A full-wave finite element analysis is used to examine the dispersive effects of a thin metal-insulating layer in CPW and microstrip MMICs. This layer is often encountered in the MMIC manufacturing process residing on top of a semiconducting substrate. The effects of metallization thickness are also examined.

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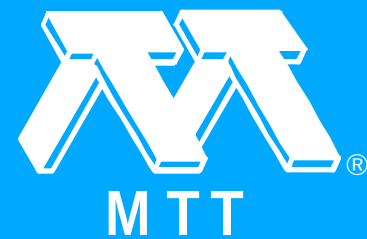


Abstracts

The Analysis and Reduction of Crosstalk on Coupled Microstrip Lines Using Nonuniform FDTD Formulation

S. Dai, A.Z. Elsherbeni and C.E. Smith. "The Analysis and Reduction of Crosstalk on Coupled Microstrip Lines Using Nonuniform FDTD Formulation." 1996 MTT-S International Microwave Symposium Digest 96.1 (1996 Vol. I [MWSYM]): 307-310.

A FDTD formulation with nonuniform mesh for inhomogeneous lossy media has been derived and applied to reduce crosstalk on models of high speed computer and millimeter wave integrated circuits. Our investigation shows that the use of PEC cover and PEC doping between coupled microstrip lines reduces the crosstalk by approximately 15dB over a very wide frequency range.



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Low Conductor Loss Microstrip Lines with Side-Grooves

K. Li and K. Atsuki. "Low Conductor Loss Microstrip Lines with Side-Grooves." 1996 MTT-S International Microwave Symposium Digest 96.1 (1996 Vol. I [MWSYM]): 311-314.

In this paper, we propose two low loss microstrip lines with side-grooves which can weaken the concentration of the current density at the edges of the strip conductor. A method called partial-boundary element method (p-BEM) is employed in our analysis. Theoretical results for these lines demonstrate significant effects on the conductor loss reduction by the side-grooves and inlaid dielectric material.

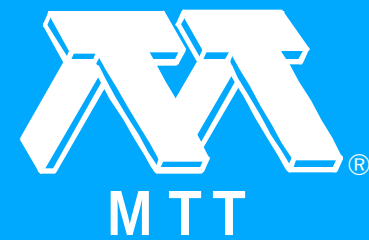
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Abstracts

Session TU4C -- Intelligent Transportation Systems

"Session TU4C -- Intelligent Transportation Systems." 1996 MTT-S International Microwave Symposium Digest 96.1 (1996 Vol. I [MWSYM]): 315-316.



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Automotive Radars-Development Status

R. Dixit. "Automotive Radars-Development Status." 1996 MTT-S International Microwave Symposium Digest 96.1 (1996 Vol. I [MWSYM]): 317-320.

This article provides an overview of the advances in developing a mmw radar sensor for automotive applications. While the promise of large business opportunities still exists, there are significant challenges to developing a commercially viable radar based system for the automotive consumer. The article will cover the issues related from systems configurations, and FCC licensing, through the various components in the radar unit itself, and finally touch on the cost, manufacturability and human factors topics.

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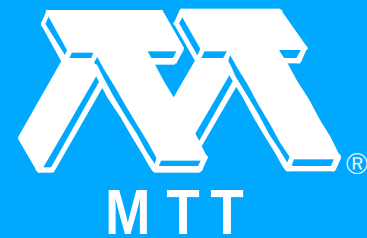


Abstracts

W-Band Collision Avoidance Radar for Light Rail Applications

M. Sholley, R. Alvarez, T. Leary, D. Renkowitz, S. Schell, L. Wendel, D. Cisneros, W. Brunner, B. Osgood, C. Gage, J. Alley, T. Cazares and P. Yocum. "W-Band Collision Avoidance Radar for Light Rail Applications." 1996 MTT-S International Microwave Symposium Digest 96.1 (1996 Vol. 1 [MWSYM]): 321-324.

W-Band Radar Transceiver System is applied to the application of detecting obstacles on the direct Rail path of an on-coming train. This paper presents the system concept, and the initial data confirming the performance requirement of detecting an adult 1000 ft away in a highly cluttered environment. This work was performed on contract for the Siemens Transportation Systems, Inc. and Los Angeles County Metropolitan Transportation Authority.



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5.8 GHz Phased Array Antenna for Electronic Toll Collection in Road Traffic Applications

W. Grabow, T. Wixforth and H. Ziegler. "5.8 GHz Phased Array Antenna for Electronic Toll Collection in Road Traffic Applications." 1996 MTT-S International Microwave Symposium Digest 96.1 (1996 Vol. 1 [MWSYM]): 325-328.

Concept and realization of a phased array antenna for road traffic applications based on the 5.8 GHz dedicated short range communication standard is presented. Localization and tracking of vehicles is possible even at high velocities and under critical signal situations. Measurements confirm a robust system performance and high reliability.



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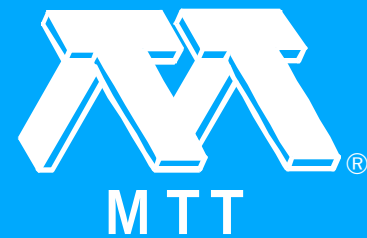


Abstracts

A Low Cost K-Band Safety Warning Radar Receiver System

M.C. Tsai, C. Autio, M. Batten, M. Gagne, T. Kvenvold, C. Papadopoulos, B. Ricker, S. Sarkar and A. Perlowski. "A Low Cost K-Band Safety Warning Radar Receiver System." 1996 MTT-S International Microwave Symposium Digest 96.1 (1996 Vol. I [MWSYM]): 329-332.

A low cost K-band safety warning radar receiver system has been developed to receive highway hazard-warning messages transmitted from a newly developed Safety Warning System. This paper describes a radar detection scheme, which includes down converter, FM detector, microprocessor, and analog control circuits, intended for the K-Band transmitter.



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Abstracts

A Self-Mixing Active Antenna for Communication and Vehicle Identification Applications

C.M. Montiel, L. Fan and K. Chang. "A Self-Mixing Active Antenna for Communication and Vehicle Identification Applications." 1996 MTT-S International Microwave Symposium Digest 96.1 (1996 Vol. 1 [MWSYM]): 333-336.

A cavity backed, Gunn diode driven, self-mixing active inverted stripline circular patch antenna has been developed. The active antenna provides good radiation patterns with cross-polarization levels 18 dB below co-polarization at boresight. The self-mixing performance shows that the circuit has a 2 dB conversion gain for IFs up to 450 MHz and a double sideband noise figure of 15 dB at 200 MHz. The antenna is suitable for use as a transceiver for short communications links or as a microwave identification transceiver.



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Abstracts

Monolithic, W-Band, Voltage-Controlled Oscillator

M.J. Vaughan, R.C. Compton, S. Duncan, D. Tu and S. Weinreb. "Monolithic, W-Band, Voltage-Controlled Oscillator." 1996 MTT-S International Microwave Symposium Digest 96.1 (1996 Vol. I [MWSYM]): 337-340.

A 77 GHz monolithic voltage-controlled oscillator is described. The active element is a "low-noise" pseudomorphic HEMT. Tuning is achieved with a second HEMT in which the source and drain are connected and the gate-channel capacitance forms a varactor diode. The oscillator has a 3 dB tuning bandwidth of 230 MHz and an output power of 300 μ W.



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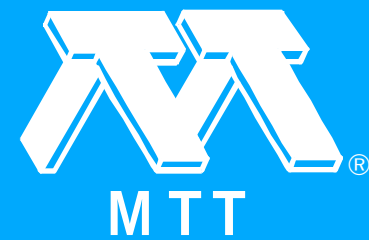
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Abstracts

Session TU4D -- Modern Concepts in Microwave Field Theory

"Session TU4D -- Modern Concepts in Microwave Field Theory." 1996 MTT-S International Microwave Symposium Digest 96.1 (1996 Vol. I [MWSYM]): 341-342.



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Use of Frequency Derivatives in the 3-D Full-Wave Spectral Domain Technique

J. Pekarek and T. Itoh. "Use of Frequency Derivatives in the 3-D Full-Wave Spectral Domain Technique." 1996 MTT-S International Microwave Symposium Digest 96.1 (1996 Vol. 1 [MWSYM]): 343-346.

Rational function approximations are used to extrapolate the frequency response of the scattering coefficients of 3-D structures. The rational functions are constructed by applying Pade approximation techniques to single frequency solutions of the currents and the derivatives of the currents with respect to frequency. The currents and current derivatives are computed using a modified spectral domain technique. The efficiency of the method, along with the direct determination of the poles and zeros of the transfer function, make the method well suited for Model-Based Parameter Estimation (MBPE). Multi-frequency-point Pade approximations are also investigated.

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3-D Modeling of Interconnects in MMICs by the Method of Lines

L. Vietzorreck and R. Pregla. "3-D Modeling of Interconnects in MMICs by the Method of Lines." 1996 MTT-S International Microwave Symposium Digest 96.1 (1996 Vol. I [MWSYM]): 347-350.

A new eigenmode algorithm, based on the method of lines, is presented for full-wave analysis of real 3-D structures. Finite conductor thickness, finite substrate and very short or long interconnection are rigorously modelled. S-parameters of air bridges, via holes and bead transitions investigated agree very well with literature.

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Abstracts

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." 1996 MTT-S International Microwave Symposium Digest 96.1 (1996 Vol. I [MWSYM]): 351-354.

A fast method for the suppression of excitation-induced spurious modes in the Transmission Line Matrix (TLM) method is presented for the symmetrical condensed node (SCN) scheme. The method of spurious-free excitation allows for a coarser mesh discretization improving the effectiveness of the TLM-simulation. The capability of the method is demonstrated by way of an example.



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A New Global Finite Element Analysis of Microwave Circuits Including Lumped Elements (1996 Vol. I [MWSYM])

K. Guillouard, M.F. Wong, V.F. Hanna and J. Citerne. "A New Global Finite Element Analysis of Microwave Circuits Including Lumped Elements (1996 Vol. I [MWSYM])." 1996 MTT-S International Microwave Symposium Digest 96.1 (1996 Vol. I [MWSYM]): 355-358.

A new fullwave global analysis of complex inhomogeneous structures including passive or active, linear or non linear lumped elements is presented. Only one electromagnetic simulation of the distributed part, by a 3D finite element method using edge elements, is needed corresponding to the insertion of several lumped elements placed at the same position. Results for a resistor, a diode inserted in a microstrip circuit as well as a Gunn diode amplifier are presented and comparisons with measurements are given for an active structure.



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FD-TD/Matrix-Pencil Method for the Efficient Simulation of Waveguide Components Including Structures of More General Shape

J. Ritter and F. Arndt. "FD-TD/Matrix-Pencil Method for the Efficient Simulation of Waveguide Components Including Structures of More General Shape." 1996 MTT-S International Microwave Symposium Digest 96.1 (1996 Vol. 1 [MWSYM]): 359-362.

A combined FD-TD/matrix-pencil method is introduced for the efficient and rigorous calculation of the full-wave modal S-parameters of waveguide components including structures of more general shape or of high complexity. The application of the S-parameter definition for unmatched ports requires merely standard Mur's absorbing boundaries for reliable results, and a nonorthogonal or contour path mesh formulation allows the convenient inclusion of curved boundaries. The efficiency of the method is demonstrated at the analysis of waveguide components of practical importance, such as the twisted waveguide, the twisted waveguide bend, and the waffle-iron filter. The proposed method is verified by excellent agreement with FEM/mode-matching results.



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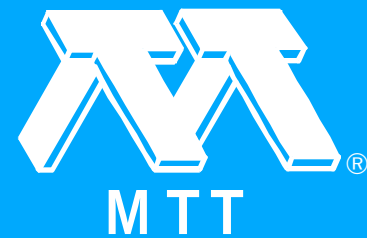


Abstracts

Diakoptics Using Finite Element Analysis

K. Guillouard, M.F. Wong, V.F. Hanna and J. Citerne. "Diakoptics Using Finite Element Analysis." 1996 MTT-S International Microwave Symposium Digest 96.1 (1996 Vol. 1 [MWSYM]): 363-366.

A diakoptics technique based on the use of finite element method is developed in this paper. This method enables the analysis of large microwave structures by modular computation of subdomains. The proposed algorithm is validated on a test case of a step in width finline discontinuity.



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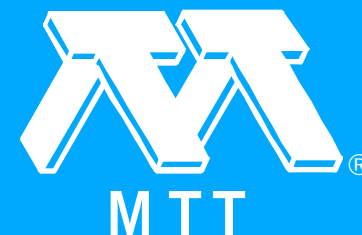
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Abstracts

Session TU4E -- Millimeter and Sub-Millimeter Wave Receivers

"Session TU4E -- Millimeter and Sub-Millimeter Wave Receivers." 1996 MTT-S International Microwave Symposium Digest 96.1 (1996 Vol. I [MWSYM]): 367-368.



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Large Scale W-Band Focal Plane Array for Passive Radiometric Imaging

G.S. Dow, D.C.W. Lo, Y. Guo, E.W. Lin, T.T. Chung, M.D. Biedenbender, O. Miromontes, A. Marashi, L. Yujiri, P.S.C. Lee, M.M. Shoucri and B.R. Allen. "Large Scale W-Band Focal Plane Array for Passive Radiometric Imaging." 1996 MTT-S International Microwave Symposium Digest 96.1 (1996 Vol. I [MWSYM]): 369-372.

This paper discusses the development of a large scale W-band focal plane array (FPA) for passive radiometric imaging application. The goal is to develop a 40x26 (1040-pixels) FPA to cover 15°x 10° instantaneous field-of-view. Each receiver consists of a single direct detection MMIC which is a W-band high gain, wide bandwidth switched LNA with integrated Schottky barrier diode detector. A 1x4 FPA module, employing linearly tapered slot antenna, is used as the basic building block for the FPA. Typical receiver temperature sensitivity is 0.4K with 10 ms integration time. For the first time, an automated assembly process is used to produce W-band MMIC modules in large volume.

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A Millimeter Wave Monolithic Load Switching Twist Reflector for Compact Imaging Cameras

G.R. Huguenin, S. Bandla and E.L. Moore. "A Millimeter Wave Monolithic Load Switching Twist Reflector for Compact Imaging Cameras." 1996 MTT-S International Microwave Symposium Digest 96.1 (1996 Vol. 1 [MWSYM]): 373-376.

A monolithic load comparison twist reflector (LSTR) has been built and tested for use in 94 GHz passive imaging cameras. Radiometric and quasioptical tests show that the array has an insertion loss of 0.25 dB. This active array of PIN diodes replaces the mechanical choppers often used in load comparison.

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600 GHz Planar-Schottky-Diode Subharmonic Waveguide Mixers

I. Mehdi, T.H. Lee, D.A. Humphrey, S.C. Martin, R.J. Dengler, J.E. Oswald, A. Pease, R.P. Smith and P.H. Siegel. "600 GHz Planar-Schottky-Diode Subharmonic Waveguide Mixers." 1996 MTT-S International Microwave Symposium Digest 96.1 (1996 Vol. I [MWSYM]): 377-380.

We report on the first planar two-diode subharmonic mixer operating at 600 GHz. The measured mixer noise temperature of 4200 K DSB is only a factor of 2 worse than the best single diode (whisker-contacted or planar) fundamental mixers and a factor 1.5 worse than the best ever single diode (whisker-contacted) harmonic mixer at similar frequencies. The measured conversion loss is /spl ap/12 dB and a noise temperature between 4200-5300 K can be maintained with a fix tuned circuit over a 1-18 GHz IF bandwidth. The anodes are made via a trilayer direct e-beam write process that results in extremely low parasitic devices with high cutoff frequencies. The mixers are being developed for NASA's Mission to Planet Earth.

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Fabrication and Performance of Separately-Biasable Antiparallel-Pair "T-Anode" Mixer Diodes Employing a Compact Multiple-Layer Integrated Bias Circuit at 210 GHz

T.-H. Lee, D.A. Humphrey, R.J. Dengler, I. Mehdi, S.C. Martin, A. Pease, J.E. Oswald, R.P. Smith and P.H. Siegel. "Fabrication and Performance of Separately-Biasable Antiparallel-Pair "T-Anode" Mixer Diodes Employing a Compact Multiple-Layer Integrated Bias Circuit at 210 GHz." 1996 MTT-S International Microwave Symposium Digest 96.1 (1996 Vol. I [MWSYM]): 381-384.

A 210 GHz waveguide subharmonically-pumped mixer with integrated antiparallel-pair planar "T-anode" Schottky diodes and a novel compact multiple-layer bias circuit has been successfully fabricated and measured. The diode anodes are defined by electron-beam lithography using technology similar to that employed for T-gate transistors. A compact multiple-layer filter structure provides individual biasing capability for each diode, which reduces the required local oscillator power for subharmonic mixing. Unbiased, a DSB mixer noise temperature of 1420 K was achieved with 6.4 mW of required LO power. Using separate diode bias to reduce the required LO power to 3.2 mW, the noise temperature increased slightly to 1640 K. This is the lowest noise temperature reported for a separately biased mixer at this frequency.

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A 94 GHz Uniplanar Subharmonic Mixer

S. Raman and G.M. Rebeiz. "A 94 GHz Uniplanar Subharmonic Mixer." 1996 MTT-S International Microwave Symposium Digest 96.1 (1996 Vol. 1 [MWSYM]): 385-388.

A uniplanar subharmonic mixer has been implemented in coplanar waveguide 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 is less than 2 mm x 1.5 mm. The measured minimum SSB conversion loss is 9.4 dB at a 94 GHz RF, 2 GHz IF, and an LO power of 9 dBm, and represents state-of-the-art performance for a planar W-band subharmonic mixer. Potential applications for this mixer are millimeter-wave receivers for smart munition seekers and automotive collision avoidance radars.

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Abstracts

A Monolithic W-Band CPW Rat-Race Mixer with HBT IF Amplifier

H. Matsuura, K. Tezuka, I. Aoki, A. Miura, M. Yamanaka, T. Yakhara, S. Kobayashi, S. Oka, T. Fujita and D. Murata. "A Monolithic W-Band CPW Rat-Race Mixer with HBT IF Amplifier." 1996 MTT-S International Microwave Symposium Digest 96.1 (1996 Vol. 1 [MWSYM]): 389-392.

This paper reports on a fully monolithic W-band Schottky diode down converter with an IF amplifier using heterojunction bipolar transistors (HBTs). We use a coplanar wave guide (CPW) as a transmission line element for a rat-race, because a CPW requires one-side wafer processing only. The conversion gain is +9.5 dB with the HBT amplifier and -8.8 dB without the HBT amplifier at an RF of 95 GHz. The isolation from the LO port to the RF port is 29 dB with the HBT amplifier and 27 dB without the HBT amplifier.



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Millimeter-Wave Gaussian-Beam Antenna and Integration with Planar Circuits

T. Matsui, M. Kiyokawa and N. Hirose. "Millimeter-Wave Gaussian-Beam Antenna and Integration with Planar Circuits." 1996 MTT-S International Microwave Symposium Digest 96.1 (1996 Vol. 1 [MWSYM]): 393-396.

A quasi-planar antenna, which uses a dielectric loaded Gaussian-beam resonator is developed for 60 GHz. The resonator antenna with a Gaussian distribution of the aperture electric field is formed with a spherical and a plane mirror surfaces, which were fabricated on both sides of a piano-convex fused quartz lens with 20-mm diameter and 1.3mm thickness. This new antenna features a very low sidelobe level (<-30 dB) and a high radiation efficiency ($>90\%$). Antenna characteristics and integration with a mixer circuit are described.

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Abstracts

Focus Sessions, Panel and Rump Sessions, Workshops, μ APS Technical Program and MMWMC Symposium Schedule (1996 Vol. I [MWSYM])

"Focus Sessions, Panel and Rump Sessions, Workshops, μ APS Technical Program and MMWMC Symposium Schedule (1996 Vol. I [MWSYM])." 1996 MTT-S International Microwave Symposium Digest 96.1 (1996 Vol. I [MWSYM]): 397-398.



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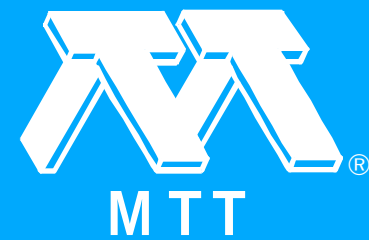
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Abstracts

Special MTT-S Technical Sessions (1996 Vol. I [MWSYM])

"Special MTT-S Technical Sessions (1996 Vol. I [MWSYM])." 1996 MTT-S International Microwave Symposium Digest 96.1 (1996 Vol. I [MWSYM]): 399-400.



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MTT-S Panel Sessions (1996 Vol. I [MWSYM])

"MTT-S Panel Sessions (1996 Vol. I [MWSYM])." 1996 MTT-S International Microwave Symposium Digest 96.1 (1996 Vol. I [MWSYM]): 401-402.



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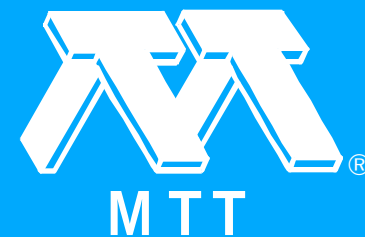
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Abstracts

Rump Session and MTT-S Sunday Workshops (1996 Vol. I [MWSYM])

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Message from the 1996 μ APS Chairman (1996 Vol. I [MWSYM])

M.I. Grace, B.D. Bakner and G.L. Koker. "Message from the 1996 μ APS Chairman (1996 Vol. I [MWSYM])." 1996 MTT-S International Microwave Symposium Digest 96.1 (1996 Vol. I [MWSYM]): 412-413.

On behalf of the Industry Participation Committee, welcome to the 1996 IMS in San Francisco and to the first Microwave Application & Product Seminars (μ APS) presented by the Symposium Exhibitors. The purpose of the new Microwave Application & Product Seminars is to provide a forum for topical presentations on microwave products, applications, services and markets at the level of the microwave practitioner, including design and manufacturing engineers and marketing and management professionals.



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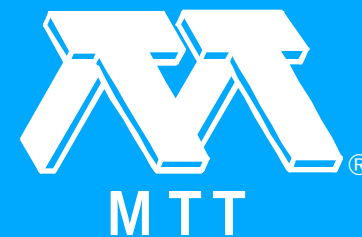
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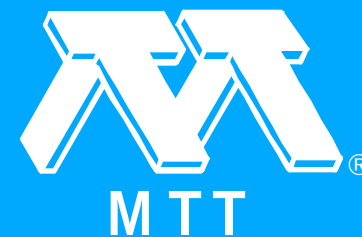
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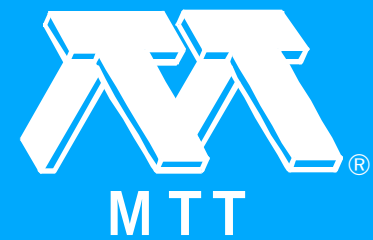
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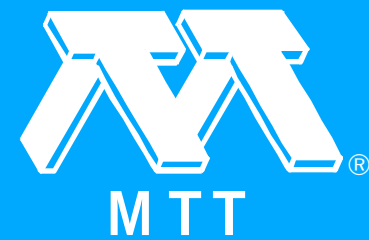
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Technical Program Contents (1996 Vol. II [MWSYM])

"Technical Program Contents (1996 Vol. II [MWSYM])." 1996 MTT-S International Microwave Symposium Digest 96.2 (1996 Vol. II [MWSYM]): vii-xxii.



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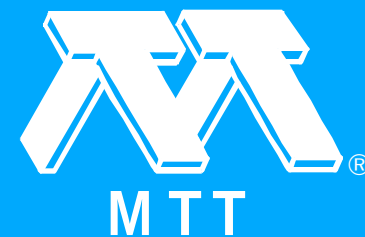
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Technical Program Schedule (1996 Vol. II [MWSYM])

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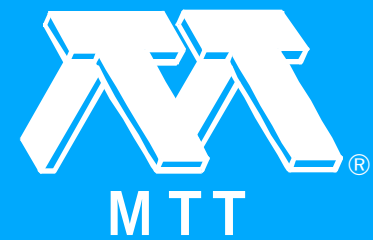
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Abstracts

Session WE1A -- Low Loss Acoustic Filters

"Session WE1A -- Low Loss Acoustic Filters." 1996 MTT-S International Microwave Symposium Digest 96.2 (1996 Vol. II [MWSYM]): 399-400.



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Abstracts

A Bleustein-Gulyaev-Shimizu Wave Resonator Having Resonances for TV and VCR Traps (1996 Vol. II [MWSYM])

M. Kadota, J. Ago and H. Horiuchi. "A Bleustein-Gulyaev-Shimizu Wave Resonator Having Resonances for TV and VCR Traps (1996 Vol. II [MWSYM])." 1996 MTT-S International Microwave Symposium Digest 96.2 (1996 Vol. II [MWSYM]): 401-404.

A Bleustein-Gulyaev-Shimizu (BGS) wave has only a shear horizontal (SH) wave showing a complete reflection at a free edge of a substrate. In this paper, using the responses excited by a weighted interdigital transducer (IDT) and generated by the $2N \pm 2$ th mode complete reflections at free edges of a ceramic substrate, we realized a new type of BGS resonator having three resonances without reflector electrodes. This resonator showed sufficient trap attenuations for practical use at both adjacent picture carrier frequency (fap) and adjacent sound carrier one (fas) in the TV · VCR VIF (video intermediate frequency) circuit.



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5 GHz Low-Loss SAW Filters

K. Yamanouchi, H. Odagawa and T. Meguro. "5 GHz Low-Loss SAW Filters." 1996 MTT-S International Microwave Symposium Digest 96.2 (1996 Vol. II [MWSYM]): 405-408.

A new electrode thickness difference type of single phase unidirectional surface acoustic wave (SAW) transducer (ETD-SPUDT), which as $\lambda/4$ narrow-gap electrodes us investigated. The ETD-SPUDT is fabricated by cutting a part of a meander-line electrode by using the shadow of the resist pattern. The theoretical and experimental results show the low loss and large directivity. The low photo-lithography techniques in 2 GHz-range and by electron beam exposure in 5 GHz-range. The results show 2.2db insertion loss a 1 GHz, 3.0dB at 2 GHz and 4.1dB at 5 GHz.

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Microwave Low Insertion Loss SAW Filter By Using ZnO/Sapphire Substrate with Ni Dopant

H. Ieki, H. Tanaka, J. Koike and T. Nishikawa. "Microwave Low Insertion Loss SAW Filter By Using ZnO/Sapphire Substrate with Ni Dopant." 1996 MTT-S International Microwave Symposium Digest 96.2 (1996 Vol. II [MWSYM]): 409-412.

Microwave low insertion loss SAW filters are realized by using ZnO epitaxial film on sapphire substrate. The epitaxial growth conditions and dopant are carefully determined to realize low propagation loss and high stability. 1.5 to 2.5 GHz range SAW filters are fabricated with the insertion loss of only 1 to 2dB and the outline dimensions of 0.01 to 0.02cc.

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A 900 MHz Ladder-Type SAW Filter Duplexer

R. Weigel, K. Weigenthaler, R. Dill and I. Schropp. "A 900 MHz Ladder-Type SAW Filter Duplexer." 1996 MTT-S International Microwave Symposium Digest 96.2 (1996 Vol. II [MWSYM]): 413-416.

A low-cost hybrid-integrated SAW filter duplexer consisting of receiver top filter, transmitter final-stage filter and antenna terminal has been developed. The prototype design was oriented at the GSM system specifications in the 900 MHz-band. Three-stage ladder-type SAW filters have been designed to perform the duplexing function by the use of only one transmission line. The complete duplexer has an insertion loss of 1.2 dB in the Tx path (Tx) and 2.1 dB in the Rx path (Rx). The 3 dB-bandwidth is 40.1 MHz (Tx) and 47.4 MHz (Rx), respectively.

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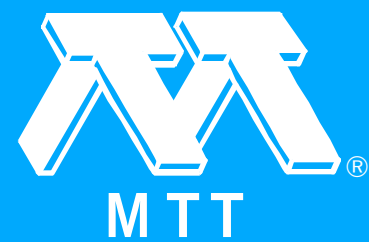
A New Balanced-Unbalanced Type RF-Band SAW Filter

Y. Taguchi, S.-I. Seki, K. Onishi and K. Eda. "A New Balanced-Unbalanced Type RF-Band SAW Filter." 1996 MTT-S International Microwave Symposium Digest 96.2 (1996 Vol. II [MWSYM]): 417-420.

A new balanced-unbalanced type RF-band (950MHz) surface acoustic wave (SAW) filter for use in portable telephones is presented. This SAW filter has unbalanced input and balanced output terminals. These balanced-unbalanced type SAW filters having a pass-band at 950MHz were fabricated. The obtained results showed excellent characteristics such as low insertion loss, wide bandwidth, and small VSWR. Using the SAW filter, one can realize balanced-type RF circuits in portable telephones.

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A New Understanding for Characterizing Acoustic Rectangular-Rod Waveguides and 3D Discontinuities

T. Katsura, M. Tsuji and H. Shigesawa. "A New Understanding for Characterizing Acoustic Rectangular-Rod Waveguides and 3D Discontinuities." 1996 MTT-S International Microwave Symposium Digest 96.2 (1996 Vol. II [MWSYM]): 421-424.

Our investigation on the full finite-element analysis has been extended to the precise discussions on the vector-modal behavior on uniform rectangular waveguides, and has found some specific vector-modal behavior in the fundamental mode of the pseudo-longitudinal, flexural and torsional waves. As an example, we show here for the first time that the modal behavior of the fundamental flexural mode on a 3D rectangular waveguide can be discussed well by the behavior of the fundamental Lamb mode on the correspondingly-approximated 2D elastic-plate waveguide. This new understanding is then applied to develop a novel 2D Lamb-mode-waveguide model for analyzing the transmission characteristics of double-step discontinuities (or a resonator cavity) on 3D acoustic rectangular waveguide.

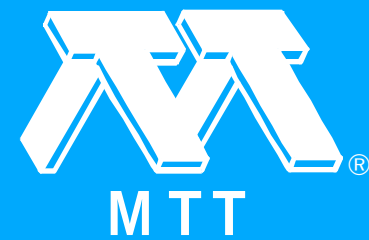
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Abstracts

Session WE1B -- TLM Modeling of Microwave Structures

"Session WE1B -- TLM Modeling of Microwave Structures." 1996 MTT-S International Microwave Symposium Digest 96.2 (1996 Vol. II [MWSYM]): 425-426.



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A New Hybrid Symmetrical Condensed Node for the Frequency-Domain TLM Method

S. Chen and R. Vahldieck. "A New Hybrid Symmetrical Condensed Node for the Frequency-Domain TLM Method." 1996 MTT-S International Microwave Symposium Digest 96.2 (1996 Vol. II [MWSYM]): 427-430.

This paper presents a new hybrid symmetrical condensed node (SCN) for the frequency-domain TLM (FDTLM) method. The scattering matrix of the new node is developed by taking advantage of a new port numbering scheme introduced for the time-domain node and a shunt decomposition technique to determine the propagation constant and characteristic admittances on the node link lines. The characteristics of the new frequency-domain node are described by a symmetric symbolic scattering matrix. The symmetry of the matrix allows significant savings in computer memory. For lossless media the scattering matrix becomes Hermitian. A dispersion analysis shows that the new node exhibits a much smaller wave propagation error than other FDTLM nodes. To test the new node, eigenvalues and scattering parameters for microstrip lines and discontinuities are computed and compared with well established results from measurements and other numerical methods.

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Advanced Node Formulations in TLM - The Adaptable Symmetrical Condensed Node (ASCN)

V. Trenkic, C. Christopoulos and T.M. Benson. "Advanced Node Formulations in TLM - The Adaptable Symmetrical Condensed Node (ASCN)." 1996 MTT-S International Microwave Symposium Digest 96.2 (1996 Vol. II [MWSYM]): 431-434.

The paper describes the development of the adaptable symmetrical condensed TLM node (ASCN). The node exploits the opposing contributions to dispersion of stubs and link lines to minimize numerical errors. It is shown that this approach is effective and can be used to optimize nodal properties according to problem requirements.

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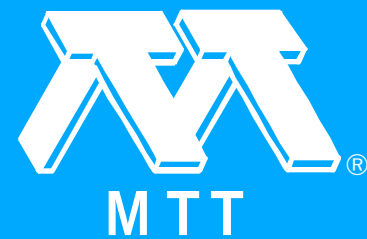


Abstracts

The Generalized TLM Based Finite-Difference Time-Domain (FD-TD) Method and its Applications to Frequency-Dependent and Anisotropic Media

Z. Chen. "The Generalized TLM Based Finite-Difference Time-Domain (FD-TD) Method and its Applications to Frequency-Dependent and Anisotropic Media." 1996 MTT-S International Microwave Symposium Digest 96.2 (1996 Vol. II [MWSYM]): 435-438.

In this paper, the generalized TLM-based finite-difference time-domain method (FD-TD) is presented for modeling and simulation of frequency-dependent and anisotropic media. The method is the generalized FD-TD form of the TLM symmetrical condensed node and therefore retains the properties of both the FD-TD and TLM methods. It allows the direct use of electromagnetic field quantities in the algorithm and direct treatments of anisotropic media.



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A New Multi-Grid 3-D TLM Algorithm for Simulation of Microwave FSS

M.I. Sobhy, M.H.A. El-Azeem and K.W. Royer. "A New Multi-Grid 3-D TLM Algorithm for Simulation of Microwave FSS." 1996 MTT-S International Microwave Symposium Digest 96.2 (1996 Vol. II [MWSYM]): 439-442.

This paper describes and demonstrates a new TLM multi-grid algorithm which allows arbitrary mesh dimension changes. Its use is demonstrated in the modelling of Frequency Selective Surfaces (FSS) used in microwave antenna systems where the mesh can be adjusted to describe arbitrary dimensions precisely. The algorithm demonstrates good numerical stability and has been applied to numerous Symmetric Condensed Node (SCN) TLM problems.

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Abstracts

A Quasi-Static Modification of TLM at Knife Edge and 90° Wedge Singularities (1996 Vol. II [MWSYM])

L. Cascio, G. Tardioli, T. Rozzi and W.J.R. Hoefer. "A Quasi-Static Modification of TLM at Knife Edge and 90° Wedge Singularities (1996 Vol. II [MWSYM])." 1996 MTT-S International Microwave Symposium Digest 96.2 (1996 Vol. II [MWSYM]): 443-447.

A common drawback of numerical techniques such as TLM and FDTD resides in the difficulty to accurately describe the electromagnetic field in structures with singularities. In this paper a local modification of the 2D-TLM algorithm for the nodes surrounding a knife edge and a 90° wedge is proposed. A quasi-static approximation of the field is used to derive an equivalent circuit of the edge. The proposed corner correction is compared with the uncorrected TLM results and with data available in the literature, revealing a marked enhancement in the accuracy and convergence of the results.



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Efficient Hybrid TLM/Mode Matching Analysis of Packaged Components

M. Righi and W.J.R. Hoefer. "Efficient Hybrid TLM/Mode Matching Analysis of Packaged Components." 1996 MTT-S International Microwave Symposium Digest 96.2 (1996 Vol. II [MWSYM]): 447-450.

A combination of Transmission Line Matrix (TLM) method and time domain mode matching is proposed. The resulting hybrid algorithm allows to take full advantage of the characteristics of time domain methods for regions with highly complex geometries while exploiting the efficiency of analytical formulations for the more regular regions. The approach is demonstrated for a packaged microstrip line containing a via-hole. 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. We thus 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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Abstracts

A Signal Averaging Technique for a Wide Bandwidth Absorbing Boundary Condition in the TLM Method

A. Dhouib, M.G. Stubbs, N.R.S. Simons and M. Lecours. "A Signal Averaging Technique for a Wide Bandwidth Absorbing Boundary Condition in the TLM Method." 1996 MTT-S International Microwave Symposium Digest 96.2 (1996 Vol. II [MWSYM]): 451-454.

This paper reports a new and simple technique for obtaining an accurate wide bandwidth absorbing boundary condition (ABC). The technique is based on signal averaging of the scattering parameters calculated from current and voltage waves propagating in planar structures. Although the ABC has been modelled by a match-termination for normal incident waves, the errors due to imperfect ABCs can be significantly reduced from the computed scattering parameter data using a signal averaging technique. The computed reflection coefficients in highly dispersive microstrip lines have been improved from -30 dB to better than -58 dB for the entire frequency range 1-150 GHz.



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"Session WE1C -- Filters I." 1996 MTT-S International Microwave Symposium Digest 96.2 (1996 Vol. II [MWSYM]): 455-456.



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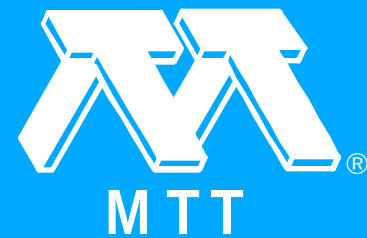
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Narrow-Band Hairpin-Comb Filters for HTS and Other Applications

G.L. Matthaei, N.O. Fenzi, R. Forse and S. Rohlfing. "Narrow-Band Hairpin-Comb Filters for HTS and Other Applications." 1996 MTT-S International Microwave Symposium Digest 96.2 (1996 Vol. II [MWSYM]): 457-460.

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 have attractive properties for design of compact, narrow-band filters such as are often desired for high-temperature-superconductivity and other applications.



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Transitional Comblines/Evanescent Mode Microwave Filters

R. Levy, H.-W. Yao and K.A. Zaki. "Transitional Comblines/Evanescent Mode Microwave Filters." 1996 MTT-S International Microwave Symposium Digest 96.2 (1996 Vol. II [MWSYM]): 461-464.

Traditional comblines 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/λ . As the b/λ ratio increases from 0 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 comblines resonators using mode matching. Accompanying the increased bandwidth is a considerable increase in the unloaded Q, as expected from the higher Q of the evanescent waveguide modes.

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Inverted-Resonator Evanescent Mode Filters

R.V. Snyder. "Inverted-Resonator Evanescent Mode Filters." 1996 MTT-S International Microwave Symposium Digest 96.2 (1996 Vol. II [MWSYM]): 465-468.

Inversion of some or all of the resonators in an evanescent-mode bandpass structure allows for achieving wide bandwidth filters, with some transmission zeroes located at DC, some at infinity. Close spacing, as occurs when bandwidth is large, implies higher-order mode coupling and thus accurate design requires consideration of these modes. The resulting filters still display the small size, low loss and wide stopbands common to evanescent mode structures in general.

Resonator inversion is equivalent to replacing the electric wall equivalent between conventional evanescent resonators with a magnetic wall, which allows for some degree of net capacitive coupling. Use of spectral domain and other field solving techniques combined with measurement of two-resonator sets, and extraction of multimode equivalent circuits, enables look-up table design for both conventional and inverted resonator configurations thus facilitating the use of both within the same filter. In the method used in this paper, multimode equivalent circuits are extracted using the Weierstrassian E-function to minimize the difference between E-M calculated or lab measured S-parameters and assumed equivalent circuit S-parameters. This paper applies the method to filters with similar upper and lower stopband slopes, bandwidths of up to 80% and stopbands extending up to 20 times the filter center frequency. As has been shown in [10], the method can be applied to cases in which the resonators are a mixture of dielectric resonator, waveguide, etc.

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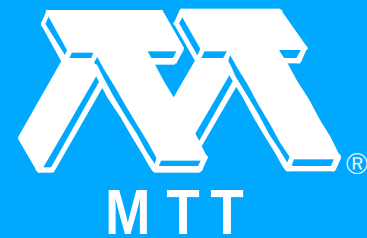


Abstracts

L-Resonator Bandstop Filters (1996 Vol. II [MWSYM])

H.C. Bell. "L-Resonator Bandstop Filters (1996 Vol. II [MWSYM])." 1996 MTT-S International Microwave Symposium Digest 96.2 (1996 Vol. II [MWSYM]): 469-472.

A design procedure is presented for TEM narrow bandstop filters using L resonators, which are intermediate of the gap- and parallel-coupled resonators typically used, having parallel coupling only over a portion of the resonator length and a grounded end in either the coupled or stub portion of the resonator.



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Abstracts

Analysis of Quarter Wavelength Ceramic Comblines Filters

H.-W. Yao, C. Wang and K.A. Zaki. "Analysis of Quarter Wavelength Ceramic Comblines Filters." 1996 MTT-S International Microwave Symposium Digest 96.2 (1996 Vol. II [MWSYM]): 473-476.

This paper describes a rigorous method for analysis of coupled dielectric quarter wavelength combline resonators. The results of resonant frequencies and couplings by different coupling structures are presented. A filter design technique using the results of numerical analysis is presented. A three-pole slot coupled filter is designed and tested. Excellent experimental results verify the theory.



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Modelling Structure Parasitic in Comb-Line Filters

I. Shapir and V. Sharir. "Modelling Structure Parasitic in Comb-Line Filters." 1996 MTT-S International Microwave Symposium Digest 96.2 (1996 Vol. II [MWSYM]): 477-480.

Compline filters frequently show wider bandwidth then initially synthesized and analyzed. The main cause, as presented in the paper, is distortion of the TEM electromagnetic fields at the resonators open ends. These distortions depend on the three dimensional structure of this region, requiring heavy computation for 3-D field analysis. A modification to the classic equivalent network of combline filters, which represents this effect is described and formulas to calculate its elements are given, which enables good approximation of the filter's actual performance by using inexpensive network analysis tools.

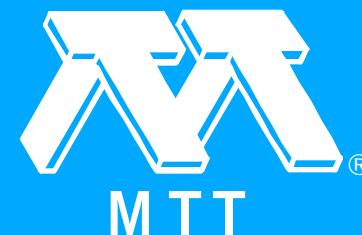
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Abstracts

Session WE1D -- Millimeter Wave/Optical Applications in Personal Communications

"Session WE1D -- Millimeter Wave/Optical Applications in Personal Communications." 1996 MTT-S International Microwave Symposium Digest 96.2 (1996 Vol. II [MWSYM]): 481-482.



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Abstracts

Microwave and mm-Wave Engineering Challenges in Pan-European Communications Research

J.G. Gardiner. "Microwave and mm-Wave Engineering Challenges in Pan-European Communications Research." 1996 MTT-S International Microwave Symposium Digest 96.2 (1996 Vol. II [MWSYM]): 483-486.

The pan-European research programmed under the 3rd and 4th Frameworks have identified, and are now researching radio-based personal communications systems operating at frequencies from UHF to 60GHz. The performance targets for these systems are set out by reference to particular projects recently launched and also those proposed for projects offered under the 2nd call for the current programme.



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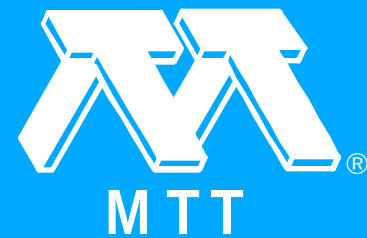


Abstracts

The Market for Short-Haul Line-of-Sight Millimeterwave Transmission Links

H.H. Meinel. "The Market for Short-Haul Line-of-Sight Millimeterwave Transmission Links." 1996 MTT-S International Microwave Symposium Digest 96.2 (1996 Vol. II [MWSYM]): 487-490.

GSM type telephone systems have become a global standard today. In such a digital network, mobile CELLULAR-TELEPHONEs communicate at 0.9 or 1.8 GHz within cell sizes of 1 to 20 km in diameter; groups of five to 20 of these cells have to be linked to a controller-station. This is the first valuable niche market, where millimeter radio fits in. Wireless CATV with projects like CellularVision, utilizing defined spectrum allocations at 28 and 42 GHz, respectively, are the basis for another upcoming market: VIDEO-ON-DEMAND, i.e. interactive television transmission and teleconferencing. This is the second valuable niche market, where millimeter radio fits in. The actual market situation - upcoming trends and development directions - with emphasis on Europe, will be reviewed in this paper.



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K/_a- and V-Band MMIC Components for Personal Communication Networks

J. Wenger and J. Splettstosser. "K/_a- and V-Band MMIC Components for Personal Communication Networks." 1996 MTT-S International Microwave Symposium Digest 96.2 (1996 Vol. II [MWSYM]): 491-494.

The "wireless revolution" has created a number of new opportunities not only at lower microwave communication frequencies at 0.9GHz and 1.8GHz, but also at millimeterwave frequencies. The 38±2GHz frequency range has emerged as an internationally accepted frequency band for typical radio applications with a promising market for transmit and receive modules in the next years. Another frequency allocation has been granted for mobile broadband communication networks in the 62GHz to 66GHz band aiming to extend the scope of the broadband integrated services digital networks (B-ISDN). This system is envisaged to give mobile users access to future broadband services like speech, data, and video. In order to produce radio-frontends for these communication systems, low cost, reliable, high performance components in monolithic form are a basic necessity. This paper describes GaAs technologies developed at Daimler-Benz which can serve the needs and requirements of wireless millimeterwave communication systems at K/_a- and V-band frequencies. Based on different available technologies (HBT, Schottky diodes, MESFET, PM-HFET) oscillators, low-noise amplifiers, medium power amplifiers, variable-gain amplifiers, single-gate mixers, dual-gate mixers, and diode mixers have been fabricated and will be described.

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60 GHz GaAs MMIC Technology for a High Data Rate Mobile Broadband Demonstrator

U. Guttich, A. Plattner, W. Schwab, I. Telliez, S. Tranchant, P. Savary, P. Bourne-Yaonaba, B. Byzery, E. Delhay, C. Cordier and M. Chelouche. "60 GHz GaAs MMIC Technology for a High Data Rate Mobile Broadband Demonstrator." 1996 MTT-S International Microwave Symposium Digest 96.2 (1996 Vol. II [MWSYM]): 495-498.

A millimeter-wave front end demonstrator for broadband pico-cell networks has been developed using 60 GHz GaAs MMIC technology. The following sub-assemblies are integrated in the demonstrator a 56.8 GHz phase locked LO, an upconverter from 5.2 - 6.2 GHz IF to a 62 - 63 GHz band, a double-channel low noise downconverter from the 62 - 63 GHz band to an IF of 5.2 - 6.2 GHz, and a power amplifier for the 62 GHz to 66 GHz band. For a duplex operation a second upconverter module operating at 65-66 GHz (IF 8.2 - 9.2 GHz) is used. All monolithic HFET and PHFET circuits are realised using subquarter micron technologies. For the fully assembled receivers overall noise figures of less than 10 dB have been measured. Field tests have proven the ability to transmit data nearly error free over a distance of 200m.

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Abstracts

Optical Microwave Generation and Transmission Experiments in the 12 and 60 GHz-Region for Wireless Communications

*R.P. Braun, G. Grosskopf, C.H. von Helmolt, K. Kruger, U. Kruger, D. Rohde and F. Schmidt.
"Optical Microwave Generation and Transmission Experiments in the 12 and 60 GHz-Region for Wireless Communications." 1996 MTT-S International Microwave Symposium Digest 96.2 (1996 Vol. II [MWSYM]): 499-502.*

The optical generation and transmission of microwave radio signals is important for future broadband wireless communications. For the first time, bit error ratio measurements were carried out successfully in optical multichannel and single channel transmission experiments at radio frequencies of 12 GHz and 60 GHz, respectively.



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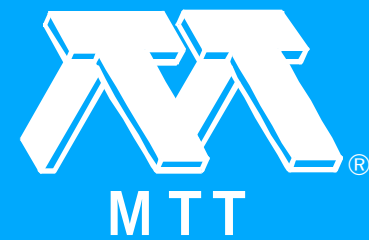
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Abstracts

Session WE1E -- Millimeter Wave Systems and Components

"Session WE1E -- Millimeter Wave Systems and Components." 1996 MTT-S International Microwave Symposium Digest 96.2 (1996 Vol. II [MWSYM]): 503-504.



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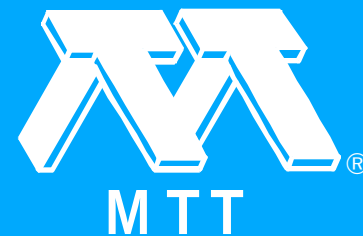


Abstracts

Recent Progress in U.S. Millimeter Wave Spectrum Management Policy

M.J. Marcus. "Recent Progress in U.S. Millimeter Wave Spectrum Management Policy." 1996 MTT-S International Microwave Symposium Digest 96.2 (1996 Vol. II [MWSYM]): 505-507.

This paper describes recent actions by the Federal Communications Commission to establish routine rules for the commercial use of frequencies above 40 GHz. These rules will enable the development and sale of new products in this spectrum which will pioneer the commercial use of the millimeter wave region.



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Abstracts

60 GHz Short Range Transceivers and Applications for Minimum Delay Spread LAN

Y. Takimoto, H. Yatsuka, A. Inoue, T. Yokoyama, T. Aoyagi, K. Ohata, T. Saito, T. Negishi and N. Okubo. "60 GHz Short Range Transceivers and Applications for Minimum Delay Spread LAN." 1996 MTT-S International Microwave Symposium Digest 96.2 (1996 Vol. II [MWSYM]): 509-512.

The authors describe the design and measured performances of the developed 60 GHz band MMICs, fabricated brass-board models of millimeter-wave application systems such as high and ultra-high speed wireless LAN, wide-band analog signal transmission and low bit-rate contactless ID systems, and the demonstrated performance of the wireless LAN system in a Minimum Delay Spread (MDS) configuration set in our new conceptual propagation test room.



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An Advanced Single-Chip Ka-Band Transceiver

E.W. Lin, Y. Kok, G.S. Dow, H. Wang, T.T. Chung, S. Lau, D. Okamuro and B.R. Allen. "An Advanced Single-Chip Ka-Band Transceiver." 1996 MTT-S International Microwave Symposium Digest 96.2 (1996 Vol. II [MWSYM]): 513-516.

This paper describes the development of an advanced single-chip Ka-band transceiver for military applications. The in-fixture measured performance of the transceiver chip will be presented. The transceiver chip monolithically integrates seven separate chips and one filter onto a single chip. In-fixture, the monolithic transceiver chip has demonstrated measured receiver noise figure of less than 6.5 dB across the RF band from 38.0 - 38.5 GHz at an IF of 2.45 GHz under -10 dBm LO drive. The transmitter output power was measured to be greater than 17.5 dBm across the 38.0 - 38.5 GHz band.

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Injection-Locked Oscillator Chain: A Possible Solution to Millimeter-Wave MMIC Synthesizers (1996 Vol. II [MWSYM])

K. Kamogawa, T. Tokumitsu and M. Aikawa. "Injection-Locked Oscillator Chain: A Possible Solution to Millimeter-Wave MMIC Synthesizers (1996 Vol. II [MWSYM])." 1996 MTT-S International Microwave Symposium Digest 96.2 (1996 Vol. II [MWSYM]): 517-520.

An injection-locked oscillator (ILO) MMIC chain, which cascades low/high frequency-band ILO's, is proposed for simple and cost-effective millimeter-wave local oscillators and synthesizers, and primary 5-GHz-band and 50-GHz-band ILO MMIC's which are injection-locked at subharmonic factors from 1 to 1/16 and from 1 to 1/4 respectively, are demonstrated.

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Integrated Coplanar mm-Wave Amplifier with Gain Control Using a Dual-Gate InP HEMT (1996 Vol. II [MWSYM])

M. Schefer, H.-P. Meier, B.-U. Klepser, W. Patrick and W. Bachtold. "Integrated Coplanar mm-Wave Amplifier with Gain Control Using a Dual-Gate InP HEMT (1996 Vol. II [MWSYM])." 1996 MTT-S International Microwave Symposium Digest 96.2 (1996 Vol. II [MWSYM]): 521-524.

A variable gain mm-wave amplifier, based on InP HEMT devices, is demonstrated. The measured gain control range of 14 dB is the largest reported in the mm-wave range for a monolithically integrated variable gain amplifier. The two stage circuit consists of a single gate transistor and a dual-gate transistor. The circuit has a maximum gain of 22 dB at 44 GHz and a bandwidth of 14.6 GHz. The circuit was fabricated in coplanar technology.

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W-Band MMIC VCO with a Large Tuning Range Using a Pseudomorphic HFET

A. Bangert, M. Schlechtweg, M. Lang, W. Haydl, W. Bronner, T. Fink, K. Kohler and B. Raynor.
"W-Band MMIC VCO with a Large Tuning Range Using a Pseudomorphic HFET." 1996 MTT-S International Microwave Symposium Digest 96.2 (1996 Vol. II [MWSYM]): 525-528.

A widely tunable oscillator with a center frequency of 94 GHz including a two stage buffer amplifier has been designed and fabricated. The output power was 6 mW. The mechanical tuning range by removing air-bridges was 18 GHz. The electrical tuning range was 8 GHz. The noise performance was better than -67 dBc/Hz at 1 MHz from the carrier.

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The Potential of InP IMPATT Diodes as High-Power Millimeter-Wave Sources: First Experimental Results

H. Eisele, C.-C. Chen, G.O. Munns and G.I. Haddad. "The Potential of InP IMPATT Diodes as High-Power Millimeter-Wave Sources: First Experimental Results." 1996 MTT-S International Microwave Symposium Digest 96.2 (1996 Vol. II [MWSYM]): 529-532.

Extensive simulations of GaAs and InP transit-time diodes clearly show the advantages of the InP material system. RF power levels of more than 1 W as well as dc-to-RF conversion efficiencies of more than 18 % around 100 GHz can be expected from optimized diodes. The fabrication process was adopted from the process for InP Gunn devices on integral heat sinks. Typical RF power levels were around 80 mW from about 60 GHz to 80 GHz with corresponding dc-to-RF conversion efficiencies ranging from 3 % to 4 %. The best device yielded more than 110 mW (more than 5 %) at 64.7GHz, 82 mW (3.7 %) at 79 GHz and 55 mW (2.4 %) at 84.8 GHz. These preliminary experimental results are better than those of single-drift flat-profile GaAs IMPATT diodes on integral heat sinks and also indicate the strong potential for millimeter-wave InP IMPATT diodes.

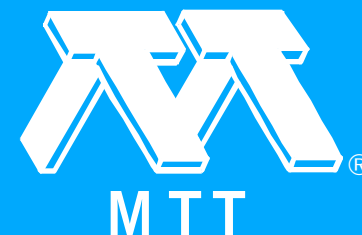
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Abstracts

Session WE2A -- Power Amplifiers, Wireless Applications

"Session WE2A -- Power Amplifiers, Wireless Applications." 1996 MTT-S International Microwave Symposium Digest 96.2 (1996 Vol. II [MWSYM]): 533-534.



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A Low Distortion and High Efficiency Parallel-Operation Power Amplifier Combined in Different Phases in Wide Range of Load Impedances

H. Ikeda, H. Kosugi and T. Uwano. "A Low Distortion and High Efficiency Parallel-Operation Power Amplifier Combined in Different Phases in Wide Range of Load Impedances." 1996 MTT-S International Microwave Symposium Digest 96.2 (1996 Vol. II [MWSYM]): 535-538.

We proposed a new four-paralleled power amplifier combined in different phases in order to accomplish a low distortion and high efficiency in wide range of load impedances. We studied them by simulation and experiment and realized an amplifier in that adjacent channel leakage power of $\pi/4$ -DQPSK modulation was improved by 13dB in range of load VSWR ≤ 3 without decreasing efficiency.

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L- and S-Band 50-Watt Power GaAs MESFETs

H. Ishimura, M. Murayama, K. Arai, Y. Saito, Y. Oda and H. Kuroda. "L- and S-Band 50-Watt Power GaAs MESFETs." 1996 MTT-S International Microwave Symposium Digest 96.2 (1996 Vol. II [MWSYM]): 539-542.

L- and S-band high power GaAs FETs have been developed. At 1.8 GHz, the FET delivers an output power at 1 dB gain-compression point of 42.7W (46.3 dBm) with 13.3 dB gain and 42 % power-added efficiency, and a saturated output power of 51.3W (47.1 dBm). The developed FETs will contribute to improve the performance of microwave SSPAs used in various radar and communication systems which require higher output power and low distortion.

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Digital Implementations of Adaptive Feedforward Amplifier Linearization Techniques

G. Zhao, F.M. Ghannouchi, F. Bearegard and A.B. Kouki. "Digital Implementations of Adaptive Feedforward Amplifier Linearization Techniques." 1996 MTT-S International Microwave Symposium Digest 96.2 (1996 Vol. II [MWSYM]): 543-546.

Feedforward power amplifier linearizes using complete digital adaptive control algorithms are proposed. Two different versions, one using frequency domain cancellation and the other using a power gradient approach, are developed. Simulation results, showing carrier signal cancellation in the first loop and distortion cancellation in the second loop for both methods, are presented. This study demonstrates that digital adaptive implementation of feedforward linearization is indeed a promising approach.

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Pseudomorphic Power HEMT with 53.5% Power-Added Efficiency for 1.9-GHz PHS Standards

H. Ono, Y. Umemoto, M. Mori, M. Miyazaki, A. Terano and M. Kudo. "Pseudomorphic Power HEMT with 53.5% Power-Added Efficiency for 1.9-GHz PHS Standards." 1996 MTT-S International Microwave Symposium Digest 96.2 (1996 Vol. II [MWSYM]): 547-550.

We demonstrate a power-added efficiency of 53.5% at a very low idling current of 13 mA with a drain bias of 3 V in a proposed power amplifier. This amplifier meets the standards for the 1.9-GHz Japanese Personal Handy-phone System (PHS) which requires highly linear amplifiers, and this is the highest power-added efficiency and the lowest idling current so far reported. The proposed power amplifier uses a pseudomorphic high electron mobility transistor (PHEMT) which provides high transconductance, high linearity, and low idling current operation. This PHEMT was fabricated by using advanced power-device technology: the GaAs/InGaAs/GaAs PHEMT structure has a 0.35- μm gate made using phase-shifting lithography and a high In mole ratio (0.35) InGaAs channel.

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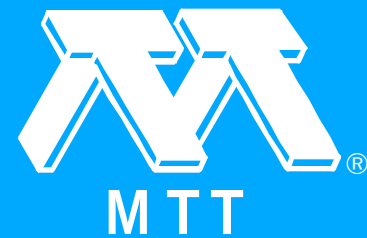


Abstracts

AlGaAs/InGaAs Power P-HEMTs for High-Efficiency, Low-Voltage Portable Applications

M.J. Martinez, E. Schirmann, M. Durlam, J.-H. Huang, S. Tehrani, N. Cody, T. Driver and K. Barkley. "AlGaAs/InGaAs Power P-HEMTs for High-Efficiency, Low-Voltage Portable Applications." 1996 MTT-S International Microwave Symposium Digest 96.2 (1996 Vol. II [MWSYM]): 551-554.

Power Pseudomorphic High Electron Mobility Transistors (P-HEMTs) with unprecedented efficiency are being produced for low-voltage portable wireless products. 12-mm devices operating at 3.5 achieve more than 75% power added efficiency, 1.5 W output power, and 11.5 dB gain, simultaneously, at a frequency of 850 MHz.



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The Effect of Source Impedance on Linearity in InGaP/GaAs Power HBTs

H. Yamada, S. Ohara, T. Iwai, Y. Yamaguchi, K. Imanishi and K. Joshin. "The Effect of Source Impedance on Linearity in InGaP/GaAs Power HBTs." 1996 MTT-S International Microwave Symposium Digest 96.2 (1996 Vol. II [MWSYM]): 555-558.

L-band power amplifiers operating with high efficiency and linearity at a single, low supply voltage are in strong demand in mobile communication systems. This paper reports the effect of source impedance on the phase distortion and the adjacent channel power (ACP) for a $\pi/4$ -shift QPSK modulated signal in the InGaP/GaAs power heterojunction bipolar transistors (HBTs). Our results show that the phase distortion and the ACP of our HBTs are improved by adding a positive reactance to a gain-matched source impedance. The ACP for a 50 kHz offset is -49.2 dBc with a power-added efficiency (PAE) of 56 % at a output power ($P_{\text{sub out}}$) of 31 dBm under a supply voltage of 3.5 V.

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RF Silicon MOS Integrated Power Amplifier for Analog Cellular Applications

D. Ngo, C. Dragon, J. Costa, D. Lamey, E. Spears, W. Burger and N. Camilleri. "RF Silicon MOS Integrated Power Amplifier for Analog Cellular Applications." 1996 MTT-S International Microwave Symposium Digest 96.2 (1996 Vol. II [MWSYM]): 559-562.

We report the RF performance of the first Integrated Power Amplifier using silicon MOS Field Effect Transistors, shunt and series capacitors, transmission lines, spiral inductors, ground vias and ESD protection devices. The amplifier provided an output power of 1.5W and 56% efficiency at a supply voltage of 5.8V (850MHz) with 25dB of small signal gain and more than 10dB input return loss.

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Abstracts

High Efficiency L-Band Variable Output Power Amplifiers for Use in Communication Systems

S. Bouthillette and A. Platzker. "High Efficiency L-Band Variable Output Power Amplifiers for Use in Communication Systems." 1996 MTT-S International Microwave Symposium Digest 96.2 (1996 Vol. II [MWSYM]): 563-566.

A pair of high efficiency low distortion L-band power amplifiers operating over variable drain voltages with a fixed gate voltage were developed. High efficiency and low distortion are maintained for drain voltages over the range of 2-8 Volts, while providing 12dB of output power variation. The two amplifiers are single stage reactively matched hybrids that utilize discrete 0.5 μ m PHEMT devices consisting of 4.8mm and 17.6mm peripheries. These amplifiers are ideally suited for L-band transmitters in Communication Systems.



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Abstracts

Session WE2B -- Time Domain Techniques

"Session WE2B -- Time Domain Techniques." 1996 MTT-S International Microwave Symposium Digest 96.2 (1996 Vol. II [MWSYM]): 567-568.



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Abstracts

GT-PML: Generalized Theory of Perfectly Matched Layers and its Application to the Reflectionless Truncation of Finite-Difference Time-Domain Grids (1996 Vol. II [MWSYM])

L. Zhao and A.C. Cangellaris. "GT-PML: Generalized Theory of Perfectly Matched Layers and its Application to the Reflectionless Truncation of Finite-Difference Time-Domain Grids (1996 Vol. II [MWSYM])." 1996 MTT-S International Microwave Symposium Digest 96.2 (1996 Vol. II [MWSYM]): 569-572.

A new formulation is presented for the systematic development of perfectly matched layers (PML) from Maxwell's equations in properly constructed anisotropic media. The proposed formulation has an important advantage over the original Berenger's PML in that it can be implemented in the time domain without any splitting of the fields. Results from 3-D simulations illustrate the effectiveness of the proposed method.



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Application of MRTD to Printed Transmission Lines

E. Tentzeris, M. Krumholz and L.P.B. Katehi. "Application of MRTD to Printed Transmission Lines." 1996 MTT-S International Microwave Symposium Digest 96.2 (1996 Vol. II [MWSYM]): 573-576.

The recently developed MRTD scheme is applied to the solution of printed transmission line problems. Specifically, the field pattern and the characteristic impedance of a membrane stripline is calculated. The results are compared to those obtained by use of the conventional FDTD scheme to indicate considerable savings in memory and computational times.

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Abstracts

Accurate and Detailed FDTD Solution of Microwave Integrated Circuits Using the Frequency Shifting Technique

A.P. Zhao and A.V. Raisanen. "Accurate and Detailed FDTD Solution of Microwave Integrated Circuits Using the Frequency Shifting Technique." 1996 MTT-S International Microwave Symposium Digest 96.2 (1996 Vol. II [MWSYM]): 577-580.

By employing the elementary property (i.e., the frequency shifting technique) of the Fourier transform, a simple and efficient spectral estimation technique is developed. With this technique, extremely accurate and detailed frequency domain scattering parameters of general microwave integrated circuits can be obtained, without increasing any additional computation and programming efforts in the original FDTD simulation.



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Stability Considerations in the Application of PML Absorbing Boundary Condition to FDTD Simulation of Microwave Circuits

K. Naishadham. "Stability Considerations in the Application of PML Absorbing Boundary Condition to FDTD Simulation of Microwave Circuits." 1996 MTT-S International Microwave Symposium Digest 96.2 (1996 Vol. II [MWSYM]): 581-584.

Berenger introduced the concept of a terminating boundary known as perfectly matched layer (PML), in which electromagnetic waves are absorbed without reflection, irrespective of frequency and angle of incidence of the incoming wave. This absorbing boundary condition promises to be very attractive for microwave CAD applications involving complex geometries such as high-density microwave integrated circuits and electronic packages, because the computational domain can be significantly reduced. This paper presents, for the first time, a rigorous analysis of the stability of the PML boundary condition applied to finite-difference time-domain (FDTD) simulation. We discuss the FDTD simulation of a high-Q microstrip filter to show improvement in computational efficiency without any manifestation of instability.

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Correction of Imperfect Absorbing Boundary Conditions in FD-TD

F. Moglie, T. Rozzi, E. Martelli and S. Anmara. "Correction of Imperfect Absorbing Boundary Conditions in FD-TD." 1996 MTT-S International Microwave Symposium Digest 96.2 (1996 Vol. II [MWSYM]): 585-588.

In the Finite Differences in the Time Domain (FD-TD) technique the knowledge of the field is often unnecessary, as that of the scattering parameter suffices. We introduce a very simple method to correct Absorbing Boundary Condition (ABC) errors in the scattering parameter evaluation arising from any ABC, however imperfect: this method allows universal use of any one simple ABC for any transmission media, therefore facilitating the development of general purpose codes. The technique is based on the evaluation of the reflection coefficient due to the absorbing boundary condition in the time-domain and a subsequent correction in the frequency domain. Hence, it is independent of the kind of line and applicable to microstrip, classical waveguide or any other transmission media. The technique can also be applied to any kind of ABC.

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Hybrid FDTD Simulations of Rib-Waveguides

A. Lauer, A. Bahr and I. Wolff. "Hybrid FDTD Simulations of Rib-Waveguides." 1996 MTT-S International Microwave Symposium Digest 96.2 (1996 Vol. II [MWSYM]): 589-592.

Finite Difference Time Domain simulations of rib-waveguides on GaAs substrate are performed using a real-number hybrid (Yee/discrete-wave-equation) scheme in two dimensions. Local grid refinements are derived using equivalent circuit modifications. Discrete formulas are written using shift-operators, which make them short and easy to use. Results are compared to those obtained using the well-known effective-refractive-index (ERI) approximation. FDTD results show excellent agreement with the approximative formula which is given in an explicit form. The refinements work well for low frequencies to determine cutoff-frequencies.

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Abstracts

A Universal Method of Accurate S-Parameter Extraction from FD-TD Simulations Applicable to Oblique Ports

M. Celuch-Marcysiak, A. Kozak and W.K. Gwarek. "A Universal Method of Accurate S-Parameter Extraction from FD-TD Simulations Applicable to Oblique Ports." 1996 MTT-S International Microwave Symposium Digest 96.2 (1996 Vol. II [MWSYM]): 593-596.

A differential method for accurate extraction of the complete S-parameters from FD-TD simulations is proposed. In reciprocal circuits no a priori knowledge of reference impedances or field distribution in the ports is needed. The method is directly applicable to arbitrarily shaped and inhomogeneous transmission lines, oblique to the FD-TD grid.



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MRTD Modeling of Nonlinear Pulse Propagation

M. Krumpholz, H.G. Winful and L.P.B. Katehi. "MRTD Modeling of Nonlinear Pulse Propagation." 1996 MTT-S International Microwave Symposium Digest 96.2 (1996 Vol. II [MWSYM]): 597-600.

The nonlinear pulse propagation in optical fiber filters is modeled by a multiresolution time domain (MRTD) scheme based on the expansion in scaling functions. As for the case of the linear modeling of microwave structures, the MRTD scheme exhibits advantages over Yee's FDTD scheme, since it allows to reduce the mesh size by a factor of five per dimension. This is demonstrated by modeling the pulse compression with both MRTD and FDTD schemes.

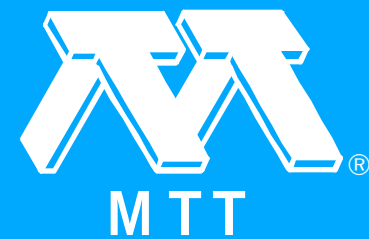
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Abstracts

Session WE2C -- Filters II

"Session WE2C -- Filters II." 1996 MTT-S International Microwave Symposium Digest 96.2 (1996 Vol. II [MWSYM]): 601-602.



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Whispering Gallery Dielectric Resonator Filters

D. Cros, F. Nigon, P. Besnier, M. Aubourg and P. Guillon. "Whispering Gallery Dielectric Resonator Filters." 1996 MTT-S International Microwave Symposium Digest 96.2 (1996 Vol. II [MWSYM]): 603-606.

This paper discusses the utilization of whispering gallery mode dielectric resonators for the design of filters at high frequencies. The analysis based on the three dimensional finite element method makes it possible to predict the theoretical responses of filters. Two kinds of filters are presented. The first one is a volumic one and uses two resonators placed in a metallic cavity and coupled to two electric probes. The second one is a planar one and is the association of elementary devices which are composed of a dielectric resonator coupled to two parallel microstrip lines.

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Miniature Microstrip Stepped Impedance Resonator Bandpass Filters and Diplexers for Mobile Communications

A.F. Sheta, J.P. Coupez, G. Tanne, S. Toutain and J.P. Blot. "Miniature Microstrip Stepped Impedance Resonator Bandpass Filters and Diplexers for Mobile Communications." 1996 MTT-S International Microwave Symposium Digest 96.2 (1996 Vol. II [MWSYM]): 607-610.

Miniature microstrip stepped impedance resonator bandpass filters and diplexers for satellite mobile communications have been developed. A very high dielectric constant substrate (epsilon r=89 and h=2mm) is used. Experimental results show that an unloaded half wave resonator quality factor as high as 400 at 1.5 GHz, with such substrate, maybe possible. The merit of this circuit lies in the simplicity of design procedure, the possibility of developing this filter with quite a variety of high dielectric constant substrate materials and the simplicity of simulation with most commercial software packages. A four resonator bandpass filter with 35 MHz bandwidth at 1.55 GHz was designed and implemented with this substrate. Based on this filter, a diplexer which meets satellite mobile communications performance has been developed. Experimental results are in good agreement with theoretical predictions

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Low-Cost Waveguide Filters with Printed-Circuit Inserts

H. Schmiedel, M. Muller and A. Anufriev. "Low-Cost Waveguide Filters with Printed-Circuit Inserts." 1996 MTT-S International Microwave Symposium Digest 96.2 (1996 Vol. II [MWSYM]): 611-614.

An easy to manufacture waveguide filter is presented. This type of filter is based on printed-circuit-board inserts with resonator strips. The electromagnetic properties of the strips interacting with the electromagnetic field inside the waveguide are described by equivalent circuit elements. Filter synthesis and computer optimization is applied to design band-stop filters. Finally simulated results are compared with measurements.

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A New Dielectric Loaded Cavity for High Power Microwave Filtering

S. Moraud, S. Verdeyme, P. Guillon, Y. Latouche, S. Vigneron and B. Theron. "A New Dielectric Loaded Cavity for High Power Microwave Filtering." 1996 MTT-S International Microwave Symposium Digest 96.2 (1996 Vol. II [MWSYM]): 615-618.

This paper is devoted to high electrical performances filter realization for space application. A new form of new dielectric plate resonator shielded in a metallic cavity is presented. It is suitable for high power applications and presents the advantage to be easily manufactured. The finite element method is applied to design the resonators. Experimental 4 poles quasi elliptic filters have been realized to prove the efficiency of our new technique.

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A Multilayer Bandpass Filter Integrated Into RF Module Board

H.-C. Chang, C.-C. Yeh, W.-C. Ku and K.-C. Tao. "A Multilayer Bandpass Filter Integrated Into RF Module Board." 1996 MTT-S International Microwave Symposium Digest 96.2 (1996 Vol. II [MWSYM]): 619-622.

A bandpass filter using multilayer structure is designed and manufactured. This filter is for the DECT handset RF module, hence must be compact, easy for mass-production, and low cost. This design uses standard (yet lowloss) FR4 board (epsilon $r=4.8$) and tapped I/O for the ease of manufacturing. A zero is introduced at the image frequency. Its multilayer structure occupies only three layers, and allows the filter to be integrated into the RF module board, while its tapped I/O increases manufacturing tolerance, and is easy for connection.

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High-Order Monolithic Active Recursive Filter Based Upon Multicellular Approach

M. Delmond, L. Billonnet, B. Jarry and P. Guillon. "High-Order Monolithic Active Recursive Filter Based Upon Multicellular Approach." 1996 MTT-S International Microwave Symposium Digest 96.2 (1996 Vol. II [MWSYM]): 623-626.

This article deals with a multicellular approach for high-order monolithic active recursive filter design. The transfer function results from a cascade association of first-order recursive cells, each characterizing a single pole. We illustrate our approach with simulated results for a higher-order bandpass filter in the X-band and finally present measurements for the corresponding structures resulting from the cascade association of first-order recursive tunable filters, in MMIC technology.

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A Four-Pole Dual Mode Elliptic Filter Realized in Circular Cavity without Screws (1996 Vol. II [MWSYM])

L. Accatino, G. Bertin and M. Mongiardo. "A Four-Pole Dual Mode Elliptic Filter Realized in Circular Cavity without Screws (1996 Vol. II [MWSYM])." 1996 MTT-S International Microwave Symposium Digest 96.2 (1996 Vol. II [MWSYM]): 627-630.

A 4-pole filter displaying an elliptic type response and implemented in circular cavity without tuning screws is presented. The cavity employs a novel arrangement, consisting in the insertion of a short length of inclined rectangular waveguide in the middle of the cavity body, in order to obtain the desired coupling and tuning actions. A full-wave model of the complete filter has been developed and specialized pretuning techniques are used. The measured response of a breadboard channel filter operating at Ku-Band shows good agreement with computed data and proves the proposed approach to be valid and viable.

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A Millimeter-Wave Micromachined Lowpass Filter Using Lumped Elements

T.M. Weller and L.P.B. Katehi. "A Millimeter-Wave Micromachined Lowpass Filter Using Lumped Elements." 1996 MTT-S International Microwave Symposium Digest 96.2 (1996 Vol. II [MWSYM]): 631-634.

A new approach is presented for realizing millimeter-wave micromachined lowpass filters using lumped elements. An efficient quasi-static analysis is utilized to design a Ka-band filter with 0.5 dB insertion loss and a rejection bandwidth from 30-125 GHz. The layout requires ten times less area than a comparable stepped-impedance implementation.

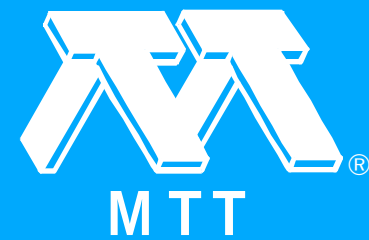
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Abstracts

Session WE2D -- Personal Communications via Satellites Technology and Trends

"Session WE2D -- Personal Communications via Satellites Technology and Trends." 1996 MTT-S International Microwave Symposium Digest 96.2 (1996 Vol. II [MWSYM]): 635-636.



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Personal Communications via Present and Future Satellite Systems

A.E. Williams, R.K. Gupta and A.I. Zaghloul. "Personal Communications via Present and Future Satellite Systems." 1996 MTT-S International Microwave Symposium Digest 96.2 (1996 Vol. II [MWSYM]): 637-640.

Personal communications satellite systems are designed to provide narrowband voice service directly to a handheld transceiver no larger than a cellular phone. For the past 5 years, extensive studies have been undertaken by industry to determine whether operation into a handheld terminal can be achieved more successfully via communications satellites in low earth orbit (LEO), intermediate circular orbit (ICO), or the more conventional geostationary orbit (GEO). Systems based on these three orbit types have been proposed and are in various stages of construction, with initial deployments scheduled during the years 1998 to 2000. This paper gives an overview of proposed personal satellite communications systems, describes their current status, and offers a perspective on how these systems might evolve in the marketplace in the post-2000 time frame.

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The European Mobile System Payloads for Personal and Mobile Communications

A. Pullara, M. Marinelli and L. Miracapillo. "The European Mobile System Payloads for Personal and Mobile Communications." 1996 MTT-S International Microwave Symposium Digest 96.2 (1996 Vol. II [MWSYM]): 641-644.

This paper describes the characteristics of the Alenia Spazio payloads providing L-band personal and mobile communications services. The characteristics of a satellite under study for mobile communications at Ku and EHF band are described too. The payloads are: EMS, LLM and SECOMS. EMS (European Mobile System) is an ESA Payload embarked on the Italian satellite ITALSAT F2. It will be the first in orbit element of an European Land Mobile Satellite Communication System LLM (L - band Land Mobile) is a payload that will be embarked on the European Spacecraft ARTEMIS and will be used to increase the EMS payload capabilities. SECOMS (Satellite EHF Communications for Multimedia-mobile Services) is a satellite under study for future mobile and personal communications at Ku and EHF band.

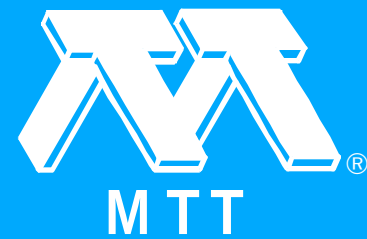
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Session WE2E -- Control and Frequency Translation

"Session WE2E -- Control and Frequency Translation." 1996 MTT-S International Microwave Symposium Digest 96.2 (1996 Vol. II [MWSYM]): 645-646.



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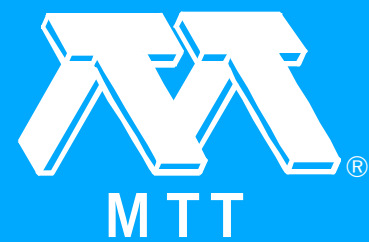
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A Novel Resonant-Type GaAs SPDT Switch IC with Low Distortion Characteristics for 1.9 GHz Personal Handy-Phone System

K. Kawakyu, Y. Ikeda, M. Nagaoka, K. Ishida, A. Kameyama, T. Nitta, M. Yoshimura, Y. Kitaura and N. Uchitomi. "A Novel Resonant-Type GaAs SPDT Switch IC with Low Distortion Characteristics for 1.9 GHz Personal Handy-Phone System." 1996 MTT-S International Microwave Symposium Digest 96.2 (1996 Vol. II [MWSYM]): 647-650.

A GaAs SPDT switch IC operating at a low power supply voltage of 2.7 V has been developed for use in Personal Handy-Phone System in the 1.9 GHz band. In combination with MESFETs with low on-resistance and high breakdown voltage, the resonant-type switch IC utilizes stacked FETs and an additional shunt capacitor at the receiver side in order to realize low insertion loss, high isolation and low distortion characteristics. An insertion loss of 0.55 dB and an isolation of 35.8 dB were obtained at 1.9 GHz. The IC also achieved a second order distortion of -54.3 dBc and an adjacent channel leakage power of -66 dBc at 600 kHz apart from 1.9 GHz at 19 dBm output power.

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Zero Power Consumption Si/SiGe HBT SPDT T/R Antenna Switch

R. Gotzfried, T. Itoh, J.F. Luy and H. Schumacher. "Zero Power Consumption Si/SiGe HBT SPDT T/R Antenna Switch." 1996 MTT-S International Microwave Symposium Digest 96.2 (1996 Vol. II [MWSYM]): 651-654.

Design and performance of a new transmit/receive (T/R) antenna switch for mobile communication systems at 1.8GHz using Si/SiGe Heterojunction Bipolar Transistors (HBT) are described. The switch is designed to be a part of a transceiver front end for DECT and DCS 1800 applications. This circuit requires no external DC bias. The insertion loss in the receive arm is <1.5dB and the isolation >25dB at the operating frequency.





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An X-Band Monolithic Active Mixer in SiGe HBT Technology

M. Case, S.A. Maas, L. Larson, D. Rensch, D. Hareme and B. Meyerson. "An X-Band Monolithic Active Mixer in SiGe HBT Technology." 1996 MTT-S International Microwave Symposium Digest 96.2 (1996 Vol. II [MWSYM]): 655-658.

We present the design, novel fabrication techniques, and measurements of a SiGe HBT X-Band active mixer MMIC. By implementing microstrip transmission lines on an inexpensive, low-loss spin-on dielectric above the lossy Si substrate, we use the high-speed SiGe HBTs in "classical" monolithic microwave circuits.

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Optimization of Active Microwave Frequency Multiplier Performance Utilizing Harmonic Terminating Impedances (1996 Vol. II [MWSYM])

D. Thomas, Jr. and G.R. Branner. "Optimization of Active Microwave Frequency Multiplier Performance Utilizing Harmonic Terminating Impedances (1996 Vol. II [MWSYM])." 1996 MTT-S International Microwave Symposium Digest 96.2 (1996 Vol. II [MWSYM]): 659-662.

A primary factor affecting optimum performance of microwave multipliers employing nonlinear devices is the proper termination of the fundamental and other harmonic frequency components. The objective of this paper is to present a quantitative analysis leading to the assessment of optimum terminating impedances in the design of active frequency multipliers. The analysis includes computer modeled HEMT data and supporting measured data for corresponding circuit realizations. An experimental design reveals an improvement in multiplier gain of 77% over the conventional approach.

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Abstracts

A Novel Technique for HEMT Tripler Design

G. Zhang, R.D. Pollard and C.M. Snowden. "A Novel Technique for HEMT Tripler Design." 1996 MTT-S International Microwave Symposium Digest 96.2 (1996 Vol. II [MWSYM]): 663-666.

The effect of fundamental loading on HEMT tripler performance has been investigated. An 11.5 to 34.5 GHz HEMT tripler has been fabricated employing a novel design technique with fundamental rejection feedback. The experimental results show good agreement with the harmonic balance simulations.



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Odd Order MESFET Multipliers with Broadband, Efficient, Low Spurious Response

O. Von Stein and J. Sherman. "Odd Order MESFET Multipliers with Broadband, Efficient, Low Spurious Response." 1996 MTT-S International Microwave Symposium Digest 96.2 (1996 Vol. II [MWSYM]): 667-670.

A novel circuit structure for odd order MESFET frequency multipliers has been developed using a generalized design approach. Improvements in efficiency, bandwidth and spurious harmonic rejection have been achieved via accurate models under large signal conditions.

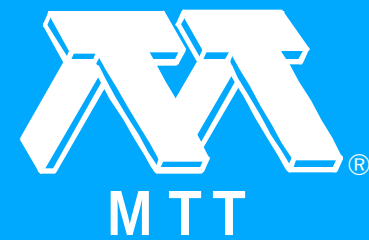
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Abstracts

Session WE3A -- Power Amplifier Technologies

"Session WE3A -- Power Amplifier Technologies." 1996 MTT-S International Microwave Symposium Digest 96.2 (1996 Vol. II [MWSYM]): 671-672.



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A 230 Watt S-Band SiGe HBT

P.A. Potyraj, K.J. Petrosky, K.D. Hobart, F.J. Kub and P.E. Thompson. "A 230 Watt S-Band SiGe HBT." 1996 MTT-S International Microwave Symposium Digest 96.2 (1996 Vol. II [MWSYM]): 673-676.

Large-area Si/Si_{1-x}Ge_x HBTs were demonstrated with record output power at S-Band. Under pulsed conditions in class C operation, >230 W saturated power was achieved at 2.8 GHz. At 200 W the device exhibited a collector efficiency of 46% and a power gain of 6.9 dB. Devices with implanted Si bases had comparable gain and 35% efficiency at 150 W, but saturated at 180 W. For high f_{max} a self-aligned silicided polysilicon-emitter structure was used in conjunction with a graded Si_{1-x}Ge_x base. The results indicate for the first time that Si/SiGe HBTs are suitable for high power, high frequency applications.

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Abstracts

Application of High Power Silicon Carbide Transistors at Radar Frequencies

A.W. Morse, P.M. Esler, R.C. Clarke, C.D. Brandt, R.R. Siemiey and A.K. Agarwal. "Application of High Power Silicon Carbide Transistors at Radar Frequencies." 1996 MTT-S International Microwave Symposium Digest 96.2 (1996 Vol. II [MWSYM]): 677-680.

Silicon carbide (SiC) is an emerging semiconductor material which has been widely predicted to allow greatly improved transistor performance over common semiconductors such as silicon and gallium arsenide. This paper describes the characteristics of recently fabricated devices in silicon carbide, and the first application of silicon carbide transistors in high power pulsed amplifiers at radar frequencies.



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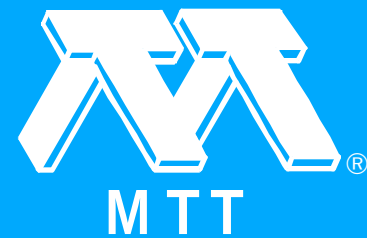


Abstracts

Silicon Carbide MESFET's with 2 W/mm and 50% P.A.E. at 1.8 GHz

S.T. Allen, J.W. Palmour, C.H. Carter, Jr., C.E. Weitzel, K.E. Moore, K.J. Nordquist and L.L. Pond, III. "Silicon Carbide MESFET's with 2 W/mm and 50% P.A.E. at 1.8 GHz." 1996 MTT-S International Microwave Symposium Digest 96.2 (1996 Vol. II [MWSYM]): 681-684.

Silicon carbide MESFET's with $0.7\text{ }\mu\text{m} \times 332\text{ }\mu\text{m}$ gates under Class B bias at 1.8 GHz had $P_{\text{sub 1dB}} = 28.3\text{ dBm}$ (2 W/mm CW) and 50.4% PAE. At the same power density, these FET's had 66% PAE at 0.85 GHz. This high power density combined with the extremely high thermal conductivity of SiC makes it a promising technology for high power microwave applications.



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Flip-Chip X-Band Operation of Thermally-Shunted Microwave HBT's with Sub-Micron Emitters

B. Bayraktaroglu, F. Ali, J. Mason and P. Smith. "Flip-Chip X-Band Operation of Thermally-Shunted Microwave HBT's with Sub-Micron Emitters." 1996 MTT-S International Microwave Symposium Digest 96.2 (1996 Vol. II [MWSYM]): 685-688.

Design and fabrication methods were developed for GaAs-based flip-chip HBTs with emitter sizes down to 1 μm or less. We have fabricated and tested identical size devices in both the conventional and the flip-chip configuration on the same wafer to make a direct comparison of their dc, microwave, and thermal properties. It was shown that flip-chip mounted microwave HBTs can produce the same or better electrical performance than their conventional upright counterparts while offering a 37% improvement in thermal resistance.

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High Efficiency Amplifiers for 8 GHz Band

S. Toyoda. "High Efficiency Amplifiers for 8 GHz Band." 1996 MTT-S International Microwave Symposium Digest 96.2 (1996 Vol. II [MWSYM]): 689-692.

This paper describes newly devised high efficiency amplifiers. They are single and push-pull power amplifiers operating in 8 GHz band. In the single amplifier, a trapezoidal voltage waveform is produced at an FET1 in the first stage of the circuit, and the operating angle is set to 74°. This voltage is amplified in the exciting stage and the power amplification is performed by a power FET in the final stage. Using an FET whose characteristics are the same as those of an FET used in the proposed amplifier, the conventional class A and class C power amplifiers are also constructed. For the three (new and conventional) amplifiers, the comparison is made in the output power and the power added efficiency, and the predominance of a new high efficiency power amplifier is demonstrated. The operating frequency is in 8 GHz band, and the output power is 2 W, 2.35 W, and 3 W for class A and class C amplifiers, and a new amplifier, respectively. For these amplifiers, the power added efficiency is 30 %, 48.5 %, and 60 %. A high efficiency push-pull power amplifier is also constructed, and the maximum power 7 W and the power added efficiency 76 % are obtained.





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High-Efficiency GaAs-Based pHEMT Power Amplifier Technology for 1-18 GHz

J.A. Puzl, J.J. Brown, J.B. Shealy, M. Hu, A.E. Schmitz, D.P. Docter, M.G. Case, M.A. Thompson and L.D. Nguyen. "High-Efficiency GaAs-Based pHEMT Power Amplifier Technology for 1-18 GHz." 1996 MTT-S International Microwave Symposium Digest 96.2 (1996 Vol. II [MWSYM]): 693-696.

Performance and reliability data for a high-efficiency microwave power amplifier design utilizing AlGaAs/InGaAs/GaAs pHEMTs are reported. A single stage MIC amplifier fabricated with a 5.6 mm gate width pHEMT resulted in $P_{\text{sub out}}=2.5$ W and PAE=73% at 4 GHz. Twenty three amplifiers with similar performance were built with devices from 4 different wafer lots. Currently, these amplifiers are undergoing an RF lifetest and have shown no change thus far to the 2000 h point. This GaAs-based pHEMT device technology supports amplifier module designs in the 1-18 GHz frequency range with output powers up to 20 W.

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Ku-Band 15W Single-Chip HJFET Power Amplifier

K. Matsunaga, Y. Okamoto, I. Miura and M. Kuzuhara. "Ku-Band 15W Single-Chip HJFET Power Amplifier." 1996 MTT-S International Microwave Symposium Digest 96.2 (1996 Vol. II [MWSYM]): 697-700.

This paper describes record power performance of Ku-band power amplifiers fabricated with a 0.45 μ m gate GaAs-based heterojunction FET (HJFET). The developed HJFET amplifier with 25.2mm gate periphery delivered a 41.98dBm (15.8W) output power with 36% power-added efficiency (PAE) and 9.6dB linear gain at 12GHz. This is the highest PAE, gain and output power combination achieved from a single-chip FET power amplifier at Ku-band.

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Abstracts

A High Power and High Efficiency Power Amplifier for Local Multipoint Distribution Service

M.K. Siddiqui, A.K. Sharma, L.G. Callejo, C.-H. Chen, K. Tan and H.-C. Yen. "A High Power and High Efficiency Power Amplifier for Local Multipoint Distribution Service." 1996 MTT-S International Microwave Symposium Digest 96.2 (1996 Vol. II [MWSYM]): 701-704.

This paper presents a high power and high efficiency MIC power amplifier using 0.2 μm InGaAs/AlGaAs/GaAs pseudomorphic HEMT (PHEMT) devices. The average performance of the power amplifier is 8.75 dB small signal gain, 39.6% power-added-efficiency, and 37 dBm (5.0 W) from 27.5 to 29.5 GHz. At these power levels, the output power density was 780 mw/mm including output circuit losses. This represents the highest output power and efficiency ever reported at Ka-band using MIC amplifiers.



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Session WE3B -- Integral-Equation-Based Numerical Analysis of Electromagnetic Microwave Problems

"Session WE3B -- Integral-Equation-Based Numerical Analysis of Electromagnetic Microwave Problems." 1996 MTT-S International Microwave Symposium Digest 96.2 (1996 Vol. II [MWSYM]): 705-706.



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Abstracts

Multiple Arbitrary Shape Via-Hole and Air-Bridge Transitions in Multilayered Structures (1996 Vol. II [MWSYM])

M.-J. Tsai, C. Chen, T.-S. Horng and N.G. Alexopoulos. "Multiple Arbitrary Shape Via-Hole and Air-Bridge Transitions in Multilayered Structures (1996 Vol. II [MWSYM])." 1996 MTT-S International Microwave Symposium Digest 96.2 (1996 Vol. II [MWSYM]): 707-710.

This paper presents a methodology for the design of multiple via-hole and air-bridge transitions of arbitrary shape in multilayered multi-port microstrip circuits. Application of multiple via holes to the design of microstrip filters and other devices will be presented. To describe properly the current along the vertical post, the simple pulse function with a triangular cross section is used. Circular, rectangular and triangular vertical transitions are analyzed and optimized for practical applications. The developed algorithms are much faster than existing softwares. The Green's function applies for any distance between and any location of field and source points.



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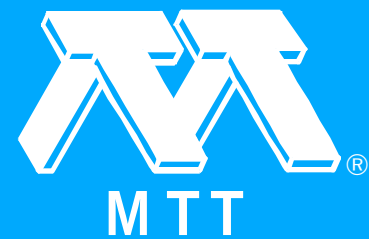
Optimization of Aperture Transitions for Multi-Port Microstrip Circuits

C. Chen, M.-J. Tsai and N.G. Alexopoulos. "Optimization of Aperture Transitions for Multi-Port Microstrip Circuits." 1996 MTT-S International Microwave Symposium Digest 96.2 (1996 Vol. II [MWSYM]): 711-714.

The printed aperture of arbitrary shape is introduced into multi-port microstrip circuits as a vertical transition within a multi-layered structure. Its use proves to be practical in the design as well as manufacturing process of multi-layered circuits. With the help of the mixed-potential integral equation based moment method, it becomes possible to analyze and optimize the performance of this arbitrary shape aperture transition for multi-port circuit applications. Bandwidth enhancement is obtained by changing the shape of the slot for a two-port back-to-back microstrip transition. Minimized size and mutual coupling have been thoroughly studied for optimized circuit performance. Using this transition, a 3-port power divider with -3 dB amplitude and 180 degree phase difference and a 4-port 3 dB directional coupler have been designed.

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A Modified Method-of-Moments Technique for the Full-Wave Analysis of Imperfect Conductors on Lossy and Finite-Extent Substrates

M. Gimersky and J. Bornemann. "A Modified Method-of-Moments Technique for the Full-Wave Analysis of Imperfect Conductors on Lossy and Finite-Extent Substrates." 1996 MTT-S International Microwave Symposium Digest 96.2 (1996 Vol. II [MWSYM]): 715-718.

A modified method-of-moments technique with general field-solver capability is presented. The structure to be analyzed is subdivided into a number of thin-wall cells. Surface impedance concepts are used to represent the material characteristics of each cell. The outstanding advantages of this method include: the absence of absorbing boundary conditions, as material parameters are defined with respect to a surrounding environment, e.g., free-space, thus minimizing the computational domain; conductor and dielectric losses are readily incorporated via the surface impedance concept; and radiation into any direction, even below the ground-plane of a finite-extent substrate, is included. Several examples involving imperfect conductors as well as lossy and finite-extent dielectric substrates are presented. The method is compared with measured results and is found to be in good agreement.

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Abstracts

A Discretized Integral Equation Approach for Solving Microstrip Circuits Embedded in Inhomogeneous Waveguides

H.M. Fahmy and T.E. van Deventer. "A Discretized Integral Equation Approach for Solving Microstrip Circuits Embedded in Inhomogeneous Waveguides." 1996 MTT-S International Microwave Symposium Digest 96.2 (1996 Vol. II [MWSYM]): 719-722.

A novel fullwave hybrid technique using the method of lines in an integral equation approach (MOL/IE) is developed. The strength of the method lies in the numerical computation of the dyadic Green's function. The advantages of the technique are presented and validation is performed for 2D and 3D structures.



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3-D Integral Equation Analysis of Guided and Leaky Waves on a Thin-Film Structure with 2-D Material Gratings

H.Y.D. Yang. "3-D Integral Equation Analysis of Guided and Leaky Waves on a Thin-Film Structure with 2-D Material Gratings." 1996 MTT-S International Microwave Symposium Digest 96.2 (1996 Vol. II [MWSYM]): 723-726.

This paper presents a 3-D integral equation analysis of guided surface waves and leaky waves on a dielectric layer structure with 2-D implanted periodic dielectric blocks. The electric fields within the implanted periodic blocks are unknowns in the moment method. The method involves a full dyadic Green's function. The guided surface waves and leaky waves are identified as eigenvalues of a deterministic equation resulting from a moment method procedure. The analysis may deal with a variety of irregular and anisotropic implants. The analysis may also deal with layered or grounded structures through the modification of the Green's function. The presented approach is also suitable for the analysis of photonic band gap materials.

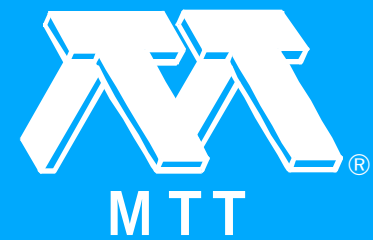
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Abstracts

Session WE3C -- CAD Methodology

"Session WE3C -- CAD Methodology." 1996 MTT-S International Microwave Symposium Digest 96.2 (1996 Vol. II [MWSYM]): 727-728.



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Simulation of Multiconductor Transmission Lines by Pade Approximation via the Lanczos Process

M. Celik and A.C. Cangellaris. "Simulation of Multiconductor Transmission Lines by Pade Approximation via the Lanczos Process." 1996 MTT-S International Microwave Symposium Digest 96.2 (1996 Vol. II [MWSYM]): 729-732.

We introduce a mathematical model for lossy, multiconductor transmission lines that makes possible the use of the Pade approximation via the Lanczos (PVL) process to the analysis of complex linear networks that contain multiple transmission line systems. Results from numerical experiments are presented to demonstrate the validity and discuss the efficiency of the proposed model.

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Artificial Neural Networks for Accurate Microwave CAD Applications

G.L. Creech, B. Paul, C. Lesniak, T. Jenkins, R. Lee and M. Calcaterra. "Artificial Neural Networks for Accurate Microwave CAD Applications." 1996 MTT-S International Microwave Symposium Digest 96.2 (1996 Vol. II [MWSYM]): 733-736.

A unique approach for applying neurocomputing technology for accurate CAD of microwave circuits is described. In our proposed method, a multilayer perception neural network (MLPNN) is trained to predict the scattering parameters of MMIC passive elements based on the element's physical dimensions. The s-parameters were obtained by performing a full-wave electromagnetic (EM) analysis of these elements. An X-band MLPNN spiral inductor model is developed. The MLPNN computed s-parameter values are in excellent agreement with those obtained from EM simulations with correlations greater than 0.99 for all modeled parameters.

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Efficient Coupling Patterns Design of Miniaturized Dielectric Filter Using EM Simulator and EPO Technique

M.-Q. Lee and S. Nam. "Efficient Coupling Patterns Design of Miniaturized Dielectric Filter Using EM Simulator and EPO Technique." 1996 MTT-S International Microwave Symposium Digest 96.2 (1996 Vol. II [MWSYM]): 737-740.

An efficient field theoretic CAD method is proposed for the design of a coupling pattern of a kind of circuits where the error parameter can be defined. In this method, the EM simulator is used in conjunction with EPO (Error Parameter Optimization) technique to expedite a coupling pattern design. The proposed technique is applied to the design of an asymmetric dielectric filter in 1900 MHz band. Only two or three iterations are needed for the coupling pattern design of a prototype filter satisfying the object response. This technique is shown to be simple and effective, and it dramatically saves computational time for electromagnetic pattern design.

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Abstracts

M)MIC Analysis Using a Hierarchy of Simulation Tools Controlled by Layout Pattern Recognition and Expert Knowledge

S. Tadjiky and R.H. Jansen. "(M)MIC Analysis Using a Hierarchy of Simulation Tools Controlled by Layout Pattern Recognition and Expert Knowledge." 1996 MTT-S International Microwave Symposium Digest 96.2 (1996 Vol. II [MWSYM]): 741-744.

An intelligent Design Assistant has been developed connecting the layout input and the netlist level of a CAD system using a hierarchy of different simulation tools. This design utility represents a new approach based on layout pattern recognition and expert knowledge for automated choice and control of the most suitable tools.



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Abstracts

Evolutionary Generation of (M)MIC Component Shapes Using 2.5D EM Simulation and Discrete Genetic Optimization

A. John and R.H. Jansen. "Evolutionary Generation of (M)MIC Component Shapes Using 2.5D EM Simulation and Discrete Genetic Optimization." 1996 MTT-S International Microwave Symposium Digest 96.2 (1996 Vol. II [MWSYM]): 745-748.

Using a combination of the fullwave 2.5D Spectral Domain Approach (SDA) and a genetic algorithm, the automated generation of (M)MIC component shapes having predescribed electrical specifications is demonstrated. Instead of merely scaling the dimensions of a predefined layout, the genetic optimizer creates the layout from the scratch exploiting explicitly the capability of the 2.5D fullwave simulation to analyze arbitrarily shaped conductor configurations. This may -- as is illustrated by two examples -- yield new, unconventional geometries.



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Abstracts

The Synthesis of Passive Circuits Using the FDTD

R.C. Tupynamba and A.S. Omar. "The Synthesis of Passive Circuits Using the FDTD." 1996 MTT-S International Microwave Symposium Digest 96.2 (1996 Vol. II [MWSYM]): 749-752.

An optimization procedure for the synthesis of passive circuits is presented. This procedure uses an FDTD code for the circuit analysis. The versatility of the FDTD allows the calculation of the circuit as a whole, with considering all discontinuities and interactions between the parts of the structure. The result is a powerful software package capable of producing an accurate circuit design.



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Fully Automated Space Mapping Optimization of 3D Structures

J.W. Bandler, R.M. Biernacki and S.H. Chen. "Fully Automated Space Mapping Optimization of 3D Structures." 1996 MTT-S International Microwave Symposium Digest 96.2 (1996 Vol. II [MWSYM]): 753-756.

We present new results of fully automating the aggressive Space Mapping™ (SM) strategy for electromagnetic optimization. The generic SM update loop and the model-specific parameter extraction loop are automated using a two-level Datapipe architecture. We apply the automated SM strategy to the optimization of waveguide transformers. We introduce a multi-point parameter extraction procedure for sharpening the solution uniqueness and improving the SM convergence. We present, for the first time, automated electromagnetic optimization utilizing the commercial 3D structure simulator HFSS.

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A Statistical Load Pull for Mixer Design Using a Commercial Circuit Simulator

J.F. Villemazet and M. Soulard. "A Statistical Load Pull for Mixer Design Using a Commercial Circuit Simulator." 1996 MTT-S International Microwave Symposium Digest 96.2 (1996 Vol. II [MWSYM]): 757-760.

This paper proposes a new approach allowing to simplify the design of mixers. As for power amplifiers, the aim of the developed load pull is to determine once for all the best parameters (loads, bias, LO pump signal...) which make a nonlinear device, used as mixing component, produce low conversion loss (or other fixtures). Knowing these data, mixers can be mainly designed using a linear approach. The method takes into account the loads at the spurious frequencies and leads to mixers which are less sensitive to these usually uncontrolled loads. It also allows to check this sensitivity. The statistical load pull has been successfully applied to the optimization of a quad of cold HEMT.

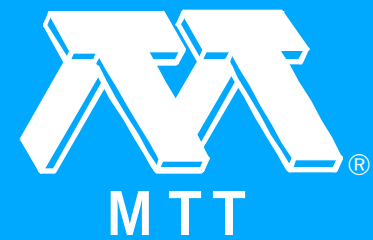
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Session WE3D -- Wireless Technology

"Session WE3D -- Wireless Technology." 1996 MTT-S International Microwave Symposium Digest 96.2 (1996 Vol. II [MWSYM]): 761-762.



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Large-Signal Automated Load-Pull of Adjacent-Channel Power for Digital Wireless Communication Systems

J.F. Sevic, M.B. Steer and A.M. Pavio. "Large-Signal Automated Load-Pull of Adjacent-Channel Power for Digital Wireless Communication Systems." 1996 MTT-S International Microwave Symposium Digest 96.2 (1996 Vol. II [MWSYM]): 763-766.

A large-signal fully automated load-pull system for characterization of adjacent-channel power for $\pi/4$ -DQPSK-based digital wireless communication systems is described. It is demonstrated that the commonly held beliefs that adjacent-channel power for the North American digital system follows a third-order process and that adjacent-channel power for the Japanese digital system follows a fifth-order process are in general not true. Instead, it is shown that adjacent-channel power is a composite of third- and fifth-order nonlinearities, the relative contributions of each being load impedance and device dependent. A simplified power series analysis coupled with spectral decomposition of the digitally modulated source signal is used to characterize conditions under which third-order intermodulation will correlate to adjacent-channel power.

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Abstracts

A High-Efficiency HBT Cellular Power Amplifier with Integrated Matching Networks

D.-W. Wu. "A High-Efficiency HBT Cellular Power Amplifier with Integrated Matching Networks." 1996 MTT-S International Microwave Symposium Digest 96.2 (1996 Vol. II [MWSYM]): 767-770.

The design, modeling, and characterization of an HBT cellular power amplifier using M/A-COM's glass-based technology is presented. The power amplifier features a single positive supply with fully integrated on-chip input and on-chip output matching circuits. The amplifier exhibited greater than 62% PAE for a collector voltage from 3 to 6V at 830MHz operating frequency, which is a record-high PAE using an integrated matching network with a single positive supply.



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PCS Amplifier with Integrated Power Control

T.A. Bos and U. Lott. "PCS Amplifier with Integrated Power Control." 1996 MTT-S International Microwave Symposium Digest 96.2 (1996 Vol. II [MWSYM]): 771-774.

A novel power control concept has been applied to a monolithic integrated power amplifier for the PCS/PCN frequency range of 1.9 to 2.4 GHz. At 3.3 V supply voltage the amplifier has a saturated power of 22.7 dBm at 1.95 GHz, which can be decreased continuously or in steps by an on chip control transistor. The amplifier has an efficiency better than 25% at P_{sat} and a gain of 25 dB at $P_{\text{sat}} - 1\text{dB}$.

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Effects of Nonlinear Distortion on CDMA Communication Systems (1996 Vol. II [MWSYM])

S.-W. Chen, W. Panton and R. Gilmore. "Effects of Nonlinear Distortion on CDMA Communication Systems (1996 Vol. II [MWSYM])." 1996 MTT-S International Microwave Symposium Digest 96.2 (1996 Vol. II [MWSYM]): 775-778.

We report a rigorous approach to analyze the effects of nonlinear distortion on code division multiple access (CDMA) wireless communication systems based on time-domain analysis and band-pass nonlinearity theory. Given AM-AM and AM-PM characteristics of a nonlinear device, this technique is capable of predicting adjacent channel power rejection (ACPR), power compression, and base-band signal vector constellation at the output of the nonlinear device. To demonstrate and verify the capability of this technique, an L-band power amplifier was designed, built, tested with CDMA waveforms, and compared with the simulated results. Excellent agreement between the measured and predicted results has been achieved.

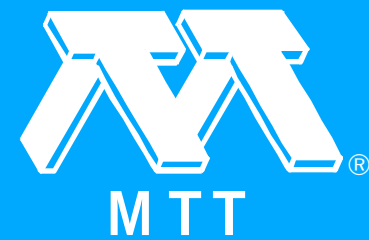
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Session WE3E -- Power Dividers and Couplers

"Session WE3E -- Power Dividers and Couplers." 1996 MTT-S International Microwave Symposium Digest 96.2 (1996 Vol. II [MWSYM]): 779-780.



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Uniplanar MIC Power Dividers Using Coupled CPW and Asymmetrical CPS

L. Fan and K. Chang. "Uniplanar MIC Power Dividers Using Coupled CPW and Asymmetrical CPS." 1996 MTT-S International Microwave Symposium Digest 96.2 (1996 Vol. II [MWSYM]): 781-784.

Two uniplanar power dividers using coupled CPW and asymmetrical CPS have been developed for MICs and MMICs. These circuits provide substantially improved performance over a wide bandwidth compared to conventional microstrip power dividers. Measured results show that both power dividers have greater than 20 dB isolation, less than 0.4 dB insertion loss over a bandwidth of more than 30% centered at 3 GHz. Experimental results agree well with calculated ones.

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A New 3-Way Power Divider with Various Output Power Ratios

J.-S. Lim and S.-Y. Eom. "A New 3-Way Power Divider with Various Output Power Ratios." 1996 MTT-S International Microwave Symposium Digest 96.2 (1996 Vol. II [MWSYM]): 785-788.

A new type of 3-way power divider which has various output power ratios is presented. This power divider without any internal resistors has a completely planar structure and can be easily realized using microstrip substrates. This divider has extremely excellent matching at each port and isolation. The 3-way divider which has been fabricated as an example shows 1:1:1, 4:1:1, 3:2:1 output power ratios. This divider also shows it can be used as a 2-way divider with 1:2, 1:1 ratios. All measured results are in good agreement with the predicted performances, and this structure is well extended to N-way power divider.

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A 50:1 Bandwidth Cost-Effective Coupler with Sliced Coaxial Cable

H. An, R.G. Bosisio, K. Wu and T. Wang. "A 50:1 Bandwidth Cost-Effective Coupler with Sliced Coaxial Cable." 1996 MTT-S International Microwave Symposium Digest 96.2 (1996 Vol. II [MWSYM]): 789-792.

A 20 dB 50:1 bandwidth, extremely low-cost coupler with sliced coaxial cable is reported in this paper. The proposed coupler consists of two shaped coaxial cables with adequate sliced linear-tapered cuts and soldered together. It has excellent performance in terms of low VSWR, good isolation, excellent EMI shielding, ultrawide coupling bandwidth, and high power handling capability. Good agreement between measurements and calculations on one hand shows the excellent performance of the coupler, and on the other hand validates the design procedure.

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Using Miniaturized 90 Degree Hybrid Coupler Using High Dielectric Substrate for QPSK Modulator

H. Tanaka, Y. Sasaki, T. Hashimoto, Y. Yagi and Y. Ishikawa. "Using Miniaturized 90 Degree Hybrid Coupler Using High Dielectric Substrate for QPSK Modulator." 1996 MTT-S International Microwave Symposium Digest 96.2 (1996 Vol. II [MWSYM]): 793-796.

This paper describes miniaturized 90 degree hybrid coupler using edge-coupled microstriplines. A high dielectric constant substrate ($K=38$) and high-dense coupled-line configuration are adopted to realize small chip size. A conventional meandered coupled-line type and a new spiral coupled-line type were discussed for high-dense configuration. A bandwidth from 1.8 GHz to 3.6 GHz with ± 0.5 dB power dividing balance and 90 ± 3 degrees phase difference were achieved with chip size of 1.5 x 1.5 mm.

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Abstracts

A 10-50 GHz Micromachined Directional Coupler

S.V. Robertson, L.P.B. Katehi and G.M. Rebeiz. "A 10-50 GHz Micromachined Directional Coupler." 1996 MTT-S International Microwave Symposium Digest 96.2 (1996 Vol. II [MWSYM]): 797-800.

A 20 dB directional coupler has been designed and fabricated on a thin dielectric membrane using micromachining techniques. Design of the asymmetric tapered coupled line coupler relies on readily available models and ideal transmission line theory. The use of membrane technology results in less than 0.4 dB insertion loss in the coupler from 10 to 50 GHz. In addition, a micromachined packaging technique creates a shielded circuit which is extremely compact and lightweight.



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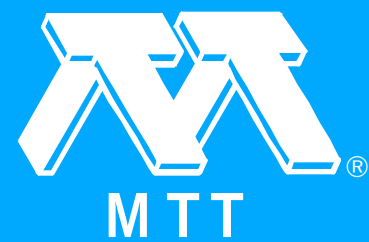
A Stripline Re-Entrant Coupler Network for Cofired Multilayer Microwave Circuits

R.E. Hayes, J.W. Gipprich and M.G. Hershfeld. "A Stripline Re-Entrant Coupler Network for Cofired Multilayer Microwave Circuits." 1996 MTT-S International Microwave Symposium Digest 96.2 (1996 Vol. II [MWSYM]): 801-804.

A stripline coupler network is presented that is suitable for cofired multilayer circuit applications. The network contains a tandem arrangement of two re-entrant coupler structures that can provide tight coupling (3 dB) and is insensitive to conductor registration or misalignments. In addition, circuit modeling and EM simulation for a coupler design using Low Temperature Cofired Ceramic (LTCC) is presented along with experimental results.

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Overlaid Parallel Coupled Inset Dielectric Guides for Broadband Applications to Directional Couplers

Z. Fan and Y.M.M. Antar. "Overlaid Parallel Coupled Inset Dielectric Guides for Broadband Applications to Directional Couplers." 1996 MTT-S International Microwave Symposium Digest 96.2 (1996 Vol. II [MWSYM]): 805-808.

Overlaid parallel coupled inset dielectric guides are proposed for broadband applications to directional couplers, and analyzed by using the integral equation formulation and Galerkin's procedure. Results are presented to illustrate effects of thickness and dielectric constant of the overlay on propagation and coupling characteristics. It is found that by suitable choice of these parameters very flat coupling can be achieved for a wide frequency range.

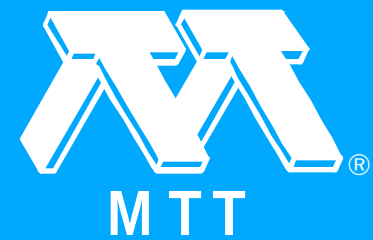
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Session WE3F -- Open Forum 1

"Session WE3F -- Open Forum 1." 1996 MTT-S International Microwave Symposium Digest 96.2 (1996 Vol. II [MWSYM]): 809-810.



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A Super Low-Noise Ion-Implanted Planar GaAs MESFET MMIC Amplifier

T. Sawai, M. Nishida, T. Hirai, K. Honda, T. Yamaguchi, S. Murai and Y. Harada. "A Super Low-Noise Ion-Implanted Planar GaAs MESFET MMIC Amplifier." 1996 MTT-S International Microwave Symposium Digest 96.2 (1996 Vol. II [MWSYM]): 811-814.

In order to develop an ultra-compact and super low-noise MMIC amplifier for the receiving system of PHS the input and output impedance of an ion-implanted planar GaAs MESFET were successfully reduced while maintaining its high-gain and low-noise characteristics. The MMIC had a noise figure of 1 dB and a gain of 13.5 dB 3 V, 20 mA and 1.9 GHz in an ultra-compact plastic package. The fabricated switch and LNA module employing this MMIC has achieved the low-noise property of less than 3 dB.

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Noise Optimization of a GaAs HBT Direct-Coupled Low Noise Amplifier

K.W. Kobayashi, L.T. Tran, A.K. Oki and D.C. Streit. "Noise Optimization of a GaAs HBT Direct-Coupled Low Noise Amplifier." 1996 MTT-S International Microwave Symposium Digest 96.2 (1996 Vol. II [MWSYM]): 815-818.

This work describes a GaAs HBT direct-coupled (inductor-less matched) MMIC LNA which was optimized for noise figure by careful selection of HBT device size, bias, and thorough consideration of its gamma opt characteristics. An optimum HBT device size and bias was determined which offers a device minimum NF (NFmin) of 0.9 dB at 2 GHz. The resulting HBT LNA achieves minimum noise figures of 1.5 dB, 1.6 dB, and 2.1 dB at 1 GHz, 2 GHz, and 3 GHz, respectively, while consuming only 6 mA of dc current through a 5 V supply. These NF's are believed to be the lowest reported for Si-BJT or GaAs HBT-based LNA MMICs in this frequency range. In addition, the LNA also achieves a gain of 22.4 dB, a 3.5 GHz bandwidth, and an IP3 greater than 8 dBm at 2 GHz. The design optimization revealed here gives insight into the noise performance trade-offs associated with GaAs HBT-based MMIC LNAs for low dc power wireless applications.

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A Novel Sub-Harmonic Pumping Direct Conversion Receiver with High Instantaneous Dynamic Range

M. Shimosawa, K. Kawakami, K. Itoh, A. Iida and O. Ishida. "A Novel Sub-Harmonic Pumping Direct Conversion Receiver with High Instantaneous Dynamic Range." 1996 MTT-S International Microwave Symposium Digest 96.2 (1996 Vol. II [MWSYM]): 819-822.

A novel sub-harmonic pumping direct conversion receiver (SHP-DCR) employing antiparallel diode pair (APDP) is proposed for high instantaneous dynamic range receivers used in mobile communications. The proposed SHP-DCR can suppress even harmonic mixing products, such as second order intermodulation (IM2) and LO noise that interfere a desired baseband signal. Moreover, the design condition of load resistance is indicated by analytical and experimental approaches for improving diode mixer disadvantages of lower conversion gain and higher LO power. A developed L-band SHP-DCR without a low noise amplifier achieves NF of 18.5dB, IP3 at input port of 3dBm and IM2 is below -90dB in the actual input range.

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New Topology of the GaAs Non-Linear Transmission Line (NLTL) Using Microstrip Line Technology

D. Salamh and D. Linton. "New Topology of the GaAs Non-Linear Transmission Line (NLTL) Using Microstrip Line Technology." 1996 MTT-S International Microwave Symposium Digest 96.2 (1996 Vol. II [MWSYM]): 823-826.

A novel NLTL is designed using microstrip as an alternative to the coplanar wave guide (CPW) approach which has the advantage of reduced chip size and cost. A frequency multiplier has been designed with the number of sections optimized for power output using harmonic balance simulation. The large and small signal models of the $4 \times 75 \mu\text{m}$ GaAs schottky diode which is used in the design are verified using S-parameters and large signal measurements.

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A Low Third Order Intermodulation Amplifier with Harmonic Feedback Circuitry

M.R. Moazzam and C.S. Aitchison. "A Low Third Order Intermodulation Amplifier with Harmonic Feedback Circuitry." 1996 MTT-S International Microwave Symposium Digest 96.2 (1996 Vol. II [MWSYM]): 827-830.

This paper describes a novel technique for reducing the third-order intermodulation product levels in a nonlinear amplifier. This technique is based on feeding the second harmonic signal produced at the output of the amplifier back to its input. Mathematical analysis and computer simulation are presented. The results of the related experiment which gave a measurement of 16 dB reduction in the level of the third order intermodulation is reported.

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A Novel Series Diode Linearizer for Mobile Radio Power Amplifiers

K. Yamauchi, K. Mori, M. Nakayama, Y. Itoh, Y. Mitsui and O. Ishida. "A Novel Series Diode Linearizer for Mobile Radio Power Amplifiers." 1996 MTT-S International Microwave Symposium Digest 96.2 (1996 Vol. II [MWSYM]): 831-834.

A novel series diode linearizer has been developed for mobile radio power amplifiers. It is composed of a series diode with a parallel capacitor, which provides positive amplitude and negative phase deviations with the increase of input power, and can compensate AM-AM and AM-PM distortions of power amplifiers. Applying this linearizer to 1.9 GHz MMIC power amplifier for the Japanese Personal Handy-phone System (PHS), an improvement of adjacent channel leakage power (ACP) up to 5 dB has been achieved for the $\pi/4$ -shifted QPSK modulated signal.

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Adaptive Digital Predistorter for Power Amplifiers with Real Time Modeling of Memoryless Complex Gains

E.G. Jeckeln, F.M. Ghannouchi and M. Sawan. "Adaptive Digital Predistorter for Power Amplifiers with Real Time Modeling of Memoryless Complex Gains." 1996 MTT-S International Microwave Symposium Digest 96.2 (1996 Vol. II [MWSYM]): 835-838.

When the resulted signal from linear modulation methods, like M-ary QAM, are passed through a nonlinear power amplifier, their fluctuating envelope causes distortion and spectral spreading. In order to avoid these effects, maintaining both power and spectral efficiency, lead to use of linearization techniques. This paper presents a digital predistorter with real time modeling of AM-AM and AM-PM characteristics of a power amplifier (PA). The input and output lowpass equivalent complex envelopes of the amplifier are sampled, scaled and updated into a lookup table to provide the predistorted signal. An improvement of 45 dB of out-of-band power is obtained in simulating with Signal Processing WorkSystem (SPW). Then, convergence time is eliminated. The proposed technique is robust and efficient since no iterative procedure is needed, hence the convergence time is eliminated.

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Abstracts

Evaluation and Correction of Time Dependent Amplifier Non-Linearity

A. Katz and R. Dorval. "Evaluation and Correction of Time Dependent Amplifier Non-Linearity." 1996 MTT-S International Microwave Symposium Digest 96.2 (1996 Vol. II [MWSYM]): 839-842.

Both very high linearity and wide bandwidth are required by many new microwave and wireless systems. The linearity of power amplifiers degrades with increasing signal bandwidth. This paper shows that this degradation is related to time-dependent changes in amplifier transfer characteristics. A new method for evaluating an amplifier's wide-band, dynamic, linearity is introduced, and strategies for improving the performance of both conventional and linearized amplifiers are discussed.



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High-Power, High-Efficiency Cell Design for 26 GHz HBT Power Amplifier

S. Tanaka, S. Murakami, Y. Amamiya, H. Shimawaki, N. Furuhashi, N. Goto, K. Honjo, Y. Ishida, Y. Saito, K. Yamamoto, M. Yajima, R. Temino and Y. Hisada. "High-Power, High-Efficiency Cell Design for 26 GHz HBT Power Amplifier." 1996 MTT-S International Microwave Symposium Digest 96.2 (1996 Vol. II [MWSYM]): 843-846.

We describe a 6-chip combination HBT power amplifier and a single-cell chip with excellent power-added efficiency (PAE) and power density at 24-26 GHz. The power amplifier, based on our conventional chip design, exhibited 2.2 W output power with 19 % PAE and 5 dB linear gain. To further improve the efficiency and power-density, various types of HBT cells were characterized. The optimum cell ($184 \mu\text{m}^2$) exhibited 740 mW output power equivalent to power density of $4.0 \text{ mW}/\mu\text{m}^2$, while a record high PAE of 42% was obtained. These results compare well with the best data reported at lower frequency bands (<18 GHz), thereby showing great potential for high-power, high-efficiency HBTs in near mmWave bands.

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Abstracts

Optimal Design of Low Crosstalk, Wideband, Bidirectional Distributed Amplifiers

S.N. Prasad and Z.M. Li. "Optimal Design of Low Crosstalk, Wideband, Bidirectional Distributed Amplifiers." 1996 MTT-S International Microwave Symposium Digest 96.2 (1996 Vol. II [MWSYM]): 847-850.

An optimal approach to the design of low crosstalk, wideband, bidirectional, distributed amplifiers is proposed. The new technique based on Chebyshev scaling of device transconductances, gives considerably greater directivity bandwidth than the previously published approach using binomial scaling, for specified number of devices and minimum directivity. The theory and design guidelines, as well as simulated and measured results are presented.



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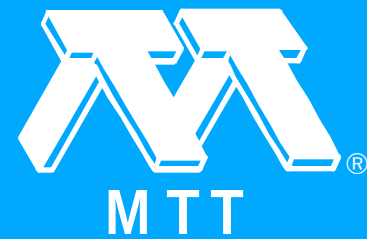


Abstracts

Linear RF Power Amplifier Design for CDMA Signals

Q. Wu, M. Testa and R. Larkin. "Linear RF Power Amplifier Design for CDMA Signals." 1996 MTT-S International Microwave Symposium Digest 96.2 (1996 Vol. II [MWSYM]): 851-854.

In this paper, we analyze the non-linear effect of an RF power amplifier on CDMA signals and then derive the design formulas which provide the direct relation between the power transistor's traditional non-linearity parameter, the 3rd order intercept point (IP3) and the out-of-band emission levels for CDMA signals. This result will be very useful to system and component engineers in design of RF power amplifiers for CDMA wireless systems.



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A Design Method for High Efficiency Class F HBT Amplifiers

A. Mallet, T. Peyretailade, R. Sommet, D. Floriot, S. Delage, J.M. Nebus and J. Obregon. "A Design Method for High Efficiency Class F HBT Amplifiers." 1996 MTT-S International Microwave Symposium Digest 96.2 (1996 Vol. II [MWSYM]): 855-858.

In this paper, we report on the Class F operation of HBTs. A temperature dependent model of a $240\mu\text{m}^2$ GaInP/GaAs HBT (THOMSON-CSF) was extracted from pulsed I/V and pulsed S parameter measurements and validated by load-pull measurements. An extensive large signal HB analysis, based on "the substitute generator technique", was achieved to optimize the load impedance at harmonic frequencies required for class F operation. Furthermore, the performances of the transistor in terms of added power, power added efficiency and dissipated power, were investigated under different bias modes (ie: constant base voltage, constant base current and self bias modes). We will show that the bias mode has a great influence on the HBT linearity.

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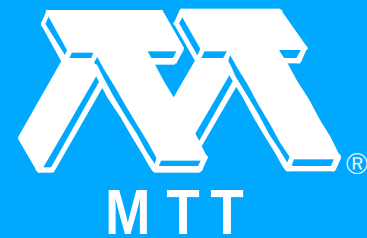


Abstracts

High Efficiency Harmonic Control Amplifier

B. Ingruber, W. Pritzl and G. Magerl. "High Efficiency Harmonic Control Amplifier." 1996 MTT-S International Microwave Symposium Digest 96.2 (1996 Vol. II [MWSYM]): 859-862.

A new high efficiency amplifier concept which ideally delivers 100 % drain efficiency and class A gain is described. The power amplifier realized with a commercially available GaAs FET has demonstrated 74 % power-added efficiency, 27.9 dBm output power, and 14.4 dB gain at 1.62 GHz.



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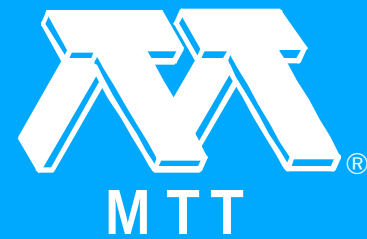


Abstracts

Conditionally Stable Amplifier Design Using Constant μ -Contours (1996 Vol. II [MWSYM])

M.L. Edwards and S. Cheng. "Conditionally Stable Amplifier Design Using Constant μ -Contours (1996 Vol. II [MWSYM])." 1996 MTT-S International Microwave Symposium Digest 96.2 (1996 Vol. II [MWSYM]): 863-866.

Conditionally stable amplifiers can be an attractive design option for commercial applications where increased gain can be achieved by accepting a measured risk of instability. A procedure is presented for designing amplifier input and output matching networks which permits an a-priori, quantitative trade-off between gain and the stability parameter, μ .



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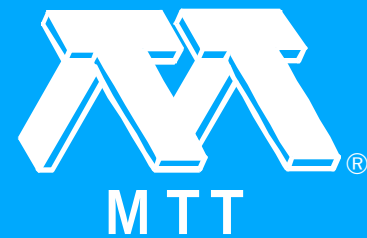


Abstracts

Analysis and Design of Broadband, High Efficiency Feedforward Amplifiers

K. Konstantinou and D.K. Paul. "Analysis and Design of Broadband, High Efficiency Feedforward Amplifiers." 1996 MTT-S International Microwave Symposium Digest 96.2 (1996 Vol. II [MWSYM]): 867-870.

A novel analysis of feedforward linearizes providing design procedures for determining circuit parameters required for specified linearity and achieving high efficiency, is presented. Experimental results are reported for a C band feedforward linearized amplifier demonstrating a minimum of 20 dB intermodulation distortion suppression across the 5.9 - 6.4 GHz satellite band.



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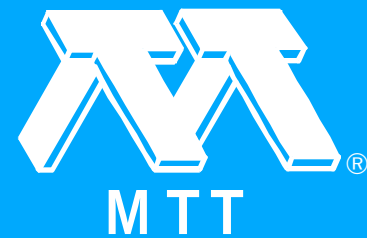


Abstracts

New Structure for DC-60 GHz Thermal Power Sensor

S. Kodato, T. Wakabayashi, Q. Zhuang and S. Uchida. "New Structure for DC-60 GHz Thermal Power Sensor." 1996 MTT-S International Microwave Symposium Digest 96.2 (1996 Vol. II [MWSYM]): 871-874.

We have developed a new structure thermopile-type thermal power sensor for the millimeter wave range (dc to 60 GHz). It consists of a ceramic substrate, metal and microcrystalline-SiGe thin films. Both fast or high-sensitivity sensors can be manufactured.



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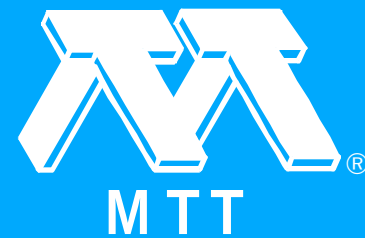


Abstracts

A Compact MMIC-Compatible Microstrip to Waveguide Transition

L. Hyvonen and A. Hujanen. "A Compact MMIC-Compatible Microstrip to Waveguide Transition." 1996 MTT-S International Microwave Symposium Digest 96.2 (1996 Vol. II [MWSYM]): 875-878.

A new type of microstrip to waveguide transition is presented, based on slot coupling and a dielectric quarter wave transformer. For a return loss of 20 dB, a relative bandwidth of 16 % was achieved. The structure is compact, MMIC-compatible and can be made hermetic.



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Abstracts

A Design Technique for Raising Upper Frequency Limit of Wide-Band 180°Hybrids

M. Nakajima and H. Tanabe. "A Design Technique for Raising Upper Frequency Limit of Wide-Band 180°Hybrids." 1996 MTT-S International Microwave Symposium Digest 96.2 (1996 Vol. II [MWSYM]): 879-882.

A design technique combining Rectangular Boundary Division method and Finite-Difference Time-Domain method is proposed for raising upper frequency limit of 180° hybrids. Characteristics of a designed 180° hybrid covering 2 to 26.5GHz are shown as experimental results.



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Photonic Band Structures for a Class of 2D Periodic Dielectric Materials

H.Y.D. Yang. "Photonic Band Structures for a Class of 2D Periodic Dielectric Materials." 1996 MTT-S International Microwave Symposium Digest 96.2 (1996 Vol. II [MWSYM]): 883-886.

In recent years, there has been extensive interest in the development of artificial electrical or optical materials. By tailoring the material electrical characteristics, one is able to control the flow of electromagnetic waves from microwave to optic frequencies. This paper presents the guided wave properties of a class of two dimensional photonic crystals made of periodic dielectric rods. An efficient finite difference method is developed for the calculation of propagation constants of guided or evanescent waves in an arbitrary direction (in-plane or out-of-plane propagation). The emphasis is on the existence of photonic bandgaps within which the in-plane propagation is prohibited. Possible applications of photonic bandgap materials are also discussed.

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Investigations and Improvements in Microwave Opto-Electronic Variable Delay Lines

I. Frigyes, O. Schwelb and J. Berces. "Investigations and Improvements in Microwave Opto-Electronic Variable Delay Lines." 1996 MTT-S International Microwave Symposium Digest 96.2 (1996 Vol. II [MWSYM]): 887-890.

A particular class of optically generated microwave delay lines is dealt with namely those that apply path length dispersions. Detailed analysis of the design, using an acousto-optic device for spatial imaging is given. Furthermore two new designs. decomposing the signal into sub-bands; a.) via a pixelled mirror and b.) using an electrical filter bank, are discussed. Detailed analysis of these structures as well as limitations of applicability are given. Numerical experiments validate the theoretical results.

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1/4 W Optical Receiver and Clock Recovery Circuit for Gb/s Digital Fiberoptic Links

A.S. Daryoush, X. Zhang and J.Y. Lin. "1/4 W Optical Receiver and Clock Recovery Circuit for Gb/s Digital Fiberoptic Links." 1996 MTT-S International Microwave Symposium Digest 96.2 (1996 Vol. II [MWSYM]): 891-894.

Design and simulation of a low power consuming MMIC chip set is presented in this paper., which is used as an optical receiver and clock recovery circuit operating up to 1.25Gb/s. This design is based on BTA24 Si BJT transistor array from Bipolarics. Major design innovations such as push-pull self-oscillating mixer and a push-push frequency doubler is used to provide a total power consumption of 247mW in an area of only 700 μ m $\times$ 700 μ m.

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Simulation of a Subcarrier Multiplexed Communications System: A Performance Enhancement Tool

S. Han, M. Vaughn, J. Laskar and D. Blumenthal. "Simulation of a Subcarrier Multiplexed Communications System: A Performance Enhancement Tool." 1996 MTT-S International Microwave Symposium Digest 96.2 (1996 Vol. II [MWSYM]): 895-898.

A 3.9 GHz RF-optical subcarrier (OSCM) packet transmission multiplexed system is simulated and experimentally demonstrated. Simulation results show that integration of the RF subsystem will greatly enhance system performance and require less power to be tapped from the fiber for header detection and processing.

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Abstracts

Ultra-Wide Bandwidth, Low Voltage, and Chirp-Free Optical Intensity Modulator: Design and Performance Analysis

M.T.C. Silva and C.A. De Francisco. "Ultra-Wide Bandwidth, Low Voltage, and Chirp-Free Optical Intensity Modulator: Design and Performance Analysis." 1996 MTT-S International Microwave Symposium Digest 96.2 (1996 Vol. II [MWSYM]): 899-902.

A novel wavelength-selective InGaAs/InP coupled asymmetric quantum well electrorefraction type optical intensity modulator is proposed. The device is based on contradirectional exchange Bragg grating coupled-waveguide structure, which avoids the use of an interferometer. For a non-optimized device the bandwidth is 111 GHz at 1.67 V and it is chirp-free. The device can be integrated with lasers, optical amplifiers, photodetectors etc. It can also be integrated in tandem.



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Abstracts

The Noise Performance of 20 GHz Optical Receivers Using a Distributed Amplifier and P-I-N Photodiode Combination with Matched and Unmatched Input Terminations

J.Y. Liang and C.S. Aitchison. "The Noise Performance of 20 GHz Optical Receivers Using a Distributed Amplifier and P-I-N Photodiode Combination with Matched and Unmatched Input Terminations." 1996 MTT-S International Microwave Symposium Digest 96.2 (1996 Vol. II [MWSYM]): 903-906.

High speed optical receivers have been fabricated by using p-i-n diode and distributed amplifier combinations. The preliminary experimental results show that the ± 3 dB bandwidth from 1 GHz to 20 GHz was achieved for both input matched and unmatched configurations, while the later reduced the average equivalent input noise to nearly half the value of the former.



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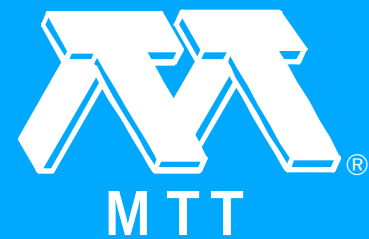
Optical Polarization Effect in Discrete Time Fiber-Optic Structures for Microwave Signal Processing

A. Ho-Quoc, S. Tedjini and A. Hilt. "Optical Polarization Effect in Discrete Time Fiber-Optic Structures for Microwave Signal Processing." 1996 MTT-S International Microwave Symposium Digest 96.2 (1996 Vol. II [MWSYM]): 907-910.

We report the effect of the optical polarization in discrete time fiber-optic devices for microwave signal processing applications. Experimental results show that even in the incoherent working regime of these devices, the polarization state of the optical carrier can strongly affect the overall microwave response. A new analysis based on the optical S-matrix representation is developed in order to model correctly these devices. It is found that the optical polarization can be exploited efficiently for tuning the microwave response.

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A New Type of Waveguide Structures with Photonic Band Structures

T. Suzuki, P.K.L. Yu, D.R. Smith and S. Schultz. "A New Type of Waveguide Structures with Photonic Band Structures." 1996 MTT-S International Microwave Symposium Digest 96.2 (1996 Vol. II [MWSYM]): 911-914.

We study a new type of waveguide structures -- two-dimensional photonic crystals sandwiched between two metal conductors. In the structures, not only the electromagnetic propagation, but also the radiation spectra can be controlled. Radiation from microwave dipole antennas can be completely suppressed in band gaps and enormously enhanced at specific pass bands frequencies.

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Abstracts

Metal-Semiconductor-Metal Photodetectors on Intermediate Temperature MBE Grown GaAs for Lightwave/Millimeter-Wave Applications

A. Paoella, G. Tait, P. Cooke, B. Nabet and B. Tousley. "Metal-Semiconductor-Metal Photodetectors on Intermediate Temperature MBE Grown GaAs for Lightwave/Millimeter-Wave Applications." 1996 MTT-S International Microwave Symposium Digest 96.2 (1996 Vol. II [MWSYM]): 915-918.

Intermediate growth temperature (IGT) GaAs GaAs Metal-Semiconductor-Metal (MSM) photodetectors enables an optimal combination of large dynamic range and speed. In addition these devices are suitable for monolithic integration. The static and temporal response of GaAs MSMs grown by Molecular Beam Epitaxy (MBE) at 350° C has been measured.



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Coherent Power Combining of Millimeter Wave Resonant Tunneling Diodes in a Quasi-Optical Resonator

T. Fujii, H. Mazaki, F. Takei, J. Bae, M. Narihiro, T. Noda, H. Sakaki and K. Mizuno. "Coherent Power Combining of Millimeter Wave Resonant Tunneling Diodes in a Quasi-Optical Resonator." 1996 MTT-S International Microwave Symposium Digest 96.2 (1996 Vol. II [MWSYM]): 919-922.

A Fabry-Perot resonator with a grating has been used for coherent power combining of a resonant tunneling diode (RTD) array in the millimeter wave region. Coherent power combining with two RTD's in the resonator has been successfully observed for the fundamental TEM/sub 00/ resonator mode at the frequency of 75 GHz.

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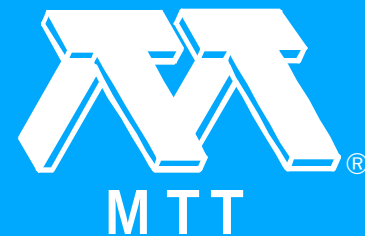


Abstracts

An Active Inverted Patch Antenna with Wideband Varactor-Tuned Capability

L. Fan and K. Chang. "An Active Inverted Patch Antenna with Wideband Varactor-Tuned Capability." 1996 MTT-S International Microwave Symposium Digest 96.2 (1996 Vol. II [MWSYM]): 923-926.

A varactor-tuned inverted circular patch antenna has been developed with a power variation of ± 1.0 dB over a 13 percent tuning bandwidth. A simple equivalent circuit has been used to model the active antenna, and the calculated results agree well with the experimental results. The circuit should have many commercial applications in wireless communications, radar, and sensors.



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Two-Dimensional Quasi-Optical Power Combining System Performance and Component Design

H.-S. Hwang, T.W. Nuteson, M.B. Steer, J.W. Mink, J. Harvey and A. Paoella. "Two-Dimensional Quasi-Optical Power Combining System Performance and Component Design." 1996 MTT-S International Microwave Symposium Digest 96.2 (1996 Vol. II [MWSYM]): 927-930.

In this paper, the design of a 2D quasioptical power combining structure is presented. Convex and concave phase transformers were used in the system comparing their scattering losses. The amplifier array is placed underneath the dielectric slab to reduce insertion loss and can also generate beam scanning by tuning the input signal frequency.

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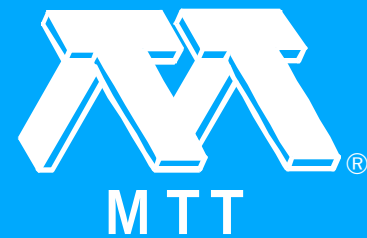


Abstracts

Transmission Line Coupled Active Microstrip Antennas for Phased Arrays

R. Ispir, S. Nogi, M. Sanagi and K. Fukui. "Transmission Line Coupled Active Microstrip Antennas for Phased Arrays." 1996 MTT-S International Microwave Symposium Digest 96.2 (1996 Vol. II [MWSYM]): 931-934.

An effective transmission line coupling network for spatial power combining and beam scanning purposes is reported. The harmful effect of radiative coupling is eliminated using a modified version of this network for peripheral elements. A technique to control the inter-element phase differences of planar arrays was also developed. Experiments on 1 x 4 and 2 x 2 oscillator arrays using the proposed coupling network agrees well with the theory.



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Noise Behavior of a 15-GHz-AlGaAs/GaAs-HEMT-Oscillator

T. Felgentreff and G.R. Olbrich. "Noise Behavior of a 15-GHz-AlGaAs/GaAs-HEMT-Oscillator." 1996 MTT-S International Microwave Symposium Digest 96.2 (1996 Vol. II [MWSYM]): 935-938.

In this paper the noise behavior of a HEMT oscillator is analyzed theoretically and experimentally. We present a large signal equivalent circuit of the HEMT device which describes also the low and high frequency noise behavior in the considered frequency range. Calculations of oscillator phase noise using this large signal and noise model are compared with results of phase noise measurements.

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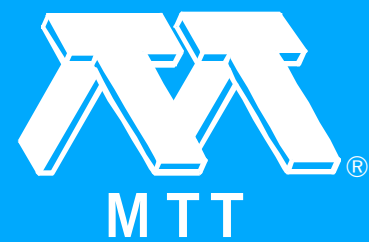
Design and Optimization of Millimeter-Wave IMPATT Oscillators

R. Judaschke and K. Schunemann. "Design and Optimization of Millimeter-Wave IMPATT Oscillators." 1996 MTT-S International Microwave Symposium Digest 96.2 (1996 Vol. II [MWSYM]): 939-942.

An efficient frequency-domain nonlinear circuit analysis for the design of IMPATT oscillators is presented. A nonlinear circuit model for the active device which is valid up to millimeter-wave frequencies is combined with the load impedance function of a radial-line resonator waveguide mount calculated by mode-matching. Results for a 140 GHz GaAs IMPATT diode oscillator demonstrate that the method is well suited to investigate the influence of resonator dimensions and parasitic elements on the oscillator performance systematically.

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Low-Frequency Noise Behavior of InP-Based HEMTs and its Connection with Phase Noise of Microwave Oscillators

R. Plana, O. Llopis, J. Verdier, L. Escotte, T. Parra, M. Gayral, A. Cappy and J. Graffeuil. "Low-Frequency Noise Behavior of InP-Based HEMTs and its Connection with Phase Noise of Microwave Oscillators." 1996 MTT-S International Microwave Symposium Digest 96.2 (1996 Vol. II [MWSYM]): 943-946.

This paper deals with the investigation of the low-frequency (L.F) noise properties of InP based HEMTs. We have found that a significant part of noise originates from the sample free surface and can be minimized by an appropriate silicon nitride passivation layer. Additional measurements suggest that 1/f noise and lorentzian noise is generated in the AlInAs donor layer of the devices. A comparative study shows that our devices compare well with the state of the art of HEMTs devices in term of excess noise. In order to investigate the correlation between phase noise and L.F noise, both residual and oscillator phase noise measurements were carried out. The obtained results compare well with the state of the art in terms of residual and phase noise performance.

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A Novel HBT Active Transformer Balanced Schottky Diode Mixer

K.W. Kobayashi. "A Novel HBT Active Transformer Balanced Schottky Diode Mixer." 1996 MTT-S International Microwave Symposium Digest 96.2 (1996 Vol. II [MWSYM]): 947-950.

This paper describes a unique HBT active transformer balun which has been monolithically integrated with a GaAs Schottky diode ring quad to construct a double balanced mixer which can operate from dc to > 2 GHz. The HBT active balun transformer achieves $< \pm 0.5$ dB gain balance and $< \pm 3^\circ$ phase balance from dc-5 GHz and provides an in-phase combined IF center-tap output. The HBT actively balanced Schottky mixer achieves positive conversion gain from dc - 2 GHz, and excellent LO-IF and LO-RF isolation in excess of 28 dB across the band. Two-tone input IP3's of -6 dBm and -14 dBm were obtained with an LO drive of +15 dBm and +6 dBm, respectively. The unique HBT active transformer balanced Schottky mixer topology can achieve multi-decade balanced performance, whereas, the passive transformer-balun approach is limited to an octave in frequency bandwidth. Furthermore, the HBT active balanced mixer topology is capable of operating from a minimum voltage supply of $\approx 2 V_{be}$ which is lower than that achieved with conventional active Gilbert cell-based mixers ($3 V_{be}$) making it potentially attractive for low voltage battery powered applications.

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An E-Mode GaAs FET Operating as a Single Balanced Gate Mixer

E. Camargo and W. Kennan. "An E-Mode GaAs FET Operating as a Single Balanced Gate Mixer." 1996 MTT-S International Microwave Symposium Digest 96.2 (1996 Vol. II [MWSYM]): 951-954.

The objective of this paper is to describe the design details of a semi-monolithic single balanced gate mixer for DBS applications. In order to obtain a low noise figure and high conversion gain it was decided to employ enhancement mode MESFETs, thus avoiding the need for a negative supply. The non-linear modeling is briefly described and contributed to the success of the mixer performance. An SSB noise figure of 6.0 dB was measured from 10.7 to 11.8 GHz with a conversion gain of 7.0 dB +/- 1.0 dB, with only + 3.0 dBm of LO power. The third order intercept point is equal to + 13.0 dBm, adequate for LNB applications.

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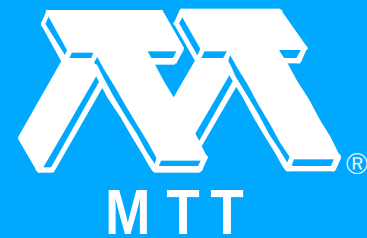


Abstracts

High Power 6-18 GHz H/V Switch Designed in Channelized Wafer Scale Fabrication Process

N. Jain and P. Onno. "High Power 6-18 GHz H/V Switch Designed in Channelized Wafer Scale Fabrication Process." 1996 MTT-S International Microwave Symposium Digest 96.2 (1996 Vol. II [MWSYM]): 955-958.

A 6-18GHz transfer switch is fabricated by a batch process technology, the HMIC (Heterolithic Microwave Integrated Circuit) process using shunt silicon diodes. The fabrication and design utilized a novel transmission medium incorporating signal channelization for high frequency high performance operation.



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Highly Integrated Single Package Monolithic VCO/Up-Converter for Digital Microwave Radio Systems

B. Rattay, V. Grognet, M. Hubner, F. Maquet and P. Guessant. "Highly Integrated Single Package Monolithic VCO/Up-Converter for Digital Microwave Radio Systems." 1996 MTT-S International Microwave Symposium Digest 96.2 (1996 Vol. II [MWSYM]): 959-962.

It is shown that with state-of-the-art microwave CAD and enhanced active and passive modelling, the concept of a highly integrated low cost macro-function inside a single package can be successfully extended up to microwave frequencies. Simulated and measured results are presented on three integrated VCO/frequency up-converters designed and fabricated at C-, X- and Ku-band frequencies.

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A Ka-Band GaInP/GaAs HBT Double Balanced Upconvert Mixer Using Lumped Element Balun

A.P. Freundorfer and C. Falt. "A Ka-Band GaInP/GaAs HBT Double Balanced Upconvert Mixer Using Lumped Element Balun." 1996 MTT-S International Microwave Symposium Digest 96.2 (1996 Vol. II [MWSYM]): 963-966.

A Ka-band GaInP/GaAs HBT double balanced upconvert mixer has been designed and fabricated. This circuit is to be used in a multifunction T/R module for local multipoint distribution systems (LMDS) which include both analog and digital transmission. A conversion gain of 1 dB, and an output power of -10 dBm from 27 GHz to 30 GHz for an LO input power of 10 dBm at 26 GHz were measured. The LO isolation to the output was measured to be 20 dB. These results are the best reported at Ka-band for a mixer using transistors from digital HBT library.

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Even Harmonic Quadrature Modulator with Low Vector Modulation Error and Low Distortion for Microwave Digital Radio

K. Itoh, M. Shimozawa, K. Kawakami, A. Iida and O. Ishida. "Even Harmonic Quadrature Modulator with Low Vector Modulation Error and Low Distortion for Microwave Digital Radio." 1996 MTT-S International Microwave Symposium Digest 96.2 (1996 Vol. II [MWSYM]): 967-970.

An even harmonic quadrature modulator (EHQMOD) with a low vector modulation error (VME) and low distortion characteristics is presented for small sized digital radio transmitters in microwave. Relationships between modulation characteristics and circuit parameters in the EHQMOD are described by analytical and experimental approaches. In addition, this paper presents an improved configuration of the EHQMOD for a low VME and low distortion characteristics. Developed X-band EHQMOD with root cosine roll-off shaped pi/4 DQPSK achieved 6% of VME without any adjustable circuits and -11dBm of output power with -50 dBc of leakage power at an adjacent channel. These experimental results verify the effectiveness of analyzed results, The EHQMOD technique indicated in this paper is effective for future high speed digital communications especially in millimeter wave band.



48/24 GHz and 20/10 GHz Regenerative Frequency Dividers

I. Angelov, H. Zirath, N. Rorsman and C. Karlsson. "48/24 GHz and 20/10 GHz Regenerative Frequency Dividers." 1996 MTT-S International Microwave Symposium Digest 96.2 (1996 Vol. II [MWSYM]): 971-974.

Low power regenerative frequency dividers have been designed and experimentally evaluated. The dividers consist of a resistive FET (HEMT) mixer, bandpass filters and an amplifier. Experimental verification of the dividers at 48/24 GHz and 20/10 GHz shows that stable division in a bandwidth of 3-5% can easily be obtained. This is, to our knowledge, the highest frequency of operation of such type of dividers.



Abstracts

Control Properties of Nonlinear Acoustic Materials

B.D. Zaitsev, V.A. Fedorenko and I.E. Kuznetsova. "Control Properties of Nonlinear Acoustic Materials." 1996 MTT-S International Microwave Symposium Digest 96.2 (1996 Vol. II [MWSYM]): 975-978.

A theoretical and experimental investigation of the external electric and magnetic field influence on the bulk and surface acoustic wave characteristics in non-linear piezoelectric, electrostrictive and piezosemiconductor materials and structures.



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Abstracts

Analysis of a Magnetically-Shielded Cellular Phone Antenna Using Finite-Difference Time-Domain Method

B.S. Yildirim and E.A. El-Sharawy. "Analysis of a Magnetically-Shielded Cellular Phone Antenna Using Finite-Difference Time-Domain Method." 1996 MTT-S International Microwave Symposium Digest 96.2 (1996 Vol. II [MWSYM]): 979-982.

The characteristics of an antenna used in a transceiver system are studied by several researchers in detail. These characteristics are mainly the radiation pattern, input impedance and the gain of the antenna. This paper proposes a new antenna suitable for cellular phone applications to reduce hazardous electromagnetic radiation toward humans. The antenna is shielded with PEC and shield is coated by a lossy magnetic material. When magnetically shielded antenna is used, it is shown that near electric field toward user drops significantly.



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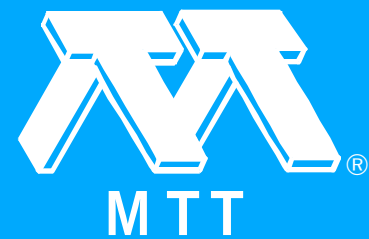
A Low-Cost Active Antenna for Personal Communications

G. Avitabile, C. Salvador and G.B. Gentili. "A Low-Cost Active Antenna for Personal Communications." 1996 MTT-S International Microwave Symposium Digest 96.2 (1996 Vol. II [MWSYM]): 983-986.

The paper introduces an active antenna module which performs both receiving and transmitting operations with an extremely reduced number of components. Receiving operations, in particular, are based on a quasi-regenerative approach, which guarantees an high sensitivity while maintaining a quite simple structure. Experimental results are reported describing a rugged 2.4 GHz ISM band prototype.

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Narrowband Filter and Annular Slot Antenna for PCS Applications

S. Kanamaluru, M.-y. Li and K. Chang. "Narrowband Filter and Annular Slot Antenna for PCS Applications." 1996 MTT-S International Microwave Symposium Digest 96.2 (1996 Vol. II [MWSYM]): 987-990.

A new narrowband filter has been developed for PCS applications. This filter has a 0.2 dB passband ripple bandwidth of 0.568% and is 60% smaller than the normal parallel coupled design. The filter can be integrated with the microstrip feedline of a novel annular slot antenna (ASA). The ASA has a 4.5% bandwidth and a planar structure. This antenna can be conveniently located on the chassis of a mobile PCS unit.

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20 GHz LTCC Phased Array Module

D. Sturzebecher, J. Leen, R. Cadotte, J. DeMarco, T.-D. Ni, T. Higgins, M. Popick, M. Cummings, B. VanMeerbeke, T. Provencher, B. Kimble, K. Shalkhauser and R. Simons. "20 GHz LTCC Phased Array Module." 1996 MTT-S International Microwave Symposium Digest 96.2 (1996 Vol. II [MWSYM]): 991-994.

A phased array multi-chip module has been developed that supports four, individually-controllable radiating elements with integral five-bit phase shifters and power amplifiers at 20 GHz. LTCC technology has been demonstrated as a valuable substrate/package material, enabling low loss, multi-layer topologies to aid the microwave circuit/package designer in creating unique solutions in three dimensions.



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T/R Module Architecture Tradeoffs for Phased Array Antennas

A. Agrawal, R. Clark and J. Komiak. "T/R Module Architecture Tradeoffs for Phased Array Antennas." 1996 MTT-S International Microwave Symposium Digest 96.2 (1996 Vol. II [MWSYM]): 995-998.

Active phased array radars typically require solid state T/R modules with high output power, low noise figure, high third order intercept (TOI), and sufficient gain in both transmit and receive. Since the T/R module cost is 40-60% of the antenna cost, it is imperative to use an architecture that meets all requirements with a minimum number of MMIC chips. In this paper we examine several T/R module architectures, analyze their performance, provide a tradeoff between different performance parameters, and recommend an architecture for a given set of requirements.

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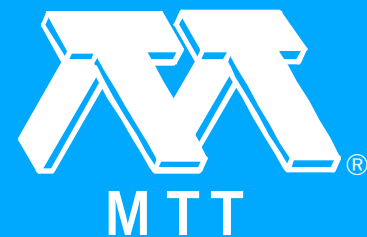


Abstracts

Intercept Points of Active Phased Array Antennas

E.L. Holzman. "Intercept Points of Active Phased Array Antennas." 1996 MTT-S International Microwave Symposium Digest 96.2 (1996 Vol. II [MWSYM]): 999-1002.

We derive an equation for the Nth order intercept point of an active phased array antenna with an amplitude taper. The antenna utilizes a T/R module to control the phase and amplitude of each array element. As an example, we show the effect of various levels of Taylor weighting on the 3rd order intercept point of a large phased array.



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Abstracts

A Real Time 'Clean' Method for Small Linear Arrays

T.B. Vu and H. Chen. "A Real Time 'Clean' Method for Small Linear Arrays." 1996 MTT-S International Microwave Symposium Digest 96.2 (1996 Vol. II [MWSYM]): 1003-1006.

The CLEAN method may be effective in eliminating unwanted interferences, but, in its existing form, it is too complex to be realised in small real-time systems. This paper discusses an improved approach which allows the "cleaning" of more interferences, and also simplifies the computation process to make the method suitable for real-time applications.



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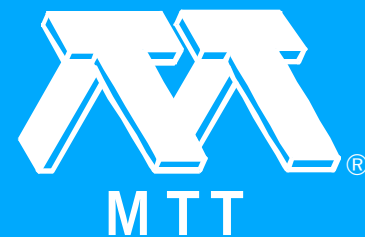


Abstracts

A 60GHz Imaging Array Using CPW-Fed Twin-Slots on Multilayered Substrates

Y. Qian and E. Yamashita. "A 60GHz Imaging Array Using CPW-Fed Twin-Slots on Multilayered Substrates." 1996 MTT-S International Microwave Symposium Digest 96.2 (1996 Vol. II [MWSYM]): 1007-1010.

We report optimal design and experiments of a novel 60GHz imaging array using CPW-fed twin-slots on multi-layered dielectric substrates. This is an all-planar structure without having to use accompanying superhemispherical substrate lenses. It has nearly symmetric radiation patterns, low surface wave losses, as well as controllable beamwidths to match the f-number of the quasi-optic system. Optimal design of the antenna/detector circuitry has been realized using FDTD analysis results of the CPW-fed slot. A 6-element array has been fabricated and tested, with results revealing excellent capabilities of this newly proposed imaging array structure.



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Simulating "Large" Microwave Circuits with the Parallel Planar Generalized Yee Algorithm

S. Gedney, F. Lansing, R.T. Kihm, N. Owona and K. Virga. "Simulating "Large" Microwave Circuits with the Parallel Planar Generalized Yee Algorithm." 1996 MTT-S International Microwave Symposium Digest 96.2 (1996 Vol. II [MWSYM]): 1011-1014.

The Planar Generalized Yee (PGY) algorithm is presented for the full-wave analysis of "electrically-large" grounded co-planar (GCPW) circuits. The method has a significant advantage over traditional Yee-algorithm based finite-difference time domain (FDTD) methods in that it is based upon unstructured and irregular grids. The PGY algorithm has been efficiently implemented on massively parallel computers and is ideal for the rapid, broadband analysis of packaged, large, high-density circuits and multi-chip modules (MCM's). Simulation and measured results on several "electrically-large" circuit structures are presented.

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Analysis of Compensated Structures in Planar Transmission Lines Using the FDTD Method Incorporating Triangular Subcells

Z. Ma, A. Miyata and E. Yamashita. "Analysis of Compensated Structures in Planar Transmission Lines Using the FDTD Method Incorporating Triangular Subcells." 1996 MTT-S International Microwave Symposium Digest 96.2 (1996 Vol. II [MWSYM]): 1015-1018.

A FDTD algorithm incorporating triangular subcells has been developed to implement dynamic analysis of compensated structures in planar transmission lines. Curvilinear or slanted metallic surfaces utilized in most compensated circuits are properly modeled by the use of triangular subcells, consequently, the numerical accuracy and computational efficiency are significantly improved. Characteristics of compensated microstrip right-angle bends, T-junctions, and meander lines are investigated, and discussions on the optimal compensation dimensioning rules are presented.

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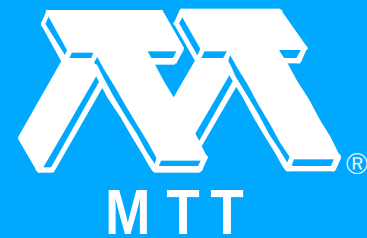


Abstracts

Accuracy of TLM Solutions of Maxwell's Equations (1996 Vol. II [MWSYM])

L. de Menezes and W.J.R. Hoefer. "Accuracy of TLM Solutions of Maxwell's Equations (1996 Vol. II [MWSYM])." 1996 MTT-S International Microwave Symposium Digest 96.2 (1996 Vol. II [MWSYM]): 1019-1022.

The physical origin of the coarseness and dispersion errors affecting TLM solutions of Maxwell's equations is investigated. The study is performed by solving the difference equations of the method analytically. The results confirm a reduction of the accuracy of the discrete solution near field singularities. This effect is a consequence of the finite number of spatial modes supported by the discretized domain.



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Application of the Eigenmode Transformation Technique for the Analysis of Planar Transmission Lines (1996 Vol. II [MWSYM])

C. Rieckmann, A. Jostingmeier and A.S. Omar. "Application of the Eigenmode Transformation Technique for the Analysis of Planar Transmission Lines (1996 Vol. II [MWSYM])." 1996 MTT-S International Microwave Symposium Digest 96.2 (1996 Vol. II [MWSYM]): 1023-1026.

The eigenmode transformation technique is suitable for the analysis of inhomogeneously filled shielded waveguides containing metal inserts. The permittivity of the filling medium may be an arbitrary function of the transverse coordinates. The method is based on expanding the electromagnetic field in terms of the eigenmodes of the corresponding empty shielding waveguide. The metal inserts have the effect of linearly transforming these eigenmodes into those of the waveguide containing the metal inserts only. This leads to a proper matrix eigenvalue problem. The method is applied to different types of planar transmission lines and the results are compared with other methods.

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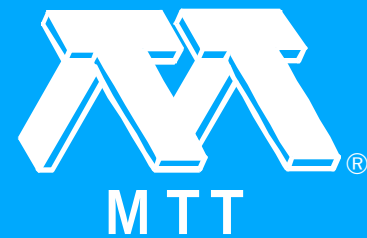


Abstracts

A General Functional Analysis to Dispersive Structures

J. Tan and G. Pan. "A General Functional Analysis to Dispersive Structures." 1996 MTT-S International Microwave Symposium Digest 96.2 (1996 Vol. II [MWSYM]): 1027-1030.

A new functional for 3-Dimensional waveguiding structures with dielectric and conductor losses is rigorously derived. Numerical examples are presented for anisotropic dielectric image waveguide, PTEE bilateral fin line, and two coupled asymmetrical dual lossy transmission lines with finite conductivity and finite thickness. Agreement with previous publications wherever available are observed.



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Improved Excitation of 3D SCN TLM Based on Voltage Sources

J.L. Herring and W.J.R. Hoefer. "Improved Excitation of 3D SCN TLM Based on Voltage Sources." 1996 MTT-S International Microwave Symposium Digest 96.2 (1996 Vol. II [MWSYM]): 1031-1034.

The implementation of voltage, current, electric field and magnetic field sources is described. The correct voltage pulses that must be injected into a TLM network to produce a given temporal and spatial field distribution are obtained by placing voltage sources in a reference structure. This gives a field of known amplitude in which transients decay more rapidly than with the conventional approach. The method is applied to a waveguide.

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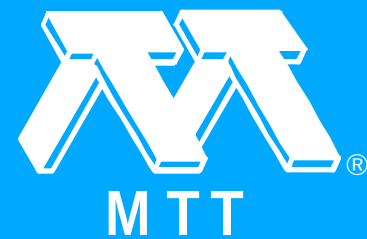


Abstracts

The Modeling of Coplanar Circuits in a Parallel Computing Environment

B. Isele and P. Russer. "The Modeling of Coplanar Circuits in a Parallel Computing Environment." 1996 MTT-S International Microwave Symposium Digest 96.2 (1996 Vol. II [MWSYM]): 1035-1038.

The time-domain simulation of coplanar waveguide (CPW) elements for picosecond pulse applications is described. CPW discontinuities were simulated using the 3D transmission-line-matrix (TLM) method. We present a cost-effective approach for the time-domain simulation of coplanar circuit structures utilizing distributed computing within a parallel software environment. The use of matched layers and skin effect models is discussed. The application of TLM method and distributed computing to the efficient analysis of coplanar structures is presented.



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Abstracts

Dispersion Analysis of TLM Node for Modeling General Anisotropic and Gyromagnetic Materials

Q. Zhang, W.J.R. Hoefer, J. Huang and K. Wu. "Dispersion Analysis of TLM Node for Modeling General Anisotropic and Gyromagnetic Materials." 1996 MTT-S International Microwave Symposium Digest 96.2 (1996 Vol. II [MWSYM]): 1039-1042.

In this paper the dispersion relation for the three-dimensional TLM condensed node for modeling materials with arbitrary permittivity and permeability tensors is presented, and the dispersion error associated with the TLM model for these media is studied. A full dispersion analysis of the TLM node is performed when modeling sapphire substrates and gyromagnetic material. The study lays the foundation for minimizing the numerical dispersion error when modeling such media.



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Synthesis of Absorbing Boundary Condition with Digital Filter Bank

C.-N. Kuo, T. Itoh and B. Houshmand. "Synthesis of Absorbing Boundary Condition with Digital Filter Bank." 1996 MTT-S International Microwave Symposium Digest 96.2 (1996 Vol. II [MWSYM]): 1043-1046.

This paper generalizes the technique of using a bank of IIR filters to realize the ABC in the FDTD method. The filter can absorb propagating and evanescent waves and multimode as well. This approach is applied to the problem of an inductive iris, which is only 0.1 lambda away from the ABC plane.

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Diaz-Fitzgerald Time Domain (D-FTD) Technique Applied to Electromagnetic Problems

F. De Flaviis, M. Noro and N.G. Alexopoulos. "Diaz-Fitzgerald Time Domain (D-FTD) Technique Applied to Electromagnetic Problems." 1996 MTT-S International Microwave Symposium Digest 96.2 (1996 Vol. II [MWSYM]): 1047-1050.

A new approach for the solution of electromagnetic problems is presented and tested. The method is based on the discretization of Maxwell's equations, but it differs from the FDTD implementation in that it exploits a different scheme to model wave propagation. Vector and Scalar potential are used instead of the magnetic field, to propagate the electric field. This implementation provides a condensed node representation for the electric field, offers a natural way to treat interfaces, and allows to model Debye relaxation media, avoiding convolution. Additionally a mechanical analog can be devised.

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Abstracts

Analysis Method for Transient Fields in Planar Structures by Marching-on-in-Time Integral Equation Technique

N. Georgieva and E. Yamashita. "Analysis Method for Transient Fields in Planar Structures by Marching-on-in-Time Integral Equation Technique." 1996 MTT-S International Microwave Symposium Digest 96.2 (1996 Vol. II [MWSYM]): 1051-1054.

A new numerical algorithm for the analysis of transient electromagnetic fields in planar structures is proposed based on the magnetic field integral equation (MFIE) and marching-on-in-time approach. This algorithm solves the problem of radiation boundary conditions in a natural way unlike the FDTD method which needs an approximated radiation boundary condition imposed at outer boundaries of the structure. The algorithm is applicable to multilayered planar structures and is competitive to the FDTD method especially in the case of open and radiating problems. The MFIE is applied in combination with boundary element approach and point matching technique.



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Abstracts

A Full-Wave Analysis for Microwave, Planar, Distributed Discontinuities

B.E. Spielman and L.G. Chen. "A Full-Wave Analysis for Microwave, Planar, Distributed Discontinuities." 1996 MTT-S International Microwave Symposium Digest 96.2 (1996 Vol. II [MWSYM]): 1055-1058.

A full-wave analysis is presented for modeling microwave, planar distributed discontinuities. By choosing current-density basis functions that better match expected singular behavior of the current density near conductor edges, implementing a mode-matching method, and approximating the distributed discontinuity by a multi-step structure, this method is found to be more efficient for studying the characteristics of the distributed discontinuity than similar, previously-reported methods. A combination of scattering matrices is used to numerically approximate the behavior of the distributed discontinuity. Simulation results are given for some specific illustrations, which exhibit good agreement with other known work.



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Abstracts

Parameterization of Arbitrary Geometrical Structures for Automated Electromagnetic Optimization

J.W. Bandler, R.M. Biernacki and S.H. Chen. "Parameterization of Arbitrary Geometrical Structures for Automated Electromagnetic Optimization." 1996 MTT-S International Microwave Symposium Digest 96.2 (1996 Vol. II [MWSYM]): 1059-1062.

For the first time, this paper reveals and discusses the theoretical foundation of the Geometry Capture technique. Geometry Capture facilitates user-parameterization, through graphical means, of arbitrary 2D and 3D geometrical structures. This makes it possible to optimize the shape and dimensions of geometrical objects in an automated electromagnetic design process by adjusting the user-defined parameters subject to explicit numerical bounds and implicit geometrical constraints.



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Abstracts

A Hybrid 3D TLM-FDTD Model of Microwave Fields

C. Eswarappa and W.J.R. Hoefer. "A Hybrid 3D TLM-FDTD Model of Microwave Fields." 1996 MTT-S International Microwave Symposium Digest 96.2 (1996 Vol. II [MWSYM]): 1063-1066.

This paper presents a hybrid method which combines 3D Symmetrical Condensed Node-Transmission Line Modeling (SCN-TLM) and Yee's Finite Difference Time Domain (FDTD) methods. This work is an extension of our earlier work on the interface between 2D TLM and FDTD. Even though, the 3D SCN-TLM and FDTD nodes differ in structure and high-frequency dispersion characteristics, they give virtually the same numerical results for identical band-limited excitation, and equal space and time resolution. Using the interface presented in this paper, the specific features of both of these nodes can be exploited when solving a given problem.



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Abstracts

An Electromagnetic Technique for Packaging Problem Analysis

K.E. Krause and B.E. Spielman. "An Electromagnetic Technique for Packaging Problem Analysis." 1996 MTT-S International Microwave Symposium Digest 96.2 (1996 Vol. II [MWSYM]): 1067-1070.

A new three-dimensional electromagnetic packaging analysis is developed for shielded configurations containing arbitrarily shaped, homogeneous, isotropic regions. Computer implementation uses and extends routines from a computational engine for electromagnetic scattering. The packaging analysis is validated using rectangular waveguide configurations. Preliminary analysis is performed on a filtering structure.



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A Linear Class AB Single-Ended to Differential Transconverter Suitable for RF Circuits

J. Durec and E. Main. "A Linear Class AB Single-Ended to Differential Transconverter Suitable for RF Circuits." 1996 MTT-S International Microwave Symposium Digest 96.2 (1996 Vol. II [MWSYM]): 1071-1074.

A novel circuit topology is presented which converts a single-ended signal into differential output currents with improved linearity. This cell operates in Class AB, allowing an output current greater than the quiescent current. A configuration which allows for the nulling of the third order distortion is derived and the implications of third order nulling on third order intermodulation is explained. Measured results of this cell implemented in 0.4 μm silicon-bipolar technology is presented.

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Distributed Small Signal Model for Multi-Fingered GaAs PHEMT/MESFET Devices

S.J. Nash, A. Platzker and W. Struble. "Distributed Small Signal Model for Multi-Fingered GaAs PHEMT/MESFET Devices." 1996 MTT-S International Microwave Symposium Digest 96.2 (1996 Vol. II [MWSYM]): 1075-1078.

A fully distributed equivalent circuit PHEMT and MESFET model is presented in closed form expressions for single finger end-fed FET geometry. The model includes self and mutual inductances and a new frequency dependent gate resistance. The model was used successfully to model multi-fingered devices which were subjected to equi-phase gate and drain excitations. Comparisons between measured data and model results are shown to be in excellent agreement for all S-parameters to 50GHz regardless of unit gate width. Scaling issues are also investigated for the new distributed model.

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A SIMMWIC 76 GHz Front-End with High Polarization Purity

M. Singer, A. Stiller, K.M. Strohm, J.-F. Luy and E.M. Biebl. "A SIMMWIC 76 GHz Front-End with High Polarization Purity." 1996 MTT-S International Microwave Symposium Digest 96.2 (1996 Vol. II [MWSYM]): 1079-1082.

An integrated active antenna with a polarization purity better than 28 dB and a radiated power of 8 dBm at 75.7 GHz is presented. The linearly polarized radiator consists of a planar resonant antenna and a transit-time diode monolithically integrated on a silicon substrate. This active antenna finds various applications in low-cost multi-channel sensor systems, e.g. for object classification. Guidelines for the design are discussed. The characterization of the fabricated SIMMWIC devices includes measurements of output power, polarization purity, and far-field pattern. Moreover, the oscillation frequency of the devices has been successfully stabilized using subharmonic injection locking. The FM noise behavior of the locked oscillator has been characterized. The measured results are presented and compared to theoretical calculations.

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Abstracts

A High Efficiency Complementary GaAs Power FET Technology for Single Supply Portable Applications

E. Glass, J. Abrokwhah, R. Lucero, E. Spears, J. Rollman, J.-H. Huang, B. Bernhardt and B. Ooms. "A High Efficiency Complementary GaAs Power FET Technology for Single Supply Portable Applications." 1996 MTT-S International Microwave Symposium Digest 96.2 (1996 Vol. II [MWSYM]): 1083-1086.

A high efficiency enhancement mode power heterostructure FET has been developed for single supply portable applications. The device requires only a single 3V supply for operation, making it an ideal candidate for portable applications. At 850 MHz, a 1.0 μm x 12 mm N-type FET exhibited a power output of +30.7 dBm, power gain of 10.6 dB, and a power-added efficiency of 60%, at a drain to source voltage of 3V, and drain to source quiescent current of 150 mA. This device was fabricated on a standard Complementary GaAs (CGaAs) process flow, which is capable of simultaneously building low-voltage, low-power digital circuits (200MHz), high-speed digital circuits (5 GHz), and RF power circuits (900 MHz).



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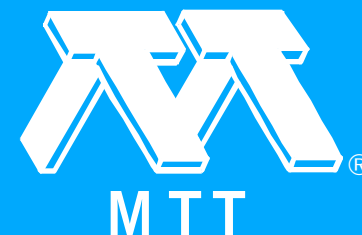
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Abstracts

Session WE4A -- Biological Effects and Medical Applications

"Session WE4A -- Biological Effects and Medical Applications." 1996 MTT-S International Microwave Symposium Digest 96.2 (1996 Vol. II [MWSYM]): 1087-1088.



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Abstracts

A New Gel Phantom Used for Three Dimensional Measurement of the Local SAR

M. Miyakawa and S. Hoshina. "A New Gel Phantom Used for Three Dimensional Measurement of the Local SAR." 1996 MTT-S International Microwave Symposium Digest 96.2 (1996 Vol. II [MWSYM]): 1089-1092.

A gel phantom containing non-ionic surface active agent, salt and sucrose which shows almost the same dielectric property as that of the biological tissue and good transparency at the room temperature has been developed. When the phantom is irradiated by the electromagnetic wave, the region where electromagnetic power is absorbed becomes white and opaque. Hence, the phantom is useful for observing or measuring the local SAR distribution in three-dimensional. The method for fabricating the phantom and a typical example applied to the electromagnetic environmental problem are presented.



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Complete Evaluation of Conformational MW Effects on ACH Channels with Parallel Computing

L. Tarricone. "Complete Evaluation of Conformational MW Effects on ACH Channels with Parallel Computing." 1996 MTT-S International Microwave Symposium Digest 96.2 (1996 Vol. II [MWSYM]): 1093-1096.

We present here a parallel implementation and optimization of a Markov model simulating the Acetylcholine-receptor (ACh) channel response to 2.45 GHz fields. It overcomes the limitations of a previous implementation, allowing a complete understanding of the simulated phenomenon. The main experimentally observed effects of microwaves on ACh channels are theoretically explained, and an energetical mapping of ACh conformational changes achieved.

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Abstracts

Design and Modeling Using the FDTD Method of Planar Multi-Applicators for Microwave Hyperthermia

P.-Y. Cresson, C. Michel, L. Dubois, M. Chive and J. Pribetich. "Design and Modeling Using the FDTD Method of Planar Multi-Applicators for Microwave Hyperthermia." 1996 MTT-S International Microwave Symposium Digest 96.2 (1996 Vol. II [MWSYM]): 1097-1100.

This paper describes a new kind of external planar applicators with several patches called multi-applicator which have been developed for microwave hyperthermia controlled by microwave radiometry. The possibility to obtain larger heating patterns than with a single patch applicator is clearly focused by the theoretical results which are presented and verified by experimental measurements.



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Abstracts

Generation of a Highly Focused Electromagnetic Field in a Lossy Biological Medium by Controlling the Phase and Time Excitation of the Microwave Sources

K.S. Nikita and N.K. Uzunoglu. "Generation of a Highly Focused Electromagnetic Field in a Lossy Biological Medium by Controlling the Phase and Time Excitation of the Microwave Sources." 1996 MTT-S International Microwave Symposium Digest 96.2 (1996 Vol. II [MWSYM]): 1101-1104.

A focused electromagnetic field is generated in a layered cylindrical biological tissue model, by using a large number of concentrically placed waveguide applicators and pulsed signals of short pulse width, with a high frequency carrier. To this end, constructive phase interference and time coincidence of pulse modulated microwave signals principles are applied. Numerical results are computed and presented for a three-layer geometry, 20 cm in diameter, irradiated by an annular waveguide array, using 30 elements.



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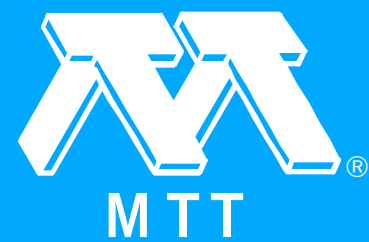
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Design and Modeling Using the FDTD Method of a New Generation of Applicators Realized from Coaxial Antennas for Microwave Hyperthermia

D. Desprez, J.C. Camart, J. Pribetich and M. Chive. "Design and Modeling Using the FDTD Method of a New Generation of Applicators Realized from Coaxial Antennas for Microwave Hyperthermia." 1996 MTT-S International Microwave Symposium Digest 96.2 (1996 Vol. II [MWSYM]): 1105-1108.

An increased interest in the application of the electromagnetic techniques for intracavitary thermotherapy treatments has been observed for treatment of prostate gland. This paper describes a new generation of applicators designed for this endocavitary thermotherapy. The applicators are realized from coaxial antennas associated with a water cooling system. The electromagnetic modeling is achieved by the FDTD. This method allow to determine the tissues volume which will be heated at the therapeutic temperature level. The possibility to increase the heated volume (by using simultaneously the urethral and rectal applicators) is clearly focused by theoretical results obtained from the bioheat transfer equation solution which are presented and confirmed by experimental measurements on a polyacrylamide phantom.

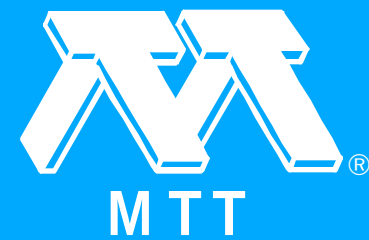
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Abstracts

Session WE4B -- Quasi-Optical Amplifiers and Systems

"Session WE4B -- Quasi-Optical Amplifiers and Systems." 1996 MTT-S International Microwave Symposium Digest 96.2 (1996 Vol. II [MWSYM]): 1109-1110.



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A PHEMT Based Monolithic Plane Wave Amplifier for 42 GHz

E.A. Sovero, Y. Kwon, D.S. Deakin, A.L. Sailer and J.A. Higgins. "A PHEMT Based Monolithic Plane Wave Amplifier for 42 GHz." 1996 MTT-S International Microwave Symposium Digest 96.2 (1996 Vol. II [MWSYM]): 1111-1114.

We report the design and operation of a monolithic Plane Wave PHEMT amplifier operating at millimeter wave frequencies. The array is made up of input slot antennas (5 x 7 array) and output patch antennas (4 x 8 array) polarized in orthogonal directions. An array of PHEMT amplifiers (7 x 8) placed between the two antennas amplifies and reradiates the input signal. The amplifier was placed in an oversized waveguide in order to avoid diffraction losses of a free space system. Gain of the amplifier was 3 dB at 42 GHz without any corrections for internal fixture losses. The amplifier results correlate well with computer model predictions of the antenna structures. These results prove the feasibility as well as the manufacturability of this approach.

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Quasi-Optical Traveling Wave Amplifiers

A. Alexanian, H.-S. Tsai and R.A. York. "Quasi-Optical Traveling Wave Amplifiers." 1996 MTT-S International Microwave Symposium Digest 96.2 (1996 Vol. II [MWSYM]): 1115-1118.

Previously reported quasi-optical amplifier arrays have limited bandwidth and suffer from poor input/output isolation. These problems can be solved by using traveling wave antennas and distributed amplifier techniques. FDTD simulations of a linearly tapered slot array topology demonstrate very broadband quasi-optical transitions are feasible with small unit-cell aperture. Experiments using a single-element low frequency prototype exhibit a 50% fractional bandwidth at 3.5GHz using Vivaldi-type slots and a hybrid microstrip MESFET TWA circuit.

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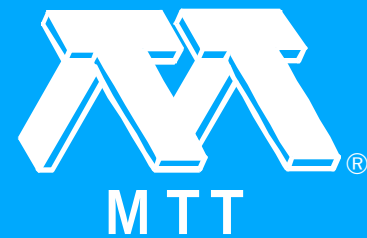


Abstracts

A 10-Element Active Lens Amplifier on a Dielectric Slab

A.R. Perkons and T. Itoh. "A 10-Element Active Lens Amplifier on a Dielectric Slab." 1996 MTT-S International Microwave Symposium Digest 96.2 (1996 Vol. II [MWSYM]): 1119-1122.

This paper presents an active lens amplifier on a dielectric slab. An amplifier gain of 11 dB at 8.25 GHz, measured from input to output connector, with a 3-dB bandwidth of 0.65 GHz has been demonstrated. Measurements of output power versus input power are also presented.



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Monolithic 40-GHz 670-mW HBT Grid Amplifier

C.-M. Liu, E.A. Sovero, W.J. Ho, J.A. Higgins, M.P. De Lisio and D.B. Rutledge. "Monolithic 40-GHz 670-mW HBT Grid Amplifier." 1996 MTT-S International Microwave Symposium Digest 96.2 (1996 Vol. II [MWSYM]): 1123-1126.

A 36-element monolithic grid amplifier has been fabricated. The active elements are pairs of heterojunction-bipolar-transistors. Measurements show a peak gain of 5 dB at 40 GHz with a 3-dB bandwidth of 1.8 GHz (4.5%). Here we also report comparisons of patterns and tuning curves between the measurements and theory. The grid includes base stabilizing capacitors which result in a highly stable grid. The maximum saturated output power is 670 mW at 40 GHz with a peak power-added efficiency of 4%. This is the first report of power measurements on the monolithic quasi-optical amplifier.

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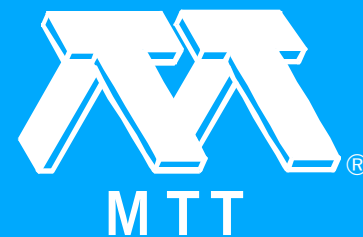


Abstracts

A 44-60 GHz Monolithic pHEMT Grid Amplifier

M.P. De Lisio, S.W. Duncan, D.-W. Tu, S. Weinreb, C.-M. Liu and D.B. Rutledge. "A 44-60 GHz Monolithic pHEMT Grid Amplifier." 1996 MTT-S International Microwave Symposium Digest 96.2 (1996 Vol. II [MWSYM]): 1127-1130.

We present a 36-element monolithic millimeter-wave grid amplifier. The grid operates in the U-band, using pseudomorphic High Electron Mobility Transistors (pHEMT's) as the active devices. The grid has a peak gain of 6.5 dB at 44 GHz. The grid can be tuned to operate from 44 GHz to 60 GHz by changing the positions of external polarizers and tuning slabs. At 60 GHz, the grid has a peak gain of 2.5 dB. Gain and tuning curves are consistent with theoretical predictions.



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A Quasi-Optical Receiver with Angle Diversity

W.A. Shiroma, E.W. Bryerton, S. Hollung and Z.B. Popovic. "A Quasi-Optical Receiver with Angle Diversity." 1996 MTT-S International Microwave Symposium Digest 96.2 (1996 Vol. II [MWSYM]): 1131-1134.

A quasi-optical receiver front end consisting of a 10-GHz lens amplifier antenna array and three self-oscillating grid mixers is presented. The lens amplifies incoming plane waves incident from different directions and focuses them to three points where the mixers are placed. Because of the angle-preserving nature of the amplifier, the mixers generate independent IF signals from three incident directions. The resulting angle diversity is useful for reducing multipath fading in communications.

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Millimeter-Wave Imaging Using Neural Networks for Object Recognition

K.-I. Watabe, K. Shimizu, K. Mizuno and M. Yoneyama. "Millimeter-Wave Imaging Using Neural Networks for Object Recognition." 1996 MTT-S International Microwave Symposium Digest 96.2 (1996 Vol. II [MWSYM]): 1135-1138.

An active-mode mm-wave (60 GHz) imaging system with Yagi antenna has been developed. The optics for the system was designed with the ray tracing method to reduce aberration. A signal processing using a neural network has been successfully introduced to recognize objects distorted with coherent mm-wave illumination. With 10 x 10 sampling points the recognition rate of 98 % has been obtained for the objects of 10 alphabetical letters and the 5 teaching trials.

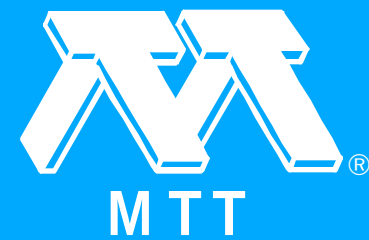
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Abstracts

Session WE4C -- Micromachining for Microwave and Millimeter Wave Applications

"Session WE4C -- Micromachining for Microwave and Millimeter Wave Applications." 1996 MTT-S International Microwave Symposium Digest 96.2 (1996 Vol. II [MWSYM]): 1139-1140.



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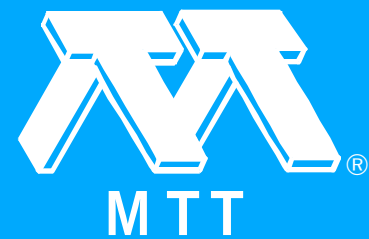
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Characteristics of Micromachined Switches at Microwave Frequencies

C. Goldsmith, J. Randall, S. Eshelman, T.H. Lin, D. Denniston, S. Chen and B. Norvell.
"Characteristics of Micromachined Switches at Microwave Frequencies." 1996 MTT-S International Microwave Symposium Digest 96.2 (1996 Vol. II [MWSYM]): 1141-1144.

This article reviews the fundamental characteristics of micromechanical membrane switches operating at microwave frequencies. The construction and theory of operation of capacitive membrane switches is reviewed. Measurement and modeling of the electromechanical and microwave properties of these switches are presented. The inherent advantages of these switches relative to semiconductor switches is discussed.

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Abstracts

Novel Micromachined Approaches to MMICs Using Low-Parasitic, High-Performance Transmission Media and Environments

L.P.B. Katehi and G.M. Rebeiz. "Novel Micromachined Approaches to MMICs Using Low-Parasitic, High-Performance Transmission Media and Environments." 1996 MTT-S International Microwave Symposium Digest 96.2 (1996 Vol. II [MWSYM]): 1145-1148.

Micromachined high-frequency circuits with integrated packaging offer light weight and controllable parasitic, which makes them appropriate for hand-held communication systems and miniature intelligent millimeter-wave sensors where system requirements impose strict limits on electrical performance. Recent advances in semiconductor processing techniques allow for integration in all of the directions of the three-dimensional space. The capability to incorporate one more dimension, and a few more parameters, in the circuit design, leads to revolutionary shapes and integration schemes. These circuit topologies have reduced ohmic loss and are free parasitic radiation or parasitic cavity resonances without losing their monolithic character. Integration capabilities are thereby extended and performance is optimized. The evolution of micromachined circuits and antennas for operation in microwave and millimeter-wave frequencies is still in its infancy.



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Abstracts

Micromachined Cellular Filters

R. Ruby. "Micromachined Cellular Filters." 1996 MTT-S International Microwave Symposium Digest 96.2 (1996 Vol. II [MWSYM]): 1149-1152.

Bulk wave Acoustic Resonators using thin piezo-electric films have the potential to become useful filters for telecommunication markets. These devices has been variously referred to as a thin film resonator (TFR) (1) or a film bulk acoustic wave resonator (FBAR) (2). Typically, the piezo-electric material is a sputter-deposited film of aluminum nitride or zinc oxide. Processing techniques such as the use of KOH or ethylene diarnine pyrocatechol (EDP) to etch silicon or the use of sacrificial materials to form "air gap" structures (J) are needed to isolate the acoustic cavity from the underlying substrate. These same techniques are also part of the micromachinists' "tools-of-the-trade" and are becoming better understood as well as becoming a part of an accepted processing infrastructure.



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Folded U-Shaped Microwire Technology for Ultra-Compact 3D MMICs

K. Onodera, M. Hirano, I. Toyoda, M. Tokumitsu and T. Tokumitsu. "Folded U-Shaped Microwire Technology for Ultra-Compact 3D MMICs." 1996 MTT-S International Microwave Symposium Digest 96.2 (1996 Vol. II [MWSYM]): 1153-1156.

A novel microwire technology has been developed to fabricate 3-dimensional structures for use in ultra-compact GaAs MMICs. By folding metal into a U-shaped wall and burying it in a relatively thick polyimide insulator, vertical microwires can be made with both greatly reduced process complexity and process compatibility with multi-level interconnects. The proposed microwires are suitable for miniature transmission lines, miniature inductors, shielding walls, and multi-function passive elements like baluns and couplers.

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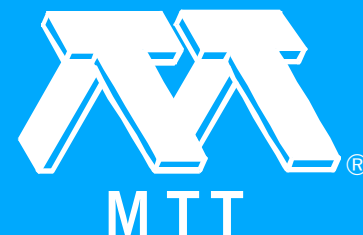


Abstracts

MM-Wave Tapered Slot Antennas on Micromachined Photonic Bandgap Dielectrics

T.J. Ellis and G.M. Rebeiz. "MM-Wave Tapered Slot Antennas on Micromachined Photonic Bandgap Dielectrics." 1996 MTT-S International Microwave Symposium Digest 96.2 (1996 Vol. II [MWSYM]): 1157-1160.

Dramatic improvements in the radiation properties of tapered slot antennas (TSA) integrated on high dielectric constant substrates have been achieved through micromachining techniques. A periodic hole structure was micromachined into the substrate converting it into a photonic bandgap material. The measured directivity of a $4\lambda_0$ TSA on a 50 mil (1.27 mm) thick Duroid substrate ($\epsilon_r = 10.5$) was increased by 240% using micromachined holes with a hexagonal geometry. A similar improvement was observed when the process was performed at 30 GHz on a 14 mil (350 μm) silicon wafer. We believe the technology can be scaled to 60 GHz and 94 GHz for communication systems, low-cost millimeter wave imaging arrays, and power combining systems.



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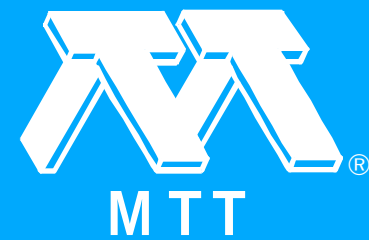
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Abstracts

Session WE4D -- Commercial and Space Microwave System Applications

"Session WE4D -- Commercial and Space Microwave System Applications." 1996 MTT-S International Microwave Symposium Digest 96.2 (1996 Vol. II [MWSYM]): 1161-1162.



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A 20 GHz MMIC Power Module for Transmit Phased Array Applications

C. Yuen, E. Balderrama, W. Findley, L. Kirby, J. Lee and P. Sturzu. "A 20 GHz MMIC Power Module for Transmit Phased Array Applications." 1996 MTT-S International Microwave Symposium Digest 96.2 (1996 Vol. II [MWSYM]): 1163-1166.

A novel high gain, high power, high efficiency and high linearity MMIC power module is developed for a 20 GHz transmit phased array for future communication satellite application. This MMIC module has a maximum gain of 50 dB, a gain range more than 30 dB, an output power of 11 Watt, an efficiency of 18% and a third-order Intermodulation of 17 dBc at 19 GHz, It has a size of 4 5x1.75x0.5", a mass of 100 gm and a DC power consumption of 6.3 Watt.

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Low Cost Electronically Steered Antenna and Receiver System for Mobile Satellite Communications (1996 Vol. II [MWSYM])

J.I. Alonso, J.M. Blas, L.E. Garcia, J. Ramos, J. de Pablos, J. Grajal, G. Gentili, J. Gismero and F. Perez. "Low Cost Electronically Steered Antenna and Receiver System for Mobile Satellite Communications (1996 Vol. II [MWSYM])." 1996 MTT-S International Microwave Symposium Digest 96.2 (1996 Vol. II [MWSYM]): 1167-1170.

The design, construction and basic characteristics of an electronically steered, adaptive phased array antenna for land mobile satellite communications are described. The antenna system includes an array of six microstrip stacked patch antennas, each connected to an RF channel, which include an MMIC Low Noise Amplifier and a commercial silicon monolithic I-Q modulator. A 6-way microstrip combiner adds the six channels so that the resulting signal is introduced in a GPS receiver, constructed with two commercial ASICs. This receiver has a PC interface which include control boards, specifically designed for this application, that allow to set the amplitude and phase of each RF channel. Acquisition and tracking algorithms have been programmed in C-language for working in real time using as input data the signal levels provided by the receiver. The work involved in the antenna RF subsystem design, calibration and tracking algorithms and some field tests is reported.

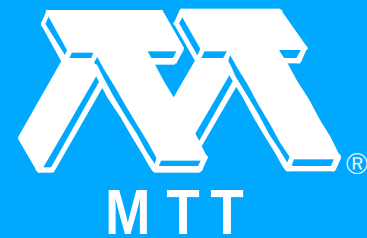


Abstracts

60-GHz Transceiver for High-Speed Wireless LAN System

T. Ninomiya, T. Saito, Y. Ohashi and H. Yatsuka. "60-GHz Transceiver for High-Speed Wireless LAN System." 1996 MTT-S International Microwave Symposium Digest 96.2 (1996 Vol. II [MWSYM]): 1171-1174.

We have developed a 60-GHz Transceiver unit for high-capacity wireless LAN systems, employing state-of-the-art MMIC technology. This prototype showed sufficiently good performance in an ethernet-compatible 10-Mbps random access CSMA/CD wireless system, and proved its potential usefulness in various commercial products.



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Simple Techniques to Correct for VCO Nonlinearities in Short Range FMCW Radars

J. Fuchs, K.D. Ward, M.P. Tulin and R.A. York. "Simple Techniques to Correct for VCO Nonlinearities in Short Range FMCW Radars." 1996 MTT-S International Microwave Symposium Digest 96.2 (1996 Vol. II [MWSYM]): 1175-1178.

Standard hardware techniques for the linearization of the frequency sweep in FMCW radars are difficult to implement and often offer only moderate improvement in linearity. A simple software-based linearization technique is introduced for short-range FMCW radars, and compared with a simple hardware linearization scheme. These techniques have been verified in an existing C-band FMCW scatterometer, and result in a dramatic focusing of the point return. The resulting range resolution (measured) approaches the theoretical limit, with a >20dB reduction in sidelobes.

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Abstracts

Session WE4E -- Passive Component Technology

"Session WE4E -- Passive Component Technology." 1996 MTT-S International Microwave Symposium Digest 96.2 (1996 Vol. II [MWSYM]): 1179-1180.



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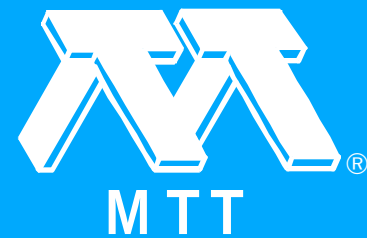


Abstracts

Design of Quasi-Ideal Couplers Using Multilayer MMIC Technology

M. Engels and R.H. Jansen. "Design of Quasi-Ideal Couplers Using Multilayer MMIC Technology." 1996 MTT-S International Microwave Symposium Digest 96.2 (1996 Vol. II [MWSYM]): 1181-1184.

Mode-related design equations not available to date are presented and discussed for quasi-ideal couplers using multilayer MMIC/MCM technology. The resulting couplers have close-to-zero reflection and new-perfect isolation over very large bandwidths. Several such couplers with varied coupling coefficients have been designed to demonstrate their realizability.



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Modeling of Generalized Double Ridge Waveguide T-Junctions

C. Wang, K.A. Zaki and R. Mansour. "Modeling of Generalized Double Ridge Waveguide T-Junctions." 1996 MTT-S International Microwave Symposium Digest 96.2 (1996 Vol. II [MWSYM]): 1185-1188.

Eigen modes in double ridge waveguide are obtained using mode-matching technique, and the scattering parameters of generalized E-plane double ridge T-junctions are computed using cascading procedure and improved three plane mode matching method. The accuracy and versatility of the method are verified through several numerical examples. The computed results are in good agreement with the measured results and that by other approach.

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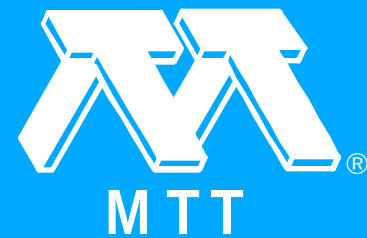


Abstracts

Novel Micromachined LIGA Microstrip Transmission Lines and Filters

T.L. Willke and S.S. Gearhart. "Novel Micromachined LIGA Microstrip Transmission Lines and Filters." 1996 MTT-S International Microwave Symposium Digest 96.2 (1996 Vol. II [MWSYM]): 1189-1192.

The LIGA-micromachined microstrip line is introduced. This transmission line and the filters presented in this paper are fabricated using the LIGA micromachining process. This process allows tall ($1\mu\text{m}$ - 1mm), 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 levels. In this paper, low-pass and bandpass filters fabricated using 120 and $160\mu\text{m}$ -tall nickel microstrip lines are demonstrated.



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Coplanar Stripline Components for High Frequency Applications

K. Goverdhanam, R.N. Simons, N. Dib and L.P.B. Katehi. "Coplanar Stripline Components for High Frequency Applications." 1996 MTT-S International Microwave Symposium Digest 96.2 (1996 Vol. II [MWSYM]): 1193-1196.

In this paper, coplanar stripline discontinuities such as a slit, a right angle bend and a T-junction are characterized and their performance is parametrized with respect to frequency and geometry. Lumped equivalent circuits are presented for some of them. The element values are obtained from the measured discontinuity scattering (S) parameters. The experimental results are compared with theoretical data obtained using the Finite Difference Time Domain (FD-TD) technique for validation and show very good agreement.

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A Novel Phase Shifter Using a GaAs MESFET in Passive Configuration

K. Purnell and A. Katz. "A Novel Phase Shifter Using a GaAs MESFET in Passive Configuration." 1996 MTT-S International Microwave Symposium Digest 96.2 (1996 Vol. II [MWSYM]): 1197-1200.

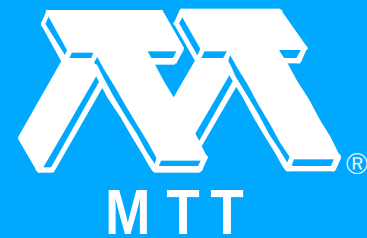
A new kind of voltage controllable phase shifter has been developed. The technique used to develop this phase shifter employs GaAs MESFETs as passive elements, similar to those used for monolithic microwave integrated circuit (MMIC) switches and attenuators. The result is a phase shifter that is smaller and that requires fewer components. A demonstration, single MESFET phase shifter was produced for the 3.7 to 4.2 -GHz satellite band. This phase shifter provided near flat, voltage linear phase shifts up to 45 degrees across the design band with a maximum insertion loss of 6 dB.

Abstracts

A Phase Compensated, Motion Insensitive Coaxial Connector

J.W. Gipprich. "A Phase Compensated, Motion Insensitive Coaxial Connector." 1996 MTT-S International Microwave Symposium Digest 96.2 (1996 Vol. II [MWSYM]): 1201-1204.

A new and unique connector design is presented that employs a novel circuit element to compensate for phase changes that occur with connector movement. The connector design is capable of providing better than 40 dB of improvement over the conventional connector in the modulation sideband levels caused by relative motion such as that seen under mechanical vibrations. This improvement may be achieved with practical designs over moderately large bandwidths up to 20% or more at microwave frequencies.



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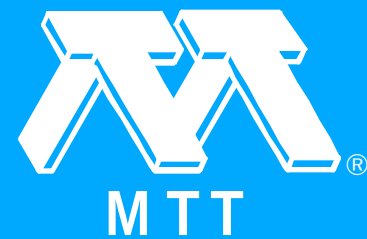
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Focus Sessions, Panel and Rump Sessions, Workshops, μ APS Technical Program and MMWMC Symposium Schedule (1996 Vol. II [MWSYM])

"Focus Sessions, Panel and Rump Sessions, Workshops, μ APS Technical Program and MMWMC Symposium Schedule (1996 Vol. II [MWSYM])." 1996 MTT-S International Microwave Symposium Digest 96.2 (1996 Vol. II [MWSYM]): 1205-1206.



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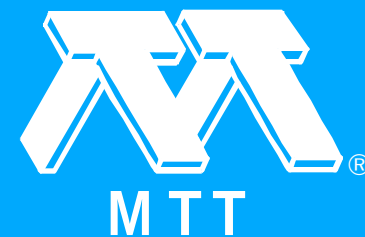
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Special MTT-S Technical Sessions (1996 Vol. II [MWSYM])

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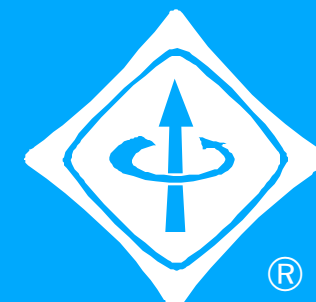
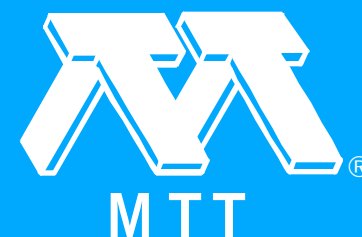
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Rump Session & MTT-S Sunday Workshops (1996 Vol. II [MWSYM])

"Rump Session & MTT-S Sunday Workshops (1996 Vol. II [MWSYM])." 1996 MTT-S International Microwave Symposium Digest 96.2 (1996 Vol. II [MWSYM]): 1211-1211.



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Abstracts

Message from the 1996 μ APS Chairman (1996 Vol. II [MWSYM])

M.I. Grace, B.D. Bakner and G.L. Koker. "Message from the 1996 μ APS Chairman (1996 Vol. II [MWSYM])." 1996 MTT-S International Microwave Symposium Digest 96.2 (1996 Vol. II [MWSYM]): 1220-1221.

On behalf of the Industry Participation Committee, welcome to the 1996 IMS in San Francisco and to the first Microwave Application & Product Seminars (μ APS) presented by the Symposium Exhibitors. The purpose of the new Microwave Application & Product Seminars is to provide a forum for topical presentations on microwave products, applications, services and markets at the level of the microwave practitioner, including design and manufacturing engineers and marketing and management professionals.



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Symposium Schedule (1996 Vol. II [MWSYM])

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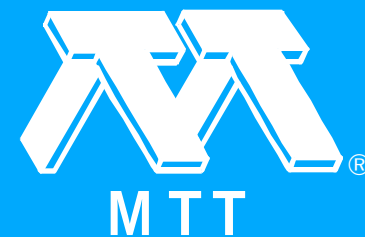
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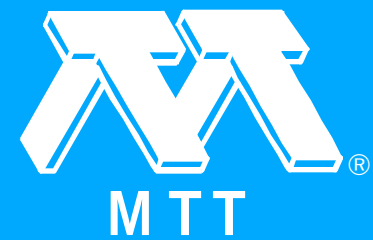
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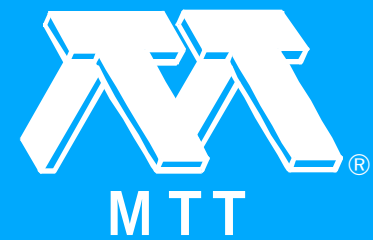
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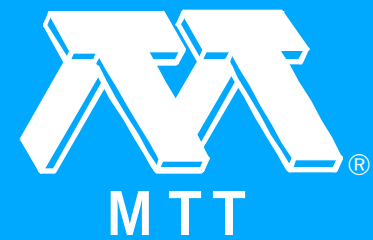
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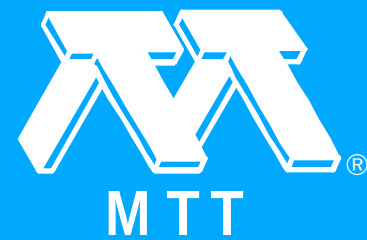
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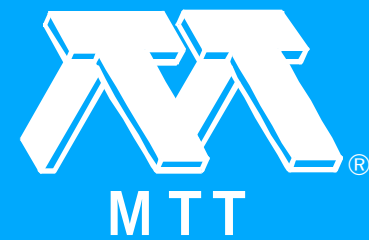
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Highly Integrated Three-Dimensional MMIC Single-Chip Receiver and Transmitter (1996 Vol. III [MWSYM])

I. Toyoda, T. Tokumitsu and M. Aikawa. "Highly Integrated Three-Dimensional MMIC Single-Chip Receiver and Transmitter (1996 Vol. III [MWSYM])." 1996 MTT-S International Microwave Symposium Digest 96.3 (1996 Vol. III [MWSYM]): 1209-1212.

A three-dimensional (3D) MMIC structure with thin polyimide-film layers on wafers significantly increases the integration level of MMICs. We newly developed 9. 2-12 GHz receiver and 9. 5-14 GHz transmitter chips with 20 dB gain using 3D MMIC technology. The integration levels of these chips are nearly three times as high as those of conventional planar ones.

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A Miniaturized X-Band 4-Stage LNA Designed Using a Novel Layout Optimization Technique

S. Chaki, T. Takagi, Y. Tsukahara, H. Matsubayashi, N. Andoh, Y. Sasaki and M. Otsubo. "A Miniaturized X-Band 4-Stage LNA Designed Using a Novel Layout Optimization Technique." 1996 MTT-S International Microwave Symposium Digest 96.3 (1996 Vol. III [MWSYM]): 1213-1216.

A novel layout optimization technique has been proposed and adapted to an X-band LNA. The layout pattern of the amplifier has been optimized in only two days by using simple equivalent circuits derived from electromagnetic simulation results. The amplifier has achieved a gain of 35 dB with a noise figure of 1.7 dB. These results have good agreement with simulated results, and the effective chip area is miniaturized to 4.8 mm².

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



A Novel Monolithic Linearized HEMT LNA Using HBT Tuneable Active Feedback

K.W. Kobayashi, D.C. Streit, A.K. Oki, D.K. Umemoto and T.R. Block. "A Novel Monolithic Linearized HEMT LNA Using HBT Tuneable Active Feedback." 1996 MTT-S International Microwave Symposium Digest 96.3 (1996 Vol. III [MWSYM]): 1217-1220.

For the first time, a novel HBT active feedback circuit is employed with a HEMT LNA which improves linearity (IP3) and gain-bandwidth performance without significantly impacting noise figure. The HEMT and HBT circuits are monolithically integrated using selective molecular beam epitaxy (MBE). The HEMT LNA achieves a nominal gain of 9 dB and noise figure of 2.5-3 dB from 1-11 GHz. By adjusting the bias of the HBT active feedback circuit, positive feedback can be induced which can increase the gain bandwidth from 11 to 16 GHz. In addition, the IP3 can be tuned from less than 20 dBm to > 24 dBm across a 1-11 GHz band with a peak improvement of 10 dB. At S-band, as much as 20 dB reduction in IM3 products has been demonstrated using the HBT active feedback. Compared to an equivalent design which employs resistive feedback only, the active feedback design achieves a 50% improvement in gain-bandwidth and a 4-10 dB improvement in IP3 while maintaining comparable noise figure performance and consuming only 15% additional dc power. This HBT active feedback linearization technique is a cost effective means of improving the linearity of HEMT-based LNA/receiver MMICs for use in multi-carrier wireless communications.





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Noise Characteristics of GaAs HBT's

G.N. Henderson and D.-W. Wu. "Noise Characteristics of GaAs HBT's." 1996 MTT-S International Microwave Symposium Digest 96.3 (1996 Vol. III [MWSYM]): 1221-1224.

A complete characterization of the bias-, area-, and frequency- dependence of GaAs HBT noise characteristics is presented. It is shown that there is an optimum device area (emitter area) and bias condition for achieving a minimum noise figure, which for the M/A-COM process at 2GHz occurs at an area of roughly $120\mu\text{m}^2$ and a collector current of 2mA yielding a minimum noise figure of 1.4dB and an associated gain of 13dB. The measured noise characteristics are validated by an extracted equivalent circuit model with associated noise sources.

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



L-Band Internally Matched Si-MMIC Low Noise Amplifier

N. Suematsu, M. Ono, S. Kubo, H. Sato, Y. Iyama and O. Ishida. "L-Band Internally Matched Si-MMIC Low Noise Amplifier." 1996 MTT-S International Microwave Symposium Digest 96.3 (1996 Vol. III [MWSYM]): 1225-1228.

A Si-MMIC low noise amplifier (LNA), fabricated in conventional 0.8 μ m Bi-CMOS process, was developed. This LNA is monolithically integrated on a low resistive Si substrate with coplanar waveguide (CPW) type matching circuits. At 1.9GHz, noise figure of 2.7dB and gain of 10dB were obtained at 2V / 2mA d.c.supply.



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Enhanced Design of a Floating Broad-Band Lossless Tunable HBT Monolithic Active Inductor

C. Zanchi, T. Parra, L. Escotte and J. Graffeuil. "Enhanced Design of a Floating Broad-Band Lossless Tunable HBT Monolithic Active Inductor." 1996 MTT-S International Microwave Symposium Digest 96.3 (1996 Vol. III [MWSYM]): 1229-1232.

A floating HBT Tunable Active Inductor (TAI) MMIC is reported. Compared with FET circuit, analytical results and measurements show significant improvements over broad-band capability, tunability and selectivity (typical Q's are over 300). HF noise is also investigated and a minimum noise figure of 0.5 dB is achieved. Measured and simulated results are compared.

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MMIC Quasi-Circulator with Low Noise and Medium Power

A. Gasmi, B. Huyart, E. Bergeault and L. Jallet. "MMIC Quasi-Circulator with Low Noise and Medium Power." 1996 MTT-S International Microwave Symposium Digest 96.3 (1996 Vol. III [MWSYM]): 1233-1236.

This paper presents the design and the measured performances of a narrow band quasi-circulator module. Its design implements active divider and combiner. The device demonstrates a noise figure of 5.5dB and an output power of 18dBm with associated gains of 4dB and 7.6dB for the receive and transmit path, respectively.

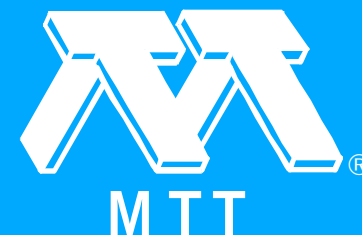
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Abstracts

Session TH1B -- Quasi-Optical Modulators and Oscillators

"Session TH1B -- Quasi-Optical Modulators and Oscillators." 1996 MTT-S International Microwave Symposium Digest 96.3 (1996 Vol. III [MWSYM]): 1237-1238.



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An Optically Controlled Modulator Using a Metal Strip Grating on a Silicon Plate for Millimeter and Submillimeter Wavelengths

J. Bae, H. Mazaki, T. Fujii and K. Mizuno. "An Optically Controlled Modulator Using a Metal Strip Grating on a Silicon Plate for Millimeter and Submillimeter Wavelengths." 1996 MTT-S International Microwave Symposium Digest 96.3 (1996 Vol. III [MWSYM]): 1239-1242.

An optically controlled modulator using a metal strip grating on a silicon plate with an external electric field applied between the strips, has been developed as a quasi-optical high-speed modulator for millimeter and submillimeter wavelengths. The experimental results obtained at 52 GHz to 60 GHz show that the maximum modulation frequency in the inductive metal strip modulator can be increased from 4 kHz to 37 kHz by applying only 13 volts ($E \sim 150$ V/cm) to the strips. A higher modulation frequency is available for the metal strip modulator with a higher external electric field.

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Abstracts

An M-PSK Modulator for Quasi-Optical Wireless Array Applications

C.E. Saavedra, M.J. Vaughan and R.C. Compton. "An M-PSK Modulator for Quasi-Optical Wireless Array Applications." 1996 MTT-S International Microwave Symposium Digest 96.3 (1996 Vol. III [MWSYM]): 1243-1246.

A new phase shift keying modulator particularly suited for quasi-optical oscillator-array applications is described. Experimental results for a 28 GHz BPSK version of the general M-PSK modulator are presented.



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Quasi-Optical Phase Modulators

M. Markovic, S. Hollung and Z.B. Popovic. "Quasi-Optical Phase Modulators." 1996 MTT-S International Microwave Symposium Digest 96.3 (1996 Vol. III [MWSYM]): 1247-1250.

Three X-band quasi-optical transmission-type phase modulators are presented: a varactor loaded grid with 25° continuous phase shift; a p-i-n diode loaded grid with digital phase shifts of 0° and 90°; and a transistor antenna array with 0° and 180° phase states. All of the modulators operate in transmission mode and are suitable for cascading with other quasi-optical components. Relative amplitude and phase change of the transmission coefficient as a function of frequency is presented for the two digital modulators. Antenna patterns for the BPSK active antenna array modulator are also presented.

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Abstracts

Electromagnetic Modeling of Finite Grid Structures in Quasi-Optical Systems

T.W. Nuteson, M.B. Steer, K. Naishadham, J.W. Mink and J. Harvey. "Electromagnetic Modeling of Finite Grid Structures in Quasi-Optical Systems." 1996 MTT-S International Microwave Symposium Digest 96.3 (1996 Vol. III [MWSYM]): 1251-1254.

A full-wave moment method technique developed for the analysis of quasi-optical systems is used to model finite grid structures. This technique incorporates an electric field dyadic Green's function for a grid centered between two lenses in free space which is derived by separately considering paraxial and non-paraxial fields. Results for the driving point reflection coefficient of a 3×3 grid are computed and compared with measurements.



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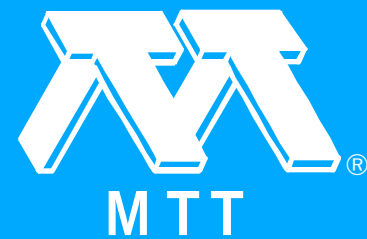


Abstracts

Method of Moments and Time Domain Analyses of Waveguide-Based Hybrid Multiple Device Oscillators

A.R. Adams, R.D. Pollard and C.M. Snowden. "Method of Moments and Time Domain Analyses of Waveguide-Based Hybrid Multiple Device Oscillators." 1996 MTT-S International Microwave Symposium Digest 96.3 (1996 Vol. III [MWSYM]): 1255-1258.

The time-domain analysis and measured performance of a novel multiple oscillator circuit consisting of densely integrated active devices and planar antennas mounted in rectangular waveguide is presented. We detail a prototype seven element circuit using hybrid pHEMT oscillators delivering 220mW at 12.40 GHz.



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Axially Symmetric Fabry-Perot Power Combiner with Active Devices Mounted on Both the Mirrors

M. Sanagi, E. Yamamoto and S. Nogi. "Axially Symmetric Fabry-Perot Power Combiner with Active Devices Mounted on Both the Mirrors." 1996 MTT-S International Microwave Symposium Digest 96.3 (1996 Vol. III [MWSYM]): 1259-1262.

We investigate an axially symmetrical Fabry-Perot power combiner with many more active devices operating in axially symmetric TEM/sub01n/ mode, which has an excellent feature of uniform device-field coupling required for high power combining efficiency. By numerical calculation using the boundary element method, it was shown that high combining efficiency can be obtained when a circular groove of larger radius is installed on either the plane mirror or the concave mirror. In experiments at X-band, almost perfect power combining of twenty or twenty-four devices mounted on both the mirror was achieved.

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An Extended Resonance Spatial Power Combining Oscillator

M. Rahman, T. Ivanov and A. Mortazawi. "An Extended Resonance Spatial Power Combining Oscillator." 1996 MTT-S International Microwave Symposium Digest 96.3 (1996 Vol. III [MWSYM]): 1263-1266.

A new circuit topology is presented for a spatial power combining oscillator based on an extended resonance technique. This oscillator uses annular slot antennas as the radiating elements and is more compact than the extended resonance circuits previously reported. A nine device power combining oscillator has been designed, fabricated and tested at the operating frequency of 10.11 GHz. The radiation patterns in both E and H plane have been measured and compared with the theoretical patterns. An effective isotropic radiated power of 2.4 W has been obtained from the nine device combiner.

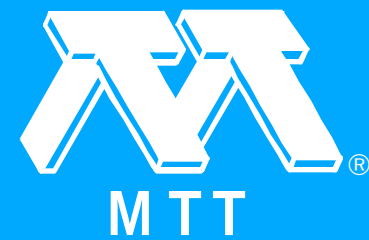
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Abstracts

Session TH1C -- Mario A. Maury, Jr. Memorial Session

"Session TH1C -- Mario A. Maury, Jr. Memorial Session." 1996 MTT-S International Microwave Symposium Digest 96.3 (1996 Vol. III [MWSYM]): 1267-1268.



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Abstracts

Retrospective on the Career of Mario A. Maury, Jr.

H.G. Oltman, Jr.. "Retrospective on the Career of Mario A. Maury, Jr.." 1996 MTT-S International Microwave Symposium Digest 96.3 (1996 Vol. III [MWSYM]): 1269-1272.

Mario A Maury, Jr., a major contributor to our microwave industry, our microwave business and the IEEE died March 30,1995. A review is presented of his life and contributions in the context of his work ethic, his enthusiasm, and his sense of responsibility toward his family, his company, and his industry and its several technical societies.



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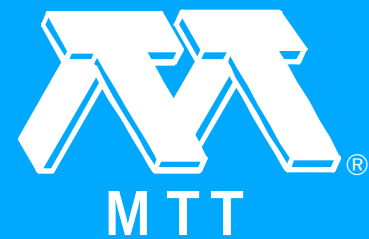
W-Band Noise Figure Measurement Designed for On-Wafer Characterisation

R. Drury, R.D. Pollard and C.M. Snowden. "W-Band Noise Figure Measurement Designed for On-Wafer Characterisation." 1996 MTT-S International Microwave Symposium Digest 96.3 (1996 Vol. III [MWSYM]): 1273-1276.

The first fully automated noise and S-parameter measurement bench is reported for W-band on-wafer characterisation. A calibration procedure is described that allows the receiver reference plane to be accurately moved to the probe tip.

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Experimental Investigation of On-Wafer Noise Parameter Measurement Accuracy

A. Boudiaf and A. Scavennec. "Experimental Investigation of On-Wafer Noise Parameter Measurement Accuracy." 1996 MTT-S International Microwave Symposium Digest 96.3 (1996 Vol. III [MWSYM]): 1277-1280.

The accuracy problem of noise parameter characterization of active microwave devices in highly mismatched systems is addressed. An experimental investigation is made to determine the dependency of noise parameter measurement uncertainty on the device's output mismatch. We have designed and fabricated five different structures of a new passive device, useful as a verification artefact, suited for on-wafer measurements. The main feature specifying this device is the same order of magnitude for input-output reflection coefficient and for noise parameters, as for low noise field effect transistors.

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Vector Corrected On-Wafer Power Measurements of Frequency Converting Two-Ports

B. Roth, D. Kother, T. Sporkmann, W. Lutke and I. Wolff. "Vector Corrected On-Wafer Power Measurements of Frequency Converting Two-Ports." 1996 MTT-S International Microwave Symposium Digest 96.3 (1996 Vol. III [MWSYM]): 1281-1284.

In this paper a universal nonlinear measurement system is presented. The On-Wafer approach described here is commercially available and utilizes a modified vectorial network analyzer (Wiltron 360 B) and a special software package developed at the IMST. The system determines the complex quantities of all power waves at all ports of the DUT. Since measurements are carried out at all interesting harmonics, the system is ideal for the complete electrical characterization of a frequency multiplier for instance. In contrast to other power and harmonic measurement approaches using VNAs, the technique proposed here does not need an additional microwave synthesizer for locking the receiver to the harmonics. The described system exhibits a power sweep range of more than 80 dB.

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Transmission Response Measurements of Frequency Translating Devices

C.J. Clark, A.A. Moulthrop, M.S. Muha and C.P. Silva. "Transmission Response Measurements of Frequency Translating Devices." 1996 MTT-S International Microwave Symposium Digest 96.3 (1996 Vol. III [MWSYM]): 1285-1288.

This paper presents two methods for accurately determining the transmission response of frequency translating devices: an inferred response technique using a vector network analyzer, and a direct response technique utilizing a microwave transition analyzer. Tradeoffs between these two approaches are presented along with results for a 20 GHz downconverter. The emphasis here is on single-sideband converters, but the application to double-sideband converters is also described briefly.

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An Application of Membrane Probes for On-Wafer Testing of Unmatched High Power MMICs

D. Tonks, W. Vaillancourt, K. Smith and E. Strid. "An Application of Membrane Probes for On-Wafer Testing of Unmatched High Power MMICs." 1996 MTT-S International Microwave Symposium Digest 96.3 (1996 Vol. III [MWSYM]): 1289-1292.

A membrane probe capable of determining large signal power handling capabilities of discrete and partially matched large periphery FETs at microwave frequencies has been developed. This paper describes the application and implementation of a membrane probe for a 15.7 mm partially matched 6W power amplifier MMIC that employs off-chip matching networks for a high volume multichip module application.

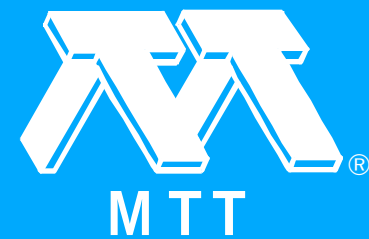
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Session TH1D -- High Speed Lightwave Communication Systems

"Session TH1D -- High Speed Lightwave Communication Systems." 1996 MTT-S International Microwave Symposium Digest 96.3 (1996 Vol. III [MWSYM]): 1293-1294.



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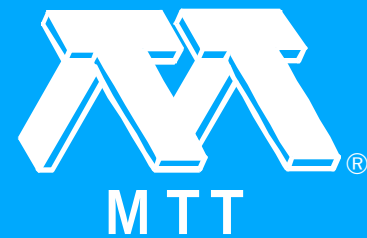


Abstracts

Progress in Optical Communications for Commercial Terrestrial Telecommunication Networks

H. Sobol. "Progress in Optical Communications for Commercial Terrestrial Telecommunication Networks." 1996 MTT-S International Microwave Symposium Digest 96.3 (1996 Vol. III [MWSYM]): 1295-1298.

The past decade has witnessed many advances that have considerably improved the capacity, span length between regenerators, network reliability, survivability, and flexibility, as well as moving optical technology to the local loop to provide cost effective multimedia services to subscribers. The device, component, and network architecture advances that resulted in this progress will be described.



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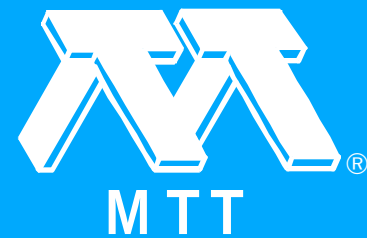


Abstracts

Undersea Lightwave Transmission Technology and Techniques

C.R. Davidson. "Undersea Lightwave Transmission Technology and Techniques." 1996 MTT-S International Microwave Symposium Digest 96.3 (1996 Vol. III [MWSYM]): 1299-1302.

This paper tracks the evolution of undersea lightwave transmission technology from digital regenerative systems to the newly developed Erbium-doped fiber amplifier (EDFA) systems, provides a perspective of the evolving technologies using EDFA's, and reviews the impact on the microwave technology and applications community.



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Session TH1E -- Linear Device Modeling

"Session TH1E -- Linear Device Modeling." 1996 MTT-S International Microwave Symposium Digest 96.3 (1996 Vol. III [MWSYM]): 1303-1304.



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Abstracts

Direct Parametric Extraction of 1/f Noise Source Magnitude and Physical Location from Baseband Spectra in HBTs

D.R. Pehlke, A. Sailer, W.-J. Ho, J.A. Higgins and M.F. Chang. "Direct Parametric Extraction of 1/f Noise Source Magnitude and Physical Location from Baseband Spectra in HBTs." 1996 MTT-S International Microwave Symposium Digest 96.3 (1996 Vol. III [MWSYM]): 1305-1308.

This work describes a novel equivalent circuit representation for the modeling of low frequency 1 / f noise in Heterojunction Bipolar Transistors (HBTs), and is presented as part of an extraction procedure which combines direct calculation of the HBT equivalent circuit from S-parameters, and separate measurement of the base and Collector noise voltage spectra to determine the magnitude and physical location of the dominant intrinsic 1 / f noise sources within the device.



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Extraction of Low-Frequency Noise Model of Self-Aligned AlGaAs/GaAs Heterojunction Bipolar Transistor

J.-H. Shin, Y. Chung, Y. Suh and B. Kim. "Extraction of Low-Frequency Noise Model of Self-Aligned AlGaAs/GaAs Heterojunction Bipolar Transistor." 1996 MTT-S International Microwave Symposium Digest 96.3 (1996 Vol. III [MWSYM]): 1309-1312.

The first quantitative extraction of low-frequency noise equivalent circuit model of self-aligned AlGaAs/GaAs heterojunction bipolar transistor has been performed. It is based on a generalized small signal circuit model including the base and emitter series resistance noise sources. The dominant noise sources are emitter-base current noise source and the resistance noise source. The emitter-collector current noise source is negligible.

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Bias-Dependent "Cold-(H)FET" Modeling

W. Stiebler, M. Matthes, G. Bock, T. Koppel and A. Schafer. "Bias-Dependent "Cold-(H)FET" Modeling." 1996 MTT-S International Microwave Symposium Digest 96.3 (1996 Vol. III [MWSYM]): 1313-1316.

A bias-dependent model for MESFET and HFET devices under zero drain bias pinched-off conditions is proposed. Parasitic capacitances are evaluated from bias-dependent Y parameters over the whole frequency range. For the first time, it is possible to clearly distinguish between all intrinsic and extrinsic capacitances by considering the distributed nature of the device.

Click on title for a complete paper.



Abstracts

Investigation and Modeling of Impact Ionization with Regard to the RF- and Noise Behaviour 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 Behaviour of HFET." 1996 MTT-S International Microwave Symposium Digest 96.3 (1996 Vol. III [MWSYM]): 1317-1320.*

A new small-signal and noise equivalent circuit for Heterostructure Field-Effect Transistors (HFET), 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 RF- and noise behaviour of InAlAs/InGaAs/InP-HFET.



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Millimeter-Wave HEMT Noise Models Verified Thru V-Band

M.D. DuFault and A.K. Sharma. "Millimeter-Wave HEMT Noise Models Verified Thru V-Band." 1996 MTT-S International Microwave Symposium Digest 96.3 (1996 Vol. III [MWSYM]): 1321-1324.

Further enhancements in the HEMT noise modeling procedure described in [1] now enables scaling of bias dependent noise models, This was experimentally verified through V-band using prematched structures utilizing the TRW 0.1 μ m gate length low noise process. With this procedure, it is now possible to scale device noise models obtained at microwave frequencies to millimeter wave frequencies with good correlation. The scaled models are further verified with Q- and V-band low noise amplifiers.

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New Aspects Concerning the Bias and Temperature Dependence of Intrinsic Noise Generators in Extracted FET Models

S.M. Lardizabal, L.P. Dunleavy and A. Boudiaf. "New Aspects Concerning the Bias and Temperature Dependence of Intrinsic Noise Generators in Extracted FET Models." 1996 MTT-S International Microwave Symposium Digest 96.3 (1996 Vol. III [MWSYM]): 1325-1328.

A systematic experimental investigation of FET noise models illustrates bias and temperature dependencies that help to explain differences between two prevalent models. Observations concerning the bias dependence of the popular temperature based noise model show that the gate noise temperature follows the ambient temperature only near the minimum noise bias condition.

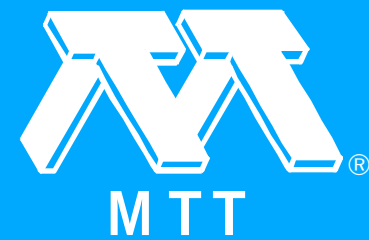
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Abstracts

Session TH2A -- Progress in High Speed Digital Applications

"Session TH2A -- Progress in High Speed Digital Applications." 1996 MTT-S International Microwave Symposium Digest 96.3 (1996 Vol. III [MWSYM]): 1329-1330.



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Abstracts

Digital Receiver Technology, Architecture, and Application

S.G. Kaiser. "Digital Receiver Technology, Architecture, and Application." 1996 MTT-S International Microwave Symposium Digest 96.3 (1996 Vol. III [MWSYM]): 1331-1334.

Digital radio receivers are now appearing in various applications. This paper discusses why digital receivers are desirable, their architecture, and the main technology drivers that are pacing their development. It also presents an Electronic Warfare digital receiver developed by Northrop Grumman.



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ADCs for Digital Receivers: The Whole World Tunes In

T. Gratzek, B. Brannon and F. Murden. "ADCs for Digital Receivers: The Whole World Tunes In." 1996 MTT-S International Microwave Symposium Digest 96.3 (1996 Vol. III [MWSYM]): 1335-1338.

Digital receivers require analog to digital converters with linear transfer functions. Dither is used to remove the effect of encoder non-linearities and increase the effective dynamic range by more than 20 dB on the AD9042, 80 dB dynamic range is shown for analog input frequencies up to 40 MHz, by removing the effects of the input amplifier. Sampling jitter of 300 femto seconds is inferred by observing the increased noise floor level when sampling 201 MHz input signals.





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Three-Level 1 GS/s Digital Correlator for Wideband Polarimetric Radiometry

J.R. Piepmeier and A.J. Gasiewski. "Three-Level 1 GS/s Digital Correlator for Wideband Polarimetric Radiometry." 1996 MTT-S International Microwave Symposium Digest 96.3 (1996 Vol. III [MWSYM]): 1339-1342.

A 500-MHz bandwidth, three-level (1.6 bit) digital correlator operating at 1 GS/s was designed and fabricated. The digital circuit is comprised of discrete high-speed silicon emitter-coupled logic components. The use of digital microwave design techniques was necessary to accomplish proper clock distribution, impedance matching, and asynchronous signal propagation. The correlator is to be part of a fully polarimetric radiometer for air-borne application. Experimental results from a 400 MS/s prototype polarimetric radiometer are presented.

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Comparison of Direct and Downconverted Digitization in GPS Receiver Front End Designs

J.B.Y. Tsui and D.M. Akos. "Comparison of Direct and Downconverted Digitization in GPS Receiver Front End Designs." 1996 MTT-S International Microwave Symposium Digest 96.3 (1996 Vol. III [MWSYM]): 1343-1346.

This paper compares two front end designs of a global positioning system (GPS) receiver. The first approach is the direct digitization of the input signal and the second approach is to downconvert the input signal to an intermediate frequency (IF) then digitize it. Theoretically, these two methods should produce similar results and our experimental data support this argument.

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Abstracts

Recent Progress in Wideband Monolithic Direct Digital Synthesizers

G. Van Andrews, J.B. Delaney, M.A. Vernon, M.P. Harris, C.T.M. Chang, T.C. Eiland, C.E. Hastings, V.L. DiPerna, M.C. Brown, W.A. White and L.J. Kushner. "Recent Progress in Wideband Monolithic Direct Digital Synthesizers." 1996 MTT-S International Microwave Symposium Digest 96.3 (1996 Vol. III [MWSYM]): 1347-1350.

This paper presents recent progress in the development of wideband monolithic GaAs DDSs, since its debut in 1992. A vvideband DDS generates sinusoidal waveforms with several hundred megahertz of bandwidth, subhertz resolution and nanosecond frequency switching speeds. A discussion of improvements made to the monolithic GaAs HBT DDS and factors driving design and performance are presented.



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Generation of High-Speed Pseudo-Random Sequences Using Multiplex-Techniques (1996 Vol. III [MWSYM])

F. Sinnesbichler, A. Ebberg, A. Felder and R. Weigel. "Generation of High-Speed Pseudo-Random Sequences Using Multiplex-Techniques (1996 Vol. III [MWSYM])." 1996 MTT-S International Microwave Symposium Digest 96.3 (1996 Vol. III [MWSYM]): 1351-1354.

We report on the design and performance of high-speed pseudo-random sequence generators for NRZ-signals. The hardware is based on multiplexer circuits that multiply the data rate of a 5 Gbit/s pseudo-random sequence to respectively 10 Gbit/s and 20 Gbit/s. We used multiplex-techniques based on the "cycle-and-add property" of pseudo-random sequences. Using both microstrip and coplanar waveguide technology, the circuitry incorporates special high-speed silicon chips. The experimental results demonstrate the feasibility of our approach.

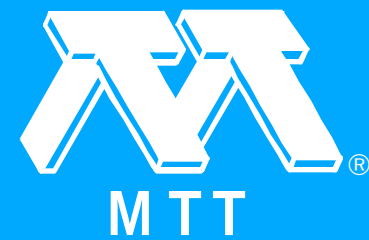
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Abstracts

Session TH2B -- Nonlinear Modeling and Analysis

"Session TH2B -- Nonlinear Modeling and Analysis." 1996 MTT-S International Microwave Symposium Digest 96.3 (1996 Vol. III [MWSYM]): 1355-1356.



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Abstracts

Harmonic-Balance Simulation of Strongly Nonlinear Very Large-Size Microwave Circuits by Inexact Newton Methods

V. Rizzoli, F. Mastri, F. Sgallari and G. Spaletta. "Harmonic-Balance Simulation of Strongly Nonlinear Very Large-Size Microwave Circuits by Inexact Newton Methods." 1996 MTT-S International Microwave Symposium Digest 96.3 (1996 Vol. III [MWSYM]): 1357-1360.

The paper introduces a new approach to harmonic-balance simulation, based on inexact Newton methods and iterative system-solving techniques. Storage and factorization of the Jacobian matrix are avoided, resulting in a dramatic drop of execution time and memory occupation. HB analyses with several tens of thousands unknowns become possible on ordinary workstations.



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Parametric Harmonic Balance

Y. Thodesen and K. Kundert. "Parametric Harmonic Balance." 1996 MTT-S International Microwave Symposium Digest 96.3 (1996 Vol. III [MWSYM]): 1361-1364.

Harmonic balance has established itself as an important technique for simulating high frequency circuits. However, this simulator struggles on strongly nonlinear circuits, particularly if there are several input signals at different frequencies. An important observation is that multi-tone nonlinear circuits usually react in a strongly nonlinear fashion in response to one signal, but in near-linear fashion in response to the others. In this paper we present an extension of harmonic balance that exploits these properties to reduce the time and memory required to perform accurate circuit-level frequency-domain simulation of mixers.

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Abstracts

Envelop Transient Analysis: A New Method for the Transient and Steady State Analysis of Microwave Communication Circuits and Systems

E. Ngoya and R. Larcheveque. "Envelop Transient Analysis: A New Method for the Transient and Steady State Analysis of Microwave Communication Circuits and Systems." 1996 MTT-S International Microwave Symposium Digest 96.3 (1996 Vol. III [MWSYM]): 1365-1368.

The two popular and general purpose simulation techniques. Time Domain Integration and Harmonic Balance, do not fulfill the requirement for analysis of microwave communication systems with arbitrary modulated carrier frequency. A new technique is presented, which overcomes this default. A dramatic saving in computer memory space and computation time is obtained with respect to the previous methods.



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Abstracts

Compressed Transient Analysis Speeds Up the Periodic Steady State Analysis of Nonlinear Microwave Circuits

R. Larcheveque and E. Ngoya. "Compressed Transient Analysis Speeds Up the Periodic Steady State Analysis of Nonlinear Microwave Circuits." 1996 MTT-S International Microwave Symposium Digest 96.3 (1996 Vol. III [MWSYM]): 1369-1372.

Harmonic Balance is nowadays the most efficient method for the periodic steady state analysis of microwave circuits. Unfortunately this method cannot conveniently handle realistic wide band input signals, because its computation time grows rapidly with the number of harmonics. A new method is proposed which resolves the above mentioned limitation of the Harmonic Balance. A substantial computation time saving is obtained with respect to the Harmonic Balance.



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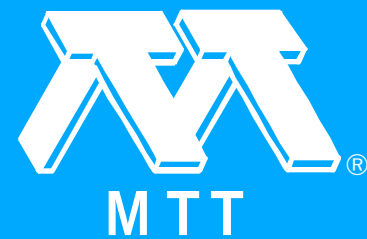


Abstracts

Low-Frequency Dispersion and its Influence on the Intermodulation Performance of AlGaAs/GaAs HBTs

K. Lu, P.M. McIntosh, C.M. Snowden and R.D. Pollard. "Low-Frequency Dispersion and its Influence on the Intermodulation Performance of AlGaAs/GaAs HBTs." 1996 MTT-S International Microwave Symposium Digest 96.3 (1996 Vol. III [MWSYM]): 1373-1376.

The relationship between low-frequency dispersion and the intermodulation performance of Al-GaAs/ GaAs HBTs has been demonstrated for the first time. The theoretical analysis and experimental results indicate that IM/sub3/ will depend strongly on the frequency spacing ($\Delta f = f_{\text{sub2}} - f_{\text{sub1}}$) in the two-tone measurement.



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Intermodulation Analysis of FET Resistive Mixers Using Volterra Series

S. Peng, P.J. McCleer and G.I. Haddad. "Intermodulation Analysis of FET Resistive Mixers Using Volterra Series." 1996 MTT-S International Microwave Symposium Digest 96.3 (1996 Vol. III [MWSYM]): 1377-1380.

We have implemented the Volterra-series method to analyze intermodulation (IM) distortion in FET resistive mixers. The nonlinearities of the channel conductance of a NE71000 MESFET and a NE32400 HFET were first characterized using a low-frequency harmonic power measurement. The data was then used in a simulation program and results for two-tone IM distortion in X-band were compared with the measured data for both MESFET and HFET resistive mixer circuits. Very good agreement was achieved in each case. We have also shown by simulation that the two separate contributions to the third-order IM distortion from the mixing between the input signals themselves and the mixing between the input signals and the second-order mixing products have a very strong cancellation, which results in the low IM distortion in the FET resistive mixers observed in measurements.

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Implicit Incorporation of Nonlinear Elements for Unconditionally Stable FDTD Analysis at Coarse Time-Steps

M. Celuch-Marcysiak and W.K. Gwarek. "Implicit Incorporation of Nonlinear Elements for Unconditionally Stable FDTD Analysis at Coarse Time-Steps." 1996 MTT-S International Microwave Symposium Digest 96.3 (1996 Vol. III [MWSYM]): 1381-1384.

A hybrid 3D FDTD algorithm with a fully implicit interface to lumped nonlinear multiport devices is presented. The algorithm is unconditionally stable and converges for arbitrarily strong nonlinearities, high voltages and with any time-step satisfying the Courant condition. In case of a strongly nonlinear bipolar transistor, the new algorithm is by over two orders of magnitude faster than previous FDTD schemes with explicit or semi-implicit interfaces.

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Behavioral Modeling of Narrowband Microwave Power Amplifiers with Applications in Simulating Spectral Regrowth

A. Leke and J.S. Kenney. "Behavioral Modeling of Narrowband Microwave Power Amplifiers with Applications in Simulating Spectral Regrowth." 1996 MTT-S International Microwave Symposium Digest 96.3 (1996 Vol. III [MWSYM]): 1385-1388.

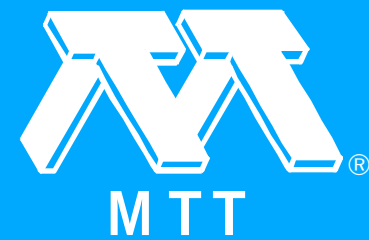
A new behavioral model for narrowband microwave power amplifiers is proposed. Analytic expressions for the gain compression (AM-AM) and amplitude dependent phase distortion (AM-PM) of a nonlinear amplifier are derived from a third-order Volterra series model. The cases of a single-tone and of a two-tone signal are explored. We show that the gain compression characteristics of nonlinear amplifiers depend on the amplitude modulation characteristics of the signal. Further more, we show that the time-averaged phase deviation is independent of the modulation envelope. This justifies the new model proposed for obtaining the envelope transfer characteristics by applying the Bessel-Fourier technique only to the AM-AM characteristic. This model is verified by comparing spectral regrowth simulations of digitally modulated signals to those measured in a 1.9 GHz GaAsFET power amplifier.



Abstracts

Session TH2C -- Scattering Parameter and Dielectric Measurements

"Session TH2C -- Scattering Parameter and Dielectric Measurements." 1996 MTT-S International Microwave Symposium Digest 96.3 (1996 Vol. III [MWSYM]): 1389-1390.



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A Novel Calibration Verification Procedure for Millimeter-Wave Measurements

M.D. DuFault and A.K. Sharma. "A Novel Calibration Verification Procedure for Millimeter-Wave Measurements." 1996 MTT-S International Microwave Symposium Digest 96.3 (1996 Vol. III [MWSYM]): 1391-1394.

A novel calibration procedure is presented for microstrip on-wafer SOLT calibration standards. In this procedure, an on-wafer multiline TRL calibration is used to measure on-wafer SOLT calibration standards. The measurements are compared to electromagnetic simulations of the SOLT standards. An SOLT calibration standard model is derived and used to measure on-wafer offset SOL standards. Close agreement of the SOLT standard measurements and the offset SOL measurements to electromagnetic simulated data provides verification. Accuracy of this calibration procedure is documented up to 75 GHz.

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Abstracts

The Implementation of Calibration on Coplanar Waveguide for On-Wafer Measurements at W-Band

H. Leroux, J.-M. Belquin, R.D. Pollard, C.M. Snowden and M.J. Howes. "The Implementation of Calibration on Coplanar Waveguide for On-Wafer Measurements at W-Band." 1996 MTT-S International Microwave Symposium Digest 96.3 (1996 Vol. III [MWSYM]): 1395-1398.

The use of 50 ohm co-planar waveguide standards fabricated on semi-insulating gallium arsenide is successfully applied to the problem of probe calibration at W-band (75 to 110 GHz). Experimental verification demonstrates the near-constant characteristic impedance and uniform propagation characteristics of the on-wafer components.



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On-Wafer Measurement of Microstrip-Based MIMICs Without via Holes

G. Strauss, P. Ehret and W. Menzel. "On-Wafer Measurement of Microstrip-Based MIMICs Without via Holes." 1996 MTT-S International Microwave Symposium Digest 96.3 (1996 Vol. III [MWSYM]): 1399-1402.

Typically, on-wafer measurements of microstrip based MMICs require via holes ground contacts. To avoid these, the design of ground contacts for on-wafer probing at mm-wave frequencies using electromagnetic field coupling is presented in this paper. Theoretical and experimental results of the respective transitions are given as well as a test deembedding this transition from the behaviour of a transmission line.

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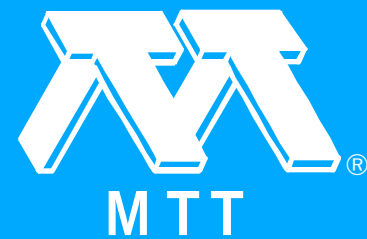


Abstracts

A Simplified Calibration Procedure for Cryogenic Microwave Measurements

J.E. van Zyl, P. Meyer and C. van Niekerk. "A Simplified Calibration Procedure for Cryogenic Microwave Measurements." 1996 MTT-S International Microwave Symposium Digest 96.3 (1996 Vol. III [MWSYM]): 1403-1406.

A single standard co-axial two-port calibration procedure which uses only one short-circuit as a calibration standard, is presented. The technique uses time-domain reflectometry to model the embedding networks as two lossy transmission lines. It has particular significance for cryogenic measurements where cooling cycles can take up to several hours.



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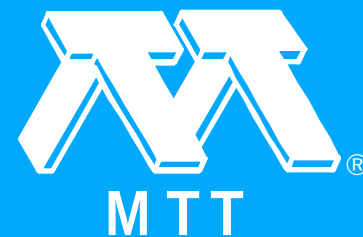


Abstracts

Measuring Complex Permittivity and Permeability Using Time Domain Network Analysis

J.A. Jargon and M.D. Janezic. "Measuring Complex Permittivity and Permeability Using Time Domain Network Analysis." 1996 MTT-S International Microwave Symposium Digest 96.3 (1996 Vol. III [MWSYM]): 1407-1410.

We use a time domain network analyzer along with a recent improvement to the transmission/reflection method to determine the complex permittivity and permeability of a sample in a coaxial line. Our data show that accurate measurements can be made without a conventional frequency domain network analyzer.



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Abstracts

Development of a Coplanar Waveguide Membrane Probe for Non-Destructive Evaluation of Thin Film Structures

E.W. Seltmann, J. Laskar and K. Smith. "Development of a Coplanar Waveguide Membrane Probe for Non-Destructive Evaluation of Thin Film Structures." 1996 MTT-S International Microwave Symposium Digest 96.3 (1996 Vol. III [MWSYM]): 1411-1414.

A novel prototype membrane coplanar waveguide probe (MCPW) has been designed and fabricated to characterize the dielectric properties of multi-layer thin film structures. The MCPW provides a convenient non-destructive technique to extract the dielectric properties of substrates as thin as 5 mils to 20 GHz. We present the design and analysis of the MCPW and demonstrate feasibility of this new approach.



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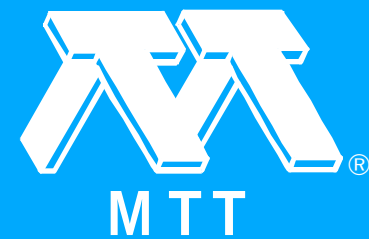


Abstracts

New Density-Independent Moisture Measurement Methods Using Frequency-Swept Microwave Transmission

F. Menke and R. Knochel. "New Density-Independent Moisture Measurement Methods Using Frequency-Swept Microwave Transmission." 1996 MTT-S International Microwave Symposium Digest 96.3 (1996 Vol. III [MWSYM]): 1415-1418.

This paper presents density independent moisture measurement procedures using frequency-swept microwaves. By proper processing changes of attenuation and phase of a transmitted signal versus frequency, calibration curves can be easily generated on-site, without any need of varying density or layer thickness of moist material under test. It is shown, that the new measurement methods are usable up to very high moisture contents of more than 40%, in contrast to previous methods, which are only usable below approximately 25%.



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Parametric Modelling of Complex Permittivity and Permeability

T. Van den Broeck, G. Dhondt, A. Barel and L. Martens. "Parametric Modelling of Complex Permittivity and Permeability." 1996 MTT-S International Microwave Symposium Digest 96.3 (1996 Vol. III [MWSYM]): 1419-1422.

This paper proposes a new method for measuring the complex permittivity and permeability of materials at microwave frequencies. Starting from reflection/transmission measurements, a parametric model of epsilon and μ is determined using a maximum likelihood estimator.

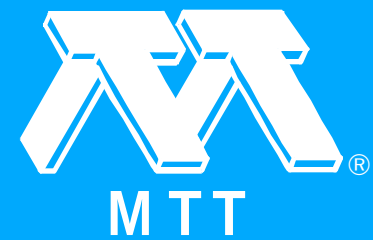
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Abstracts

Session TH2D -- Microwave Photonic Devices

"Session TH2D -- Microwave Photonic Devices." 1996 MTT-S International Microwave Symposium Digest 96.3 (1996 Vol. III [MWSYM]): 1423-1424.



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Millimeter Wave Generation by Off-Locking Optical Injection in a DFB Laser Diode

H. Scholl, H. Burkhard and M. Tamburrini. "Millimeter Wave Generation by Off-Locking Optical Injection in a DFB Laser Diode." 1996 MTT-S International Microwave Symposium Digest 96.3 (1996 Vol. III [MWSYM]): 1425-1428.

We injected CW light from a single-mode laser into the cavity of a second one, with a frequency detuning outside the locking range. After detection with a fast photodiode we observed beat notes, in the 15-45 GHz range, narrower than 100 kHz, i.e. much less than the 2.2 MHz natural beat note linewidth, observed in the absence of injection.





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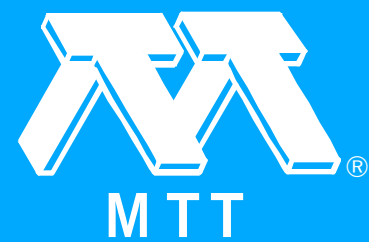
Three-Dimensional Modelling of High-Power Laser Diodes Based on the Finite Integration Beam Propagation Method

M. Niederhoff, W. Heinrich and P. Russer. "Three-Dimensional Modelling of High-Power Laser Diodes Based on the Finite Integration Beam Propagation Method." 1996 MTT-S International Microwave Symposium Digest 96.3 (1996 Vol. III [MWSYM]): 1429-1432.

A self-consistent three-dimensional method for modelling high-power laser diodes is presented, that is based on the finite integration beam propagation method (FIBPM). It allows the modelling of longitudinally inhomogeneous lasers, and takes into account the influence of the distributions of the injection current, the carrier density and the temperature profile. The method has been applied to various high-power laser diode structures. Simulation results have been verified by experimental data,

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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, M. Shimada, 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." 1996 MTT-S International Microwave Symposium Digest 96.3 (1996 Vol. III [MWSYM]): 1433-1436.

An optical modulator driver IC has been developed for 10 Gb/s optical communication systems. In order to realize both high frequency operation and low power dissipation, 0.2- μm T-shaped gate AlGaAs/InGaAs pseudomorphic HEMTs, which give large transconductance, $g_{\text{sub m}}$, of 610 mS/mm and high cut-off frequency, $f_{\text{sub T}}$, of 67.5 GHz, have been employed. In addition, by using a current mirror circuit with cascode configuration as high impedance current source, power dissipation of 1.1 W is achieved at a 10 Gb/s NRZ signal output with 3 V/sub p-p/. This dissipation is the lowest value ever reported. As an additional function, the output voltage swing can be controlled from 2 to 3.3 V /sub p-p/ by the current mirror circuit in order to adjust the duty factor of optical output signal through an optical modulator.





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A New Optoelectronic Technique for Microwave Passive Structures Tuning

J. Haidar, M. Bouthinon and A. Vilcot. "A New Optoelectronic Technique for Microwave Passive Structures Tuning." 1996 MTT-S International Microwave Symposium Digest 96.3 (1996 Vol. III [MWSYM]): 1437-1440.

An optoelectronic technique useful for microwave passive structures tuning is reported. It is based on the biasing of a photoinduced plasma loading an open terminated microstrip line. Experimental results for a tapped half-wave resonator are presented. Sharp notch characteristics with a few dB insertion loss and a tunable resonant frequency with a matching better than 45 dB are obtained by varying both the optical power and the DC bias. The observed frequency shift is more than 30% below the dark resonant frequency and is carried out without altering the Q-factor. Moreover an experimental investigation on the realisation of an optoelectronically tunable bandstop filter seems to give promising results.

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Velocity Matching for Field-Induced Electrooptic Modulators

F. Masot, K.A. Remley, R.T. Kollipara, A. Weisshaar and V.K. Tripathi. "Velocity Matching for Field-Induced Electrooptic Modulators." 1996 MTT-S International Microwave Symposium Digest 96.3 (1996 Vol. III [MWSYM]): 1441-1444.

A capacitively loaded structure is proposed for synchronizing the microwave and optical signal in a field induced multiple quantum well traveling-wave electrooptic modulator. The design procedure for the modulating structure is presented together with the experimental result.

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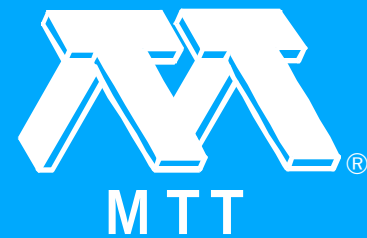


Abstracts

The Optical Performance of Microwave Transistors

L.E.M. de Barros, Jr., A. Paoella, P.R. Herczfeld and A.A.A. de Salles. "The Optical Performance of Microwave Transistors." 1996 MTT-S International Microwave Symposium Digest 96.3 (1996 Vol. III [MWSYM]): 1445-1448.

This paper renders a thorough analysis of the optical properties of microwave transistors, HBT, MESFET and HEMT. The principal photoresponse mechanisms are identified and compared in terms of gain, frequency response and sensitivity. The paper highlights newly observed effects in the HBT, where high speed and gain are realizable.



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A Balanced Distributed Preamplifier Using MMIC GaAs MESFET Technology

T.L. Nguyen and A.P. Freundorfer. "A Balanced Distributed Preamplifier Using MMIC GaAs MESFET Technology." 1996 MTT-S International Microwave Symposium Digest 96.3 (1996 Vol. III [MWSYM]): 1449-1452.

A MMIC balanced preamplifier was fabricated using a 0.8 μm gate length process. A 45 dB Omega transimpedance gain, a 6 GHz bandwidth, a 10pA/spl radic/ Hz input noise and a 12 dB CMRR were measured.

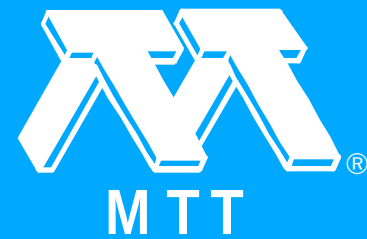
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Abstracts

Session TH2E -- CAD Techniques Using Field Theory

"Session TH2E -- CAD Techniques Using Field Theory." 1996 MTT-S International Microwave Symposium Digest 96.3 (1996 Vol. III [MWSYM]): 1453-1454.



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CAD-Oriented Equivalent Circuit Models for Rigorous Full-Wave Analysis and Design of Waveguide Components and Circuits

A. Weisshaar, M. Mongiardo, A. Tripathi and V.K. Tripathi. "CAD-Oriented Equivalent Circuit Models for Rigorous Full-Wave Analysis and Design of Waveguide Components and Circuits." 1996 MTT-S International Microwave Symposium Digest 96.3 (1996 Vol. III [MWSYM]): 1455-1458.

A new multi-mode equivalent circuit model for cascaded waveguide step discontinuities is presented. This CAD-oriented equivalent circuit model enables rigorous and efficient full-wave analysis of waveguide components and circuits entirely by circuit simulation. The method has been implemented on the microwave circuit simulator Libra. Comparisons of circuit simulation results for single and cascaded inductive irises with the standard mode-matching method show perfect agreement. Results of a Ka-band bandpass filter analysis show good agreement with other mode-matching solutions.

Click on title for a complete paper.



A Circular Cavity Structure for the Efficient CAD of Dual Mode Filters

L. Accatino, G. Bertin and M. Mongiardo. "A Circular Cavity Structure for the Efficient CAD of Dual Mode Filters." 1996 MTT-S International Microwave Symposium Digest 96.3 (1996 Vol. III [MWSYM]): 1459-1462.

A novel type of circular cavity enabling two orthogonally polarised resonances to be coupled and tuned without using screws is presented. In order to achieve an accurate and efficient electromagnetic modeling, the coupling mechanism is realized by inserting in the middle of the circular cavity a short section of rectangular waveguide at an appropriate inclination angle. The proposed cavity allows to realize dual-mode filters entirely by using junctions of waveguides with rectangular and circular cross-sections, thus enabling a very efficient CAD of such filters. Numerical analyses of this structure have been performed showing a noticeable agreement with measured data. It has also been confirmed, both theoretically and experimentally, the ability to achieve close control of resonant frequencies and coupling values without using screws.

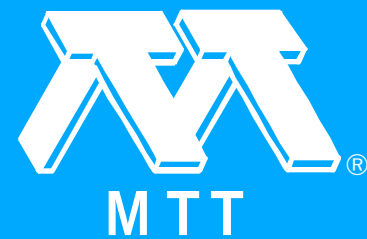


Abstracts

Order Recursive Method of Moments: A Powerful Computational Tool for Microwave CAD and Optimization

K. Naishadham and P. Misra. "Order Recursive Method of Moments: A Powerful Computational Tool for Microwave CAD and Optimization." 1996 MTT-S International Microwave Symposium Digest 96.3 (1996 Vol. III [MWSYM]): 1463-1466.

The method of moments (MoM) continues to be the most frequently used electromagnetic simulation technique for application to CAD and optimization of microwave circuits. In this paper, we present an order-recursive variant of standard LU decomposition for the efficient solution of large linear systems arising in the application of MoM to iterative design problems. In comparison with the existing matrix methods, which solve the linear system from scratch at each design iteration, the proposed order-recursive MoM allows a very large portion of recomputation to be avoided, leading to extremely efficient design iterations. Therefore, this contribution is a major advance toward EM simulation-based (or full-wave) CAD and optimization of microwave circuits.



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Abstracts

A Fast and Rigorous CAD Procedure for Complex Shielded Planar Circuits

G.V. Eleftheriades, H. Le Pezennec and J.R. Mosig. "A Fast and Rigorous CAD Procedure for Complex Shielded Planar Circuits." 1996 MTT-S International Microwave Symposium Digest 96.3 (1996 Vol. III [MWSYM]): 1467-1470.

An efficient Integral-Equation/Method of Moments (MoM) technique is presented for the analysis of shielded planar circuits (MIC's and MMIC's). Unlike traditional approaches which implicate the Fast Fourier Transform (FFT) to compute the slowly converging MoM matrix elements, this technique is not restricted to uniform meshes. This feature is exploited by introducing a new modular meshing strategy with rectangular cells. The entire formulation is extended to multilayer/multiconductor substrates.



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Analysis of Planar Circuits with a Combined 3D FDTD-Time Domain Modal Expansion Method

F. Alimenti, P. Mezzanotte, L. Roselli and R. Sorrentino. "Analysis of Planar Circuits with a Combined 3D FDTD-Time Domain Modal Expansion Method." 1996 MTT-S International Microwave Symposium Digest 96.3 (1996 Vol. III [MWSYM]): 1471-1474.

A method combining the conventional 3D FDTD algorithm with the time domain modal expansion has been applied to the analysis of planar circuits enclosed within metallic packages. This method allows for the reduction of the 3D FDTD computational domain to a restricted region close to the planar circuit. This technique has been applied to two different structures: a microstrip and a CPW discontinuity. The results show a significant improvement of the computational efficiency without any appreciable degradation of the accuracy.

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Multiple Region FDTD (MR/FDTD) and its Application to Microwave Analysis and Modeling

J.M. Johnson and Y. Rahmat-Samii. "Multiple Region FDTD (MR/FDTD) and its Application to Microwave Analysis and Modeling." 1996 MTT-S International Microwave Symposium Digest 96.3 (1996 Vol. III [MWSYM]): 1475-1478.

Multiple Region FDTD (MR/FDTD), an extension of classical FDTD to multiple sub-regions within a problem domain, is introduced. In MR/FDTD the problem domain is broken into several independent FDTD sub-region lattices. The sub-region lattices are terminated using a single surface integral radiation boundary condition applied simultaneously to all sub-regions providing mutual interaction between the sub-regions. The advantages of MR/FDTD for sparse modeling problems include computational and memory efficiencies that result from confining the FDTD lattices to the space near objects and the ability to use different lattices and/or lattice orientations within each sub-region. MR/FDTD also eliminates the need for local absorbing boundary conditions.

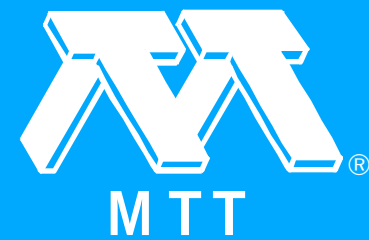
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Abstracts

Session TH3A -- Superconductor Microwave Technology

"Session TH3A -- Superconductor Microwave Technology." 1996 MTT-S International Microwave Symposium Digest 96.3 (1996 Vol. III [MWSYM]): 1479-1480.



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Hybrid Semiconductive/High-Temperature Superconductive Tunable Preselector

J. Smuk, V. Aparin, C. Trantanella and M. Okandan. "Hybrid Semiconductive/High-Temperature Superconductive Tunable Preselector." 1996 MTT-S International Microwave Symposium Digest 96.3 (1996 Vol. III [MWSYM]): 1481-1484.

HTSC lumped element filters with GaAs varactor tuning, P-HEMT LNAs with HTSC lumped element matching and a GaAs MMIC SP4T switch with integrated decoding are described for use in a broadband cryogenic preselector operating from 200MHz to 2GHz. The filters tune over their respective sub-bands and have insertion losses ranging from 2 to 14dB. The sub-band LNAs have from 8.5 to 11.5dB of gain, noise figures under 1.5dB and input return losses greater than 20dB. The SP4T MMIC multiplexing switch has under 0.5dB insertion loss, isolation in excess of 30dB and 10/90% switching speed under 100nsec. These components are designed to be assembled into a 30 cubic centimeter electronically tunable four-channel proof-of-principal preselector operating over portions of the 200MHz to 2GHz band.

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Design of High Power Superconductive Output Multiplexer

R.R. Mansour, B. Jolley, V. Dokas, S. Ye and F. Thomson. "Design of High Power Superconductive Output Multiplexer." 1996 MTT-S International Microwave Symposium Digest 96.3 (1996 Vol. III [MWSYM]): 1485-1488.

This paper presents experimental results for a fully integrated high temperature superconductive manifold-coupled output multiplexer. The high power test results indicate that the superconductive multiplexer is capable of meeting the power handling requirements of typical C-band satellite programs. Design considerations related to the implementation and design of high power superconductive multiplexers are discussed in detail.

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An Ultra-High Quality Factor Microwave Sapphire Loaded Superconducting Cavity Transducer

B.D. Cuthbertson, M.E. Tobar, E.N. Ivanov and D.G. Blair. "An Ultra-High Quality Factor Microwave Sapphire Loaded Superconducting Cavity Transducer." 1996 MTT-S International Microwave Symposium Digest 96.3 (1996 Vol. III [MWSYM]): 1489-1492.

The performance of a prototype ultra-high quality factor ($Q > 10^8$) Sapphire Loaded Superconducting Cavity Transducer (SLSCT) operating at X-band is described. The measured displacement noise floor of $3.0 \pm 0.6 \times 10^{-16}$ m/sqrt(Hz) ($\sim 2 \times 10^{-11}$ g/sqrt(Hz)) at 1 kHz was an order of magnitude better than a similar room temperature transducer, and several orders of magnitude better than current commercially available accelerometers. Improvements in the transducer's microwave system should enable the noise floor to be lowered by several orders of magnitude. An electromagnetic model of the transducer has also been developed which permits the tuning coefficient, and hence the displacement sensitivity to be accurately predicted.

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Quasi-Lumped Element Band-Pass Filters Using DC Isolated Shunt Inductors

G.L. Hey-Shipton. "Quasi-Lumped Element Band-Pass Filters Using DC Isolated Shunt Inductors." 1996 MTT-S International Microwave Symposium Digest 96.3 (1996 Vol. III [MWSYM]): 1493-1496.

The design of quasi-lumped element band-pass filters using DC isolated shunt inductors with finite frequency attenuation poles below the pass-band is described. The design uses coupled series transmission lines for improved tuning. Although generally applicable, these filters are particularly useful for planar thin film High Temperature Superconductors.

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Analysis of HTS Filters Using Novel Nonlinear Phenomenological Two Fluid Model

M. Megahed, S. El-Ghazaly and A. Fathy. "Analysis of HTS Filters Using Novel Nonlinear Phenomenological Two Fluid Model." 1996 MTT-S International Microwave Symposium Digest 96.3 (1996 Vol. III [MWSYM]): 1497-1500.

A novel nonlinear phenomenological two fluid model for High Temperature Superconductor (HTS) is proposed. The model combines the physics associated with the Ginzburg-Landau expressions and the required simplicity obtained from the linear London's equations. An empirical formula for the nonlinear surface impedance is suggested based on the developed model. Analysis of HTS filter using this novel nonlinear formulation is presented.

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Abstracts

Session TH3B -- Sources

"Session TH3B -- Sources." 1996 MTT-S International Microwave Symposium Digest 96.3 (1996 Vol. III [MWSYM]): 1501-1502.



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Wideband MMIC Voltage Controlled Oscillator Using Active Impedance Load Matching

T. Takenaka, A. Miyazaki and H. Matsuura. "Wideband MMIC Voltage Controlled Oscillator Using Active Impedance Load Matching." 1996 MTT-S International Microwave Symposium Digest 96.3 (1996 Vol. III [MWSYM]): 1503-1506.

A novel wideband MMIC voltage controlled oscillator (VCO) using an active impedance load matching composed of a common gate FET is proposed. The MMIC VCO achieves a bandwidth of 24.2 to 27.2 GHz and an output power of 9 dBm in size of 1 mm² with a fully integrated structure.

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10 and 26 GHz Differential VCOs Using InP HBTs

R.K. Montgomery, D.A. Humphrey, R. Hamm, F. Ren, R.J. Malik, R.F. Kopf, A. Tate, P.R. Smith, R.W. Ryan, J. Lin and Y.K. Chen. "10 and 26 GHz Differential VCOs Using InP HBTs." 1996 MTT-S International Microwave Symposium Digest 96.3 (1996 Vol. III [MWSYM]): 1507-1510.

We have built 10 and 26 GHz differential VCOs using InP HBTs. Both oscillators use a 3 stage emitter coupled pair ring section. The 10 GHz VCO is connected in the well known fashion but the 26 GHz circuit uses a patented summed output from each of the three ECP (Emitter Coupled Pair) stages. The circuits are powered from a single 5V supply consuming 250 mW. The chip size is 870X975 μm^2 . The phase noise at a 100 kHz offset for the 10 and 26 GHz oscillators is -83 dBc/Hz and -70 dBc/Hz respectively.



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New High-Performance Voltage-Controlled LC-Oscillator

N.T. Tchamov and P. Jarske. "New High-Performance Voltage-Controlled LC-Oscillator." 1996 MTT-S International Microwave Symposium Digest 96.3 (1996 Vol. III [MWSYM]): 1511-1514.

VCO with serial LC-contour, loaded with low input/output impedances of a resonance loop-amplifier, provides stable frequency of oscillations, and employs very low-Q inductors on Silicon. The control voltage changes the bias in one of the amplifying sections, and indirectly the voltage over P-N junction, which acts as a Varactor. This way the separation between the control and oscillation circuits is provided effectively. On 0.8 μ m BiCMOS technology (17 GHz NPN) the new VCO circuit operates with 0.4mW from only 1V, and produces 600mV sinusoid on 6.6GHz with 3.6% non-linearities, and low-phase noise. Suitable for modern communication and microprocessor circuits.

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



Abstracts

Enhanced MESFET VCO Injection-Locking Bandwidth Using Low Frequency Feedback Techniques

H.-C. Chang and R.A. York. "Enhanced MESFET VCO Injection-Locking Bandwidth Using Low Frequency Feedback Techniques." 1996 MTT-S International Microwave Symposium Digest 96.3 (1996 Vol. III [MWSYM]): 1515-1518.

A simple scheme for enhancing the locking range and capture range of MESFET VCOs is presented using a low frequency DC-coupled amplifier. This circuit is based on phase-locked loop (PLL) techniques; in the present case the MESFET VCO also provides the function of a mixer or phase detector. A 10 GHz prototype was constructed which demonstrated a locking range more than double that of the isolated VCO injection-locking range over the same range of injected signal power.



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Voltage Tuned Dielectric Resonance 20.5GHz Harmonic Oscillator with Novel Structure

S.I. Jeon, K.H. Tchah, C.S. Yim and S.J. Chung. "Voltage Tuned Dielectric Resonance 20.5GHz Harmonic Oscillator with Novel Structure." 1996 MTT-S International Microwave Symposium Digest 96.3 (1996 Vol. III [MWSYM]): 1519-1522.

This paper presents a voltage controlled K-band harmonic oscillator composed of two X-band dielectric resonator circuits at the input port and the output port of the oscillator. The novel structure supplies not only a voltage tuning circuit but also an output port at fundamental frequency as a function of prescaler on the structure. The output frequency is 20.5GHz and the maximum power level of the output is +5 .5dBm. The harmonic oscillator exhibits -30dBc of fundamental frequency rejection.

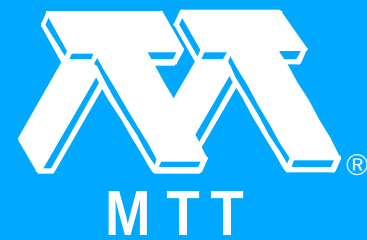
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Abstracts

Session TH3C -- Mapping of Fields and Waves in Integrated Circuit Structures

"Session TH3C -- Mapping of Fields and Waves in Integrated Circuit Structures." 1996 MTT-S International Microwave Symposium Digest 96.3 (1996 Vol. III [MWSYM]): 1523-1524.



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Abstracts

Voltage Amplitude and Voltage Phase Mapping Within Sub- μm Devices by High Frequency Scanning Force Microscopy

A. Leyk, C. Bohm and E. Kubalek. "Voltage Amplitude and Voltage Phase Mapping Within Sub- μm Devices by High Frequency Scanning Force Microscopy." 1996 MTT-S International Microwave Symposium Digest 96.3 (1996 Vol. III [MWSYM]): 1525-1528.

For detailed failure analysis of monolithic microwave integrated circuits (MMIC), device internal test systems, featuring simultaneously high spatial resolution, GHz voltage measurement ability and topographic imaging, must be used. Scanning force microscope testing proofed suitable, but former microwave measurements within sub micron devices focused on point measurements, only. Now we present for the first time mappings of sub micron device internal MMIC signals at 8 GHz on 500 nm structures. A spatial resolution of 80 nm is achieved.



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Abstracts

Design and Characterization of Integrated Probes for Millimeter Wave Applications in Scanning Probe Microscopy

C. Bohm, M. Otterbeck, S. Lipp, L. Frey, R. Reuter, A. Leyk, W. Martin, F.J. Tegude and E. Kubalek. "Design and Characterization of Integrated Probes for Millimeter Wave Applications in Scanning Probe Microscopy." 1996 MTT-S International Microwave Symposium Digest 96.3 (1996 Vol. III [MWSYM]): 1529-1532.

Scanning probe microscopy has developed to a powerful tool in surface topography and is going to become a characterization method for electrical potentials of monolithic microwave integrated circuits. Measurement bandwidths above 100 GHz force the development of optimized millimeter wave proximal probes with simultaneously nanometer spatial resolution. We present the design, production and characterization of such proximal probes using integrated planar waveguides well suited for the millimeter wave range keeping the nanometer spatial resolution of the tip for topography measurements.



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In-Circuit Electro-Optic Field Mapping for Function Test and Characterization of MMICs

G. David, R. Tempel, I. Wolff and D. Jager. "In-Circuit Electro-Optic Field Mapping for Function Test and Characterization of MMICs." 1996 MTT-S International Microwave Symposium Digest 96.3 (1996 Vol. III [MWSYM]): 1533-1536.

In this paper, the results of 2D electro-optic mapping of electric field distributions in two coplanar MMICs are presented. It is demonstrated that the obtained images of the field distributions can be used for function test, failure localization and for a quantitative high frequency characterization of the circuits.

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



A Simple Electric Near Field Probe for Microwave Circuit Diagnostics

Y. Gao and I. Wolff. "A Simple Electric Near Field Probe for Microwave Circuit Diagnostics." 1996 MTT-S International Microwave Symposium Digest 96.3 (1996 Vol. III [MWSYM]): 1537-1540.

An electric field probe applicable to the 1 - 20 GHz band has been developed, using miniaturized semirigid coaxial cable. It is shown that the probe is well suited for the diagnostic of the microwave circuits. The field probe has very small dimensions and it does not need to be connected to the operating circuit under test, therefore the circuits properties nearly are not disturbed by the probe. This simple, stable and cheap field probe is very useful for assisting the design of microwave circuits, antenna diagnostics and testing products in industry. As an example, the field distribution in a 2.4 GHz hybrid power amplifier is measured and the result is analyzed in this paper.

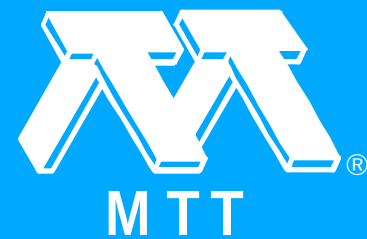


Abstracts

A Laser Probing System for Characterization of SAW Propagation on LiNbO₃, LiTaO₃, and Quartz

A. Holm, R. Weigel, P. Russer and W. Ruile. "A Laser Probing System for Characterization of SAW Propagation on LiNbO₃, LiTaO₃, and Quartz." 1996 MTT-S International Microwave Symposium Digest 96.3 (1996 Vol. III [MWSYM]): 1541-1544.

A nondestructive high-resolution technique for the optical detection of the phase and amplitude of high-frequency surface acoustic wave (SAW) devices is presented. The test setup incorporates a mode-locked ps-laser, harmonic mixing, and coherent detection. Dynamic range and minimum detectable surface displacement were 50 dB and 1 pm//spl rudi c/Hz, respectively. The probing technique allows not only the measurement of the SAW field but also the precise direct determination of the phase velocity which is a fundamental design parameter in SAW technology. We present experimental results of the phase velocity of both SAW and Leaky SAW modes on quartz, LiNbO₃ and LiTaO₃ with an accuracy of up to 1.5·10⁻⁵. Our results agree very good with theory and other experiments.



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Session TH3D -- Microwave Photonic Systems

"Session TH3D -- Microwave Photonic Systems." 1996 MTT-S International Microwave Symposium Digest 96.3 (1996 Vol. III [MWSYM]): 1545-1546.



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Abstracts

Limitations in Distance and Frequency Due to Chromatic Dispersion in Fibre-Optic Microwave and Millimeter-Wave Links

U. Gliese, S.N. Nielsen and T.N. Nielsen. "Limitations in Distance and Frequency Due to Chromatic Dispersion in Fibre-Optic Microwave and Millimeter-Wave Links." 1996 MTT-S International Microwave Symposium Digest 96.3 (1996 Vol. III [MWSYM]): 1547-1550.

Chromatic dispersion significantly limits the distance and/or frequency in fibre-optic microwave and millimeter-wave links based on direct detection due to a decrease of the carrier to noise ratio. The limitations in links based on coherent remote heterodyne detection, however, are far less significant, and are primarily due to an increase of the phase noise.



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Relationship Between Gain and Noise Figure of an Optical Analog Link

C.H. Cox, III, E.I. Ackerman and G.E. Betts. "Relationship Between Gain and Noise Figure of an Optical Analog Link." 1996 MTT-S International Microwave Symposium Digest 96.3 (1996 Vol. III [MWSYM]): 1551-1554.

Experimental confirmation is presented of the relationship between link gain and noise figure by varying the optical attenuation in an external modulation link. When we minimized the optical loss we achieved an amplifierless link gain of 31 dB and noise figure of 4.2 dB at 150 MHz.

Abstracts

Fiber-Optic Transport and RF Phase Control of Narrowband Millimeter-Wave Signals Using Multicontact Monolithic Semiconductor Lasers

J.B. Georges, R.A. Lux, D.M. Cutrer, S.P. Yeung and K.Y. Lau. "Fiber-Optic Transport and RF Phase Control of Narrowband Millimeter-Wave Signals Using Multicontact Monolithic Semiconductor Lasers." 1996 MTT-S International Microwave Symposium Digest 96.3 (1996 Vol. III [MWSYM]): 1555-1558.

We demonstrate simultaneous fiber-optic transport and continuous RF phase control of narrowband millimeter-wave signals using a three-section monolithic Distributed Bragg Reflector (DBR) laser. By injection-locking the laser at the cavity round-trip resonant frequency of 45 GHz, 360° of continuous, linear RF phase control of the input mm-wave signal is achieved by simply varying the bias current into the laser.



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Abstracts

Full Scale Hybrid Lidar-Radar System

L. Mullen and P.R. Herczfeld. "Full Scale Hybrid Lidar-Radar System." 1996 MTT-S International Microwave Symposium Digest 96.3 (1996 Vol. III [MWSYM]): 1559-1562.

This paper concerns a novel hybrid lidar-radar system for underwater surveillance. Simulations and laboratory measurements based on the hybrid detection scheme revealed a 17 dB suppression of the water backscatter signal (clutter) and corresponding target contrast enhancement. These results led to the design, implementation and testing of a full scale lidar-radar system. Details of this system and results obtained in the ocean experiment are presented.



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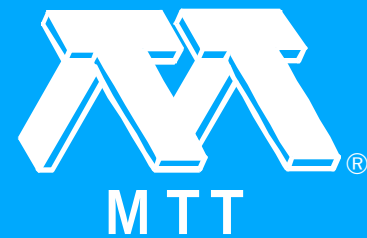


Abstracts

Optically Controlled Spread-Spectrum RF Data Link

E.E. Funk, S.E. Sadow, L.J. Jasper, Jr. and C.H. Lee. "Optically Controlled Spread-Spectrum RF Data Link." 1996 MTT-S International Microwave Symposium Digest 96.3 (1996 Vol. III [MWSYM]): 1563-1566.

An optically controlled spread-spectrum RF data link architecture was demonstrated. The data link used a time-hopped optical pulse train derived from a mode-locked laser to synchronize transmission and correlated reception of wideband RF pulses. This was the first demonstration of an optically controlled time-hopped RF spread-spectrum link.



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Is a Fiber-Fed Antenna Network Optimal for In-Building Wireless Signal Distribution?

D.M. Cutrer, J.B. Georges and K.Y. Lau. "Is a Fiber-Fed Antenna Network Optimal for In-Building Wireless Signal Distribution?." 1996 MTT-S International Microwave Symposium Digest 96.3 (1996 Vol. III [MWSYM]): 1567-1570.

In-building radio propagation measurements at 900MHz are used to analyze the dynamic range requirements and optimal architecture for a distributed antenna network. The ideal performance/cost ratio for the network is found to be achieved with a low-cost hybrid fiber-coax architecture. A system design procedure and field-trial results are presented.

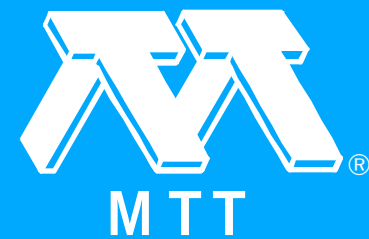
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Abstracts

Session TH3E -- Phased Arrays

"Session TH3E -- Phased Arrays." 1996 MTT-S International Microwave Symposium Digest 96.3 (1996 Vol. III [MWSYM]): 1571-1572.



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Abstracts

A Broadband, Low-Sidelobe, Dynamic Weighting, Three-Channel Receive, X-Band Active Array

S. Panaretos, C. Shoda, R. Relatores, J. Gordon, P. Curtis and D. Parker. "A Broadband, Low-Sidelobe, Dynamic Weighting, Three-Channel Receive, X-Band Active Array." 1996 MTT-S International Microwave Symposium Digest 96.3 (1996 Vol. III [MWSYM]): 1573-1576.

Hughes has recently developed a broadband low-sidelobe active array that uses T/R modules of a common-leg architecture and parts from multiple suppliers for each MMIC chip. Design of an 1140 element (8 watts per element), 4 GHz, rms sidelobes (<43 dB), X-band active array is described. High-precision phase and amplitude control (PAC) modules on each row of elements enables independent aperture illumination for receive (sum, delta-azimuth, delta-elevation) and transmit-sum channels.



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Abstracts

Two-Dimensional Fiber-Optic Control of a True Time-Steered Array Transmitter (1996 Vol. III [MWSYM])

M.Y. Frankel, P.J. Matthews and R.D. Esman. "Two-Dimensional Fiber-Optic Control of a True Time-Steered Array Transmitter (1996 Vol. III [MWSYM])." 1996 MTT-S International Microwave Symposium Digest 96.3 (1996 Vol. III [MWSYM]): 1577-1579.

We report a first demonstration of a transmit array with fiber-optic control for independent two-dimensional true time-delay steering. The 4x4 array consists of flared-notch elements and shows $\pm 30^\circ$ azimuth and $\pm 30^\circ$ elevation steering with no observed squint over the microwave component-limited bandwidth of 6-18 GHz.



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Electronically Steered, Receive Monopulse, Active Phased Array at 94 GHz

J. Sowers, N. Byer, B. Edward, D. McPherson, S. Weinreb and F. Rucky. "Electronically Steered, Receive Monopulse, Active Phased Array at 94 GHz." 1996 MTT-S International Microwave Symposium Digest 96.3 (1996 Vol. III [MWSYM]): 1581-1584.

The first 94 GHz receive active phased array providing electronically scannable monopulse patterns in two orthogonal planes has been fabricated and tested. State of the art performance has been achieved. Beamwidths of 2.3 degrees and peak to null ratios of 20 dB have been recorded.

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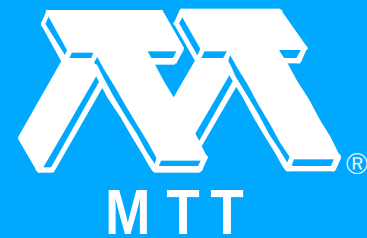


Abstracts

Broadband 50 Watt CW Receiver Protector Using Glass Integrated Circuit Technology

R. Keenan and E. Higham. "Broadband 50 Watt CW Receiver Protector Using Glass Integrated Circuit Technology." 1996 MTT-S International Microwave Symposium Digest 96.3 (1996 Vol. III [MWSYM]): 1585-1588.

This paper describes a passive glass microwave integrated circuit providing passive limiting and active switching from 2-8 GHz. The 0.265" x 0.100" chip employs discrete PIN diodes to achieve the following performance:



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A GaAs MMIC PIN Diode Receiver Protector with Switchable Attenuator

E.C. Niehenke, P.A. Stenger and J.E. Degenford. "A GaAs MMIC PIN Diode Receiver Protector with Switchable Attenuator." 1996 MTT-S International Microwave Symposium Digest 96.3 (1996 Vol. III [MWSYM]): 1589-1592.

Design and performance of a unique X-band GaAs MMIC PIN diode receiver protector (RP) with switchable attenuator is described with a maximum average and peak leakage levels of 17 dBm and 20 dBm respectively. The fast acting 8 diode RP requires no external biasing and exhibits a recovery time of 50 ns. The MMIC includes a switchable 13 dB attenuator after the RP. Two RP/Attenuator circuits for balanced operation are included in a 120 by 150 by 6 mil MMIC which exhibits only 0.55 to 0.7 dB loss, and a return loss of 15 to 30 dB over an octave bandwidth.

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System-Level Integrated Circuits for Phased Array Antenna Applications

K.A. Shalkhauser, J.A. Windyka, D.C. Dening and M.J. Fithian. "System-Level Integrated Circuits for Phased Array Antenna Applications." 1996 MTT-S International Microwave Symposium Digest 96.3 (1996 Vol. III [MWSYM]): 1593-1596.

A new, high-density microwave circuit has been developed for use in advanced communication system antennas. These System-Level Integrated Circuits, or "SLICs", include integral features and functions facilitating reliable operation, improved performance, and ready application. An optical fiber feeds both control and 20-GHz RF signals to an 8-element phased array module, wherein SLIC circuitry provides automatic gain control, thermal compensation, voltage regulation, control signal processing, and health/status feedback. Modules have been fabricated using the new SLIC MMICs and the Microwave High Density Interconnect (MHDI) multilayer lamination process.

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Multi-Chip Receive Module for a Wide-Band X-Band Dual-Beam Phased Array Communication Antenna

B.A. Kopp and T.A. Axness. "Multi-Chip Receive Module for a Wide-Band X-Band Dual-Beam Phased Array Communication Antenna." 1996 MTT-S International Microwave Symposium Digest 96.3 (1996 Vol. III [MWSYM]): 1597-1600.

A wide-bandwidth X-band receive module has been developed to support a phased array communication antenna with dual-beam operation. The module utilizes four GaAs MMIC's, a single low-temperature-cofired-ceramic (LTCC) substrate, blind-mate connectors, and a custom miniature DC/control 8-pin connector to address the electrical and packaging requirements. A typical module exhibited 3.5 dB noise figure, 23 dB of gain, .5 dB RMS amplitude error, and 7° RMS phase error from 7.0-10.0 GHz.

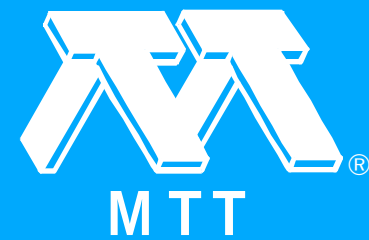
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Abstracts

Session TH3F -- Open Forum 2

"Session TH3F -- Open Forum 2." 1996 MTT-S International Microwave Symposium Digest 96.3 (1996 Vol. III [MWSYM]): 1601-1602.



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A Ku-Band Ultra Super Low-Noise Pseudomorphic Heterojunction FET in a Hollow Plastic PKG

T. Hirokawa, H. Negishi, Y. Nishimura, S. Ichikawa, J. Tanaka, T. Kimura, K. Watanabe and Y. Nashimoto. "A Ku-Band Ultra Super Low-Noise Pseudomorphic Heterojunction FET in a Hollow Plastic PKG." 1996 MTT-S International Microwave Symposium Digest 96.3 (1996 Vol. III [MWSYM]): 1603-1606.

This paper reports Ku-band ultra super low-noise pseudomorphic heterojunction FETs (pHJFETs) in a newly developed hollow plastic package. To achieve higher performance of pHJFETs, we employed further optimized epilayer structure with good interracial quality. The developed packaged HJFETs with 0.17 μm T-shaped gate exhibited extremely low noise performance of 0.35 dB typical noise figure with 12.5 dB associated gain at 12 GHz.

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Effect of Device Layout on the Thermal Resistance of High-Power Thermally-Shunted Heterojunction Bipolar Transistors

R. Dettmer, T. Jenkins, J. Barrette, C. Bozada, G. DeSalvo, J. Ebel, J. Gillespie, C. Havasy, C. Ito, K. Nakano, C. Pettiford, T. Quach, J. Sewell, D. Via and R. Anholt. "Effect of Device Layout on the Thermal Resistance of High-Power Thermally-Shunted Heterojunction Bipolar Transistors." 1996 MTT-S International Microwave Symposium Digest 96.3 (1996 Vol. III [MWSYM]): 1607-1610.

The effect of device layout on thermal impedance of thermally-shunted HBTs was investigated. A direct comparison of thermally shunted devices and standard airbridge devices is made. Changes in thermal resistance of up to 67% were observed. While thermal resistance remains sensitive to emitter element placement in thermally shunted devices, variations in the location of thermal shunt landings had little effect. These results provide a basis for optimizing thermally-shunted devices.

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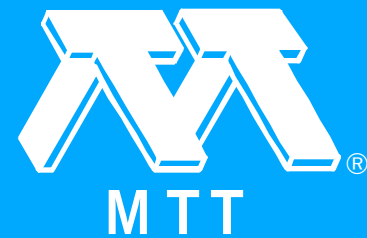


Abstracts

A New Chip Interconnection Technic for Ultra High-Speed and Millimeter-Wave Applications

G. Hanke and W.-D. Nohr. "A New Chip Interconnection Technic for Ultra High-Speed and Millimeter-Wave Applications." 1996 MTT-S International Microwave Symposium Digest 96.3 (1996 Vol. III [MWSYM]): 1611-1614.

Nearly lossless and non-reflecting interconnections between semiconductor-chips and transmission lines worhg up to 50 GHz can be realized in a "Reverse Beam-Lead Technic" as well as low-impedance ground and power supply interconnections. The paper describes the required technology, compares TDR and S-parameter measurements of state-of-the-art technics and the new one, and gives some examples of high-speed circuits.



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Advanced Monolithic Packaging Concepts for High Performance Circuits and Antennas

R.F. Drayton, R.M. Henderson and L.P.B. Katehi. "Advanced Monolithic Packaging Concepts for High Performance Circuits and Antennas." 1996 MTT-S International Microwave Symposium Digest 96.3 (1996 Vol. III [MWSYM]): 1615-1618.

Unwanted electromagnetic coupling between neighboring elements is a common problem in high frequency planar circuits. This paper reports on the elimination of cross-talk in planar circuits using conformal micromachined packaging. In the 5 to 30 GHz range, a back-to-back right-angle bend in microstrip has cross-coupling as high as -20 dB. The use of monolithic packaging concepts reduces this coupling by as much as 20-30 dB down to the noise level of the measurement system.

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An Advanced Millimeter-Wave Flip-Chip IC Integrating Different Kinds of Active Devices

K. Takahashi, S. Fujita, T. Yoshida, H. Sakai and M. Sagawa. "An Advanced Millimeter-Wave Flip-Chip IC Integrating Different Kinds of Active Devices." 1996 MTT-S International Microwave Symposium Digest 96.3 (1996 Vol. III [MWSYM]): 1619-1622.

On the basis of our proposed Millimeter-wave Flip-chip IC (MFIC) concept, K-band receiver front-end circuits integrated with both HFETs and HBTs using flip-chip bonding on the same Si substrate are newly developed. Two key technologies are newly introduced for the advanced MFIC structure. (1) BCB (Benzocyclobutene) is adopted to the dielectric material to produce low-loss lines. (2) Thin-film technology is introduced for the integration of a bias network. The newly developed advanced MFIC shows good performance, such as 1dB of conversion loss and 6dB of noise figure. The advanced MFIC is also expected as a low-cost millimeter(mm)-wave device for use in V-band as well as K-band.

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Millimeter Wave Power Module for Wireless Applications

D. Holstein, T. Ninnis, J. Cooke, T. Schoemehl, P. Ballagh, M. Wong, N. Chiang, B. Ma, R. Kopeck, J. Shumaker and B. Quinn. "Millimeter Wave Power Module for Wireless Applications." 1996 MTT-S International Microwave Symposium Digest 96.3 (1996 Vol. III [MWSYM]): 1623-1626.

The Millimeter Wave Power Module (MMPM) is capable of providing low noise, broadband millimeter wave power at high volume and mass densities and may enable the implementation of the "wish lists" in many engineering notebooks. This article details the development of the MMPM at Litton under the sponsorship of Tri-Service/ARPA Vacuum Electronics Initiatives.

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High Frequency Hermetic Packages Using LTCC

T.-D. Ni, J. DeMarco, D. Sturzebecher and M. Cummings. "High Frequency Hermetic Packages Using LTCC." 1996 MTT-S International Microwave Symposium Digest 96.3 (1996 Vol. III [MWSYM]): 1627-1630.

This paper presents an experimental comparison of stripline versus modified coplanar waveguide transitions for use in high frequency hermetic packages. Low temperature co-fired ceramic is used as the substrate and wall material. It is shown that these hermetic wall transitions have low insertion loss at the design frequency range from 30 GHz to 40 GHz, thus usable for an assortment of millimeter-wave packaging applications.

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Compact Transmitting Dielectric Resonator Filter Using Capacitive Loaded Dual Mode Method for PCS Microcellular Base Station

J. Hattori, H. Kubo, S. Abe, T. Nishiyama and Y. Ishikawa. "Compact Transmitting Dielectric Resonator Filter Using Capacitive Loaded Dual Mode Method for PCS Microcellular Base Station." 1996 MTT-S International Microwave Symposium Digest 96.3 (1996 Vol. III [MWSYM]): 1631-1634.

This paper describes a compact transmitting bandpass filter using dielectric resonators for PCS microcellular base station. We propose new size reduced capacitive loaded TM dual mode resonators that consist of monoblock high K ceramics. The electrical performance of the filter constructed by these resonators is designed by using dual mode dielectric transmission line method. A six pole bandpass filter at 1.9GHz band is manufactured. It has center frequency of 1.87GHz, low insertion loss of 1. 1dB and small dimensions of 20x20x60 mm.

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Harmonic Suppression in Microstrip Dual-Mode Ring-Resonator Bandpass Filters

U. Karacaoglu, D. Sanchez-Hernandez, I.D. Robertson and M. Guglielmi. "Harmonic Suppression in Microstrip Dual-Mode Ring-Resonator Bandpass Filters." 1996 MTT-S International Microwave Symposium Digest 96.3 (1996 Vol. III [MWSYM]): 1635-1638.

This paper introduces two new topologies for rejecting the harmonics in microstrip ring resonator filters. First one uses 50 Ohm spur line filter structures placed at the input and output of the ring to suppress the first harmonic. Second topology incorporates low-pass structures into the ring for elimination of the harmonics.

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A Full Wave Analysis of a Conductor Post Insert Reentrant Coaxial Resonator in Rectangular Waveguide Compline Filters

K.-L. Wu, R.R. Mansour and H. Wang. "A Full Wave Analysis of a Conductor Post Insert Reentrant Coaxial Resonator in Rectangular Waveguide Compline Filters." 1996 MTT-S International Microwave Symposium Digest 96.3 (1996 Vol. III [MWSYM]): 1639-1642.

Due to its wide tunability region in performance and compactness in size, a conductor post insert reentrant coaxial resonators are widely used in combline filters for mobile communications. This paper, for the first time, presents a full wave electromagnetic model for the reentrant coaxial resonator in rectangular waveguide combline filters. The model is based on the orthogonal expansion method and provides a formally exact modal solution to the problem. The model has been extensively verified by experiments and can be used in calculating resonant frequency, coupling values, or in constructing a key building block in full electromagnetic design of waveguide combline filters.

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Design of 2-Pole Band Pass Filters Using Closed Loop Resonator and Coupled Lines

D. Ahn, J.-S. Lim, I.-S. Kim, Y.-K. Shin and K.-Y. Kang. "Design of 2-Pole Band Pass Filters Using Closed Loop Resonator and Coupled Lines." 1996 MTT-S International Microwave Symposium Digest 96.3 (1996 Vol. III [MWSYM]): 1643-1646.

In this paper, a new design method of band pass filters which have improved stop band characteristics, using closed loop resonator and coupled lines, is presented. The stepped impedance line has been used in resonator structure for improving the performance and reducing physical size of band pass filters. The connections between in/output ports and resonator has been realized with microstrip coupled lines. In order to show the excellence of design method presented here, we have designed and fabricated a 2-pole band pass filter with a 25-mil-thick microstrip substrate ($\epsilon_r = 10.2$) at 1.885 - 1.905 frequency bands. The measured results are in good agreement with the simulated performances.

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Abstracts

Design of Passive Coplanar Filters in V-Band

R. Kulke and I. Wolff. "Design of Passive Coplanar Filters in V-Band." 1996 MTT-S International Microwave Symposium Digest 96.3 (1996 Vol. III [MWSYM]): 1647-1650.

Two passive coplanar filters on GaAs for V-band applications have been designed in parallel. The first one shows a Chebyshev characteristic and utilises coplanar waveguide segments, while the second one is a Cauer filter, where the elements of the prototype filter parameters have directly been transformed into coplanar lumped elements.



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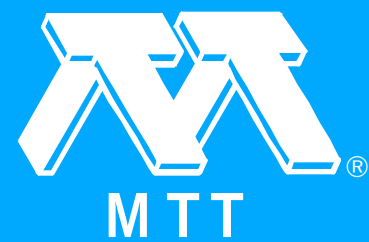
Efficient CAD of Wideband Contiguous Channel Multiplexers

A. Morini, T. Rozzi and M. Mongiardo. "Efficient CAD of Wideband Contiguous Channel Multiplexers." 1996 MTT-S International Microwave Symposium Digest 96.3 (1996 Vol. III [MWSYM]): 1651-1654.

A systematic procedure for the efficient CAD of multiplexers is presented and applied to the design of wideband contiguous channel multiplexers using manifolds consisting of interconnected Y-junctions. The procedure starts by connecting N separately designed filters to the manifold at appropriate distances. All parameters are then optimized by computing the multiplexers sensitivities by the Adjoint Network Method (ANM). The latter is specialized to account for the multiplexer topology. Moreover the ANM is applied to the optimization of both the prototype and the final component. The proposed algorithm takes advantage of the efficiency of the ANM, while also reducing code complexity and memory resources. Keywords: Microwave multiplexer, Adjoint network method, Y-junction manifold.

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Theoretical and Experimental Analysis of Ferrite Circular Resonators in Nonradiative Dielectric Structures

S. Alei, C. Di Nallo, M. Fascetti, F. Frezza, A. Galli and G. Gerosa. "Theoretical and Experimental Analysis of Ferrite Circular Resonators in Nonradiative Dielectric Structures." 1996 MTT-S International Microwave Symposium Digest 96.3 (1996 Vol. III [MWSYM]): 1655-1658.

A complete characterization of cylindrical resonators made of ferrite is presented concerning nonradiative dielectric (NRD) components, for promising applications to tunable filters, circulators, etc., at microwaves and millimeter waves. For such class of anisotropic resonators, the frequency spectrum and the relevant field configurations are accurately derived for any resonance mode excitable in NRD topology, as a function of the geometric and electromagnetic parameters. In particular, the tuning and nonreciprocal selective properties are investigated as the bias magnetization is varied. The dissipation effects are also quantified rigorously, by calculating with closed-form approaches both the complex resonant frequencies and the quality factors due to losses in the ferrite material and in the metal plates. All these theoretical results have been discussed and validated also experimentally by means of various measurements on NRD prototypes.

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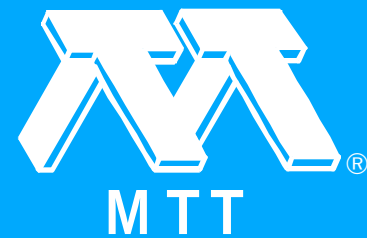


Abstracts

Systematic Analysis, Synthesis and Realization of Monolithic Microwave Active Inductors

F.E. van Vliet, F.L.M. van den Bogaart, J.L. Tauritz and R.G.F. Baets. "Systematic Analysis, Synthesis and Realization of Monolithic Microwave Active Inductors." 1996 MTT-S International Microwave Symposium Digest 96.3 (1996 Vol. III [MWSYM]): 1659-1662.

A unified analysis of monolithic microwave active inductors based on an amplifier-feedback topological description is introduced. Active inductors are classified based on the gain and feedback elements constituent to their design. Small signal, large signal and noise behavior are considered in the generic case. An illustrative example of the synthesis procedure for, as well as the measured results of a novel topology are presented.



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Bias-Field / Frequency Design Charts for Composite Gyrotropic Resonators

S.I. Sheikh, A.A.P. Gibson and B.M. Dillon. "Bias-Field / Frequency Design Charts for Composite Gyrotropic Resonators." 1996 MTT-S International Microwave Symposium Digest 96.3 (1996 Vol. III [MWSYM]): 1663-1666.

The permeability and permittivity tensors of magnetised ferrite and semiconductor materials have different dependencies on bias field, signal frequency and material properties. Mode charts are presented for composite planar ring resonator junctions: the semiconductor case has an additional resonance region and exhibits more symmetrical split frequencies than the ferrite.

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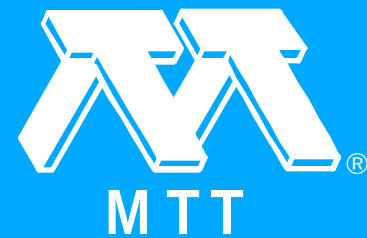


Abstracts

The Current Distribution of High-Tc Superconducting Microstrip Lines

T. Yu, X. Zhang, B. Gao and P. Wu. "The Current Distribution of High-Tc Superconducting Microstrip Lines." 1996 MTT-S International Microwave Symposium Digest 96.3 (1996 Vol. III [MWSYM]): 1667-1670.

In spectral-domain, the complex propagation constants K_{xo} of microstrip transmission lines with a definite-thickness HTSc strip and the current distributions on the strip are calculated. The key technique is that when the Current distribution are calculated, the first coefficient C_0 must be reasonably supposed as a complex value to consider the effect of Two-Fluid Model.



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A Distributed Ferroelectric Superconducting Transmission-Line Phase Shifter

F. Abbas, L.E. Davis and J.C. Gallop. "A Distributed Ferroelectric Superconducting Transmission-Line Phase Shifter." 1996 MTT-S International Microwave Symposium Digest 96.3 (1996 Vol. III [MWSYM]): 1671-1674.

A numerical solution is obtained for a sinusoidal wave propagating along a multilayered structure of superconductors, ferroelectric and dielectrics. An example of a distributed coupled strip-transmission-line phase shifter has been investigated, and such phase shifters may find applications in low-loss tunable microwave components for satellite and ground-based communications.

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Scattering Parameters of Semiconductor Microstrip Line Under Laser Spot Illumination

Y. Horii and M. Tsutsumi. "Scattering Parameters of Semiconductor Microstrip Line Under Laser Spot Illumination." 1996 MTT-S International Microwave Symposium Digest 96.3 (1996 Vol. III [MWSYM]): 1675-1678.

Scattering parameters of an optically controlled microstrip gap fabricated on the semiconductor substrate have been analyzed theoretically using the frequency-dependent finite-difference time-domain method. The transmission characteristics of interest have been shown as a function of arbitrary position of laser spot around an air gap. The results have been demonstrated experimentally using microstrip line with silicon substrate and semiconductor laser. And, it is also reported that the high-powered illumination of laser spot develops non-dispersive characteristics of S_{21} for the wide frequency range.

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Abstracts

A New Measurement Approach for Phase Noise at Close-In Offset Frequencies of Free-Running Oscillators (1996 Vol. III [MWSYM])

X. Zhang and B.J. Rizzi. "A New Measurement Approach for Phase Noise at Close-In Offset Frequencies of Free-Running Oscillators (1996 Vol. III [MWSYM])." 1996 MTT-S International Microwave Symposium Digest 96.3 (1996 Vol. III [MWSYM]): 1679-1682.

Measuring the phase noise of low Q free-running oscillators at close-in offset frequencies from carrier ($<10\text{KHZ}$) is usually difficult using conventional measurement methods due to the oscillators frequency instability. To solve this problem, a new measurement technique has been developed as a practical alternative for quick and accurate phase noise measurements without the use of expensive equipment. The injection locking technique is used to stabilize the free-running oscillator with a clean reference source, thus the phase noise can be down-converted and measured by a signal analyzer at base-band. The phase noise of a 9.3 GHz voltage control oscillator (VCO) has been tested to verify the new approach, and the measurement results agree very well with those obtained using an HP phase noise analyzer.



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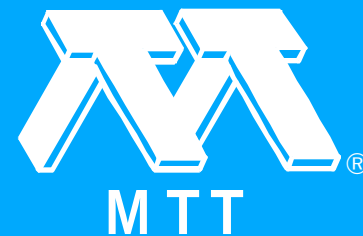


Abstracts

On-Wafer Measurement at Millimeter Wave Frequencies

D.F. Williams, J.-M. Belquin, G. Dambrine and R. Fenton. "On-Wafer Measurement at Millimeter Wave Frequencies." 1996 MTT-S International Microwave Symposium Digest 96.3 (1996 Vol. III [MWSYM]): 1683-1686.

We investigate millimeter wave on-wafer calibration and measurement in coplanar waveguide and demonstrate the applicability of the multilayer thru-reflect-line calibration and good measurement repeatability between laboratories. We also investigate calibrations in conductor-backed coplanar waveguide.



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Measurement of Complex Permittivity of Solids Up to 1000°C

T. Hauschild and R. Knochel. "Measurement of Complex Permittivity of Solids Up to 1000°C." 1996 MTT-S International Microwave Symposium Digest 96.3 (1996 Vol. III [MWSYM]): 1687-1690.

A technique suitable for measuring the permittivity of solids up to 1000°C in X-band is introduced. Although techniques for permittivity measurements are well known, there exist a lot of technological problems such as calibration and choosing the right material for carrying out measurements at high temperatures. We present a method to determine the complex permittivity over the whole temperature range from room to high temperatures using only one calibration and measurement cycle.

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Multi-Tone Transistor Characterization for Intermodulation and Distortion Analysis

R. Hajji, F. Beaugard and F.M. Ghannouchi. "Multi-Tone Transistor Characterization for Intermodulation and Distortion Analysis." 1996 MTT-S International Microwave Symposium Digest 96.3 (1996 Vol. III [MWSYM]): 1691-1694.

This paper presents an experimental study of the effect of different multi-tone excitations on the intermodulation rejection (IMR) of GaAs MESFETs. The IMR parameter is very important in transistor linearity investigation. The objective of this work is to determine the input power backoff required for MESFET operation to provide the same IMR for different tone-number excitations, and the IMR degradation as the number of tones increases at a specific transistor loading. For this purpose, 2, 4, 8, 16 and 32 tones with 100 KHz spacing were applied at the input the transistor under test and its IMR was calculated for an input power sweep and a given loading. The results show that, there is a certain back-off input power level with which the IMR is identical for the different excitation conditions. This work experimentally validate the theoretical one published in the literature.

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Hilbert-Transform-Derived Relative Group Delay Measurement of Frequency Conversion Systems

P. Perry and T.J. Brazil. "Hilbert-Transform-Derived Relative Group Delay Measurement of Frequency Conversion Systems." 1996 MTT-S International Microwave Symposium Digest 96.3 (1996 Vol. III [MWSYM]): 1695-1698.

A robust algorithm based on a form of the Hilbert transform has previously been shown to enable measurement based estimation of the group delay ripple of a broad group of passive circuit types. In this work it is tested on an active frequency conversion system. The results show good agreement with expected results for a down conversion system and also for measured results for a up and down conversion path through a complete microwave system. The technique is currently being implemented in a commercial scalar network analyser providing speed and cost benefits to the user.

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Abstracts

The Evaluation of Electrooptic-Sampling Including Diffraction and Aperture Masking of a Tilted Astigmatic Gaussian Sampling Beam

W. Thomann and P. Russer. "The Evaluation of Electrooptic-Sampling Including Diffraction and Aperture Masking of a Tilted Astigmatic Gaussian Sampling Beam." 1996 MTT-S International Microwave Symposium Digest 96.3 (1996 Vol. III [MWSYM]): 1699-1702.

Electrooptic-sampling necessitates a variety of probing geometries which include tilted astigmatic Gaussian sampling beams, whose field distribution has to be taken into consideration in the evaluation of the electrooptic-sampling signal. The generation of a tilted beam can be accomplished via an off-axis focussing lens. The formalism of ray matrices in geometrical optics is not adequate for waves with a field component in direction of the beam propagation. However, using Fresnel's diffraction integral we derived the complex beam parameters for off-axis systems which are valid for half apex angles less than 12° . In addition, the sampling beam undergoes diffraction and aperture masking.



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Near Electric Field Mapping Above X-Band MMICs Using Modulated Scattering

T.P. Budka, S.D. Waclawik and G.M. Rebeiz. "Near Electric Field Mapping Above X-Band MMICs Using Modulated Scattering." 1996 MTT-S International Microwave Symposium Digest 96.3 (1996 Vol. III [MWSYM]): 1703-1706.

This paper presents near electric field measurements above a directional coupler at 10 GHz and a Texas Instruments 220 GHz TGA8310-SCC distributed low noise amplifier at 14.5 GHz. The measurements are performed with a low cost modulated scattering system using 100 μm long monopole probes with monolithically integrated Schottky diodes on a 40 μm thick high resistivity silicon substrate. Normal electric field intensity and phase maps are presented and demonstrates the possibility of using this mapping technique for low cost MMIC diagnostics.

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Determining Timing for Isothermal Pulsed-Bias S-Parameter Measurements

A. Parker, J. Scott, J. Rathmell and M. Sayed. "Determining Timing for Isothermal Pulsed-Bias S-Parameter Measurements." 1996 MTT-S International Microwave Symposium Digest 96.3 (1996 Vol. III [MWSYM]): 1707-1710.

S-parameters measured under pulsed conditions are shown to vary from their steady-state values with pulse measurement width and pulse repetition rate. A method is presented for determining suitable timing for isothermal, pulsed-bias, pulsed-RF, S-parameter measurement of GaAs devices. Variation of S-parameters with wafer temperature and with measurement duration and duty cycle are correlated.

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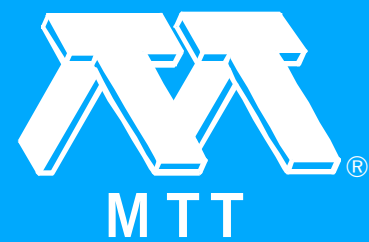
DC and RF Techniques for Computing Access Resistances in Microwave FET's

J.A. Reynoso-Hernandez and F.E. Rangel-Patino. "DC and RF Techniques for Computing Access Resistances in Microwave FET's." 1996 MTT-S International Microwave Symposium Digest 96.3 (1996 Vol. III [MWSYM]): 1711-1714.

In order to estimate the access resistances of PHEMTs two different techniques based on I(V) and RF measurements were investigated. An improved cold-FET technique is presented. The main difference between the classical and the proposed cold-FET techniques lies on the open circuit condition in drain-source instead of short circuit condition ($V_{DS}/=0$ V). A good agreement is observed between the values of parasitic resistances computed from DC I(V) and RF measurements.

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Unique and Physically Meaningful Extraction of the Bias-Dependent Series Resistors of a 0.15 μm PHEMT Demands Extremely Broadband and Highly Accurate Measurements

M. Novotny and G. Kompa. "Unique and Physically Meaningful Extraction of the Bias-Dependent Series Resistors of a 0.15 μm PHEMT Demands Extremely Broadband and Highly Accurate Measurements." 1996 MTT-S International Microwave Symposium Digest 96.3 (1996 Vol. III [MWSYM]): 1715-1718.

In addition to known extraction results this paper is focusing on the biasdependence of the series resistors of a 0.15 μm PHEMT with physics-related values. It is shown that nearly all model parameters of a 20-element device model can be obtained applying known fitting procedures. However taking into account nowadays available measurement uncertainties this approach fails in the determination of the bulk resistors $R_{\text{sub s}}$ and $R_{\text{sub d}}$. Therefore a novel highly sensitive two-frequency parameter extraction procedure is proposed. Based on simulation and experimental data it is shown that S-parameter data at least above 70 GHz are needed to obtain reliable results. The extracted frequency-dependent element value distribution directly reflects the measurement uncertainties.

Click on title for a complete paper.



Abstracts

Accurate Modeling of Noise Fluctuations in mm-Wave Semiconductor Devices and Their Spatial and Frequency Dependence

A. Abou-Elnour and K. Schunemann. "Accurate Modeling of Noise Fluctuations in mm-Wave Semiconductor Devices and Their Spatial and Frequency Dependence." 1996 MTT-S International Microwave Symposium Digest 96.3 (1996 Vol. III [MWSYM]): 1719-1722.

A rigorous model is developed to determine the noise fluctuations in millimeter-wave semiconductor devices and their spatial and frequency dependence. First the model is generally described and then it is applied to characterize the operation and to accurately interpret the noise performance of sub-quarter micrometer gate-length FETs by making use of the noise matrix which describes the noise fluctuations in the different device regions and electrodes and their correlations.



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Temperature Noise Constants Extraction of mm-Wave FETs from Measured S- and Noise Parameters

A. Abdipour and A. Pacaud. "Temperature Noise Constants Extraction of mm-Wave FETs from Measured S- and Noise Parameters." 1996 MTT-S International Microwave Symposium Digest 96.3 (1996 Vol. III [MWSYM]): 1723-1726.

For the first time, the temperature noise constants of the full semidistributed FET model are extracted by a CAD-oriented method from measured S- and noise parameters, instead of curve fitting or by optimization procedure. Using extracted noise constants and their temperature variations, the temperature dependence of the noise parameters of the mm-wave FETs are here reported.

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Characterization of RF-IC Packages by Multiport Excitation

R.T. Kollipara, J. Williams and V.K. Tripathi. "Characterization of RF-IC Packages by Multiport Excitation." 1996 MTT-S International Microwave Symposium Digest 96.3 (1996 Vol. III [MWSYM]): 1727-1729.

A new measurement technique based on multiport TDR excitation is presented. The technique is quite accurate and is used to characterize low-cost and small lead frame plastic packages. The extracted self and mutual inductance and capacitance values of a typical package are presented.

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Picosecond Dual-Source Interferometer Extending Fourier-Transform Spectrometer to Microwave Regime

D.W. Van Der Weide and F. Keilmann. "Picosecond Dual-Source Interferometer Extending Fourier-Transform Spectrometer to Microwave Regime." 1996 MTT-S International Microwave Symposium Digest 96.3 (1996 Vol. III [MWSYM]): 1731-1734.

We report a dual-source interferometer based on nonlinear transmission lines and integrated antennas which interfaces directly with a Fourier-transform infrared (FTIR) spectrometer to enable longer-wavelength measurements than normally possible with a black-body source. As a demonstration, we show preliminary transmission measurements through a plate of high-resistivity silicon.

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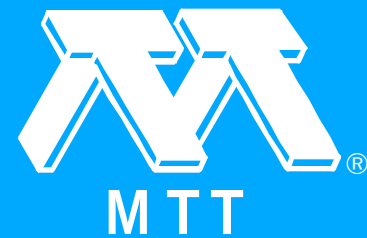


Abstracts

Black Box Modelling of Hard Nonlinear Behavior in the Frequency Domain

J. Verspecht, D. Schreurs, A. Barel and B. Nauwelaers. "Black Box Modelling of Hard Nonlinear Behavior in the Frequency Domain." 1996 MTT-S International Microwave Symposium Digest 96.3 (1996 Vol. III [MWSYM]): 1735-1738.

A black box model is proposed to describe nonlinear devices in the frequency domain. The approach is based upon the use of describing functions and allows a better description of hard nonlinearities than an approach based upon the Volterra theory. Simulations and experiments are described illustrating the mathematical theory.



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Analysis of HEMT Harmonic Generation Using a Vector Nonlinear Measurement System

J.G. Leckey, J.A.C. Stewart and A.D. Patterson. "Analysis of HEMT Harmonic Generation Using a Vector Nonlinear Measurement System." 1996 MTT-S International Microwave Symposium Digest 96.3 (1996 Vol. III [MWSYM]): 1739-1742.

A study of HEMT harmonic generation was carried out using a Vector Nonlinear Measurement System to measure drain and gate waveforms. The cause of second and third harmonic nulls with increasing input power, and their direct relation to the output IV characteristics is shown. The effect of DC drain current variation with increasing input drive level is also explained. The results indicate the potential for exploiting harmonic nulling behaviour in circuit applications. Analysis of second harmonic dependency on quiescent operating point shows a doubling mode with intrinsic suppression of unwanted third harmonic.

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Modeling of Low Frequency Noise Sources in HEMTs

T. Felgentreff and G.R. Olbrich. "Modeling of Low Frequency Noise Sources in HEMTs." 1996 MTT-S International Microwave Symposium Digest 96.3 (1996 Vol. III [MWSYM]): 1743-1746.

For amplifier and oscillator applications it is often necessary, to know the low frequency noise behavior of the used HEMT device. In this paper we present the models of two important low frequency noise contributions - the $f^{-1/2}$ noise and the generation/recombination noise (g-r noise). Starting with measurements of the noise power spectral densities at about 100 bias points we can find analytical expressions for the characterization of two noise current sources assumed in the channel of the HEMT. The two low frequency noise current sources are implemented in a large signal physics based HEMT model, which describes the signal and noise properties in the frequency range from 1 Hz to 40 GHz and is used for oscillator phase noise calculations. Also other noise current sources in this model will be discussed.

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An Examination of Data Based Large Signal Models for Wireless Amplifiers

J. Staudinger, E.Y. Lan, R. Vaitkus, R. Lucero and J. Hallmark. "An Examination of Data Based Large Signal Models for Wireless Amplifiers." 1996 MTT-S International Microwave Symposium Digest 96.3 (1996 Vol. III [MWSYM]): 1747-1750.

The validity of the assumptions used to construct a data based large signal GaAs MESFET model is examined for wireless RF power amplification. The compliance of measured S-parameter data to model consistency constraints is calculated for a wide region of the device's I-V plane. Strong compliance is observed at the contour integral point and over localized regions of the I-V plane, but not over extended regions which would be traversed by the dynamic load line of a power amplifier operating in gain compression. These effects are further examined by comparing harmonic balance predictions of the data based model to that of a common analytical large signal GaAs MESFET model and to load pull measurements of power, efficiency, and linearity.

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Abstracts

Large-Signal Modeling of Self-Heating and RF-Breakdown Effects in Power HBTs

C.J. Wei, J.C.M. Hwang, W.J. Ho and J.A. Higgins. "Large-Signal Modeling of Self-Heating and RF-Breakdown Effects in Power HBTs." 1996 MTT-S International Microwave Symposium Digest 96.3 (1996 Vol. III [MWSYM]): 1751-1754.

A large-signal HBT model including both self-heating and RF-breakdown effects was developed. The model was verified through RF waveform measurements. Using the model, the competing effects of open-base and open-emitter breakdown were analyzed.



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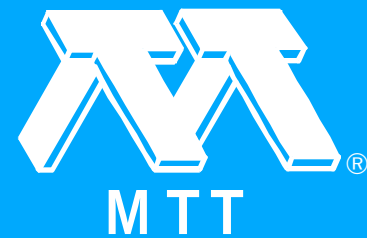


Abstracts

Non-Linear System and Subsystem Modelling in the Time Domain

M.I. Sobhy, E.A. Hosny, M.W.R. Ng and E.-S.A. Bakkar. "Non-Linear System and Subsystem Modelling in the Time Domain." 1996 MTT-S International Microwave Symposium Digest 96.3 (1996 Vol. III [MWSYM]): 1755-1758.

This work describes how non-linear subsystems can be modelled from time domain measurements. The advantage being the simplicity of the measurement and the developed models and the speed of the simulation of the entire system.



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Abstracts

A Large-Signal Physical HEMT Model

C.G. Morton, J.S. Atherton, C.M. Snowden, R.D. Pollard and M.J. Howes. "A Large-Signal Physical HEMT Model." 1996 MTT-S International Microwave Symposium Digest 96.3 (1996 Vol. III [MWSYM]): 1759-1762.

This paper reports a new, efficient physical HEMT model capable of accurately predicting DC, small- and large-signal performance. It has been interfaced to an industry standard simulator which allows for accurate, large-signal simulation to be integrated into the design process. Large-signal results demonstrate the model's suitability for MMIC CAD.



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Abstracts

A Realistic Large-Signal MESFET Model for SPICE (1996 Vol. III [MWSYM])

A.E. Parker. "A Realistic Large-Signal MESFET Model for SPICE (1996 Vol. III [MWSYM])." 1996 MTT-S International Microwave Symposium Digest 96.3 (1996 Vol. III [MWSYM]): 1763-1766.

A large-signal MESFET model, implemented with new techniques, has continuity and rate dependence. These features provide accurate prediction of circuit gain and distortion. The techniques also improve simulation speed. 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. This model is now in several simulators including Pspice v6.2.



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Abstracts

Improving the CAD of SRD Frequency Multipliers

J. Zhang and A.V. Raisanen. "Improving the CAD of SRD Frequency Multipliers." 1996 MTT-S International Microwave Symposium Digest 96.3 (1996 Vol. III [MWSYM]): 1767-1769.

A method for improving the efficiency of CAD of SRD frequency multipliers is proposed. By abating the nonlinearity of the model of the diode to an appropriate extent, the simulation and optimization of SRD frequency multipliers can be carried out faster and easier. Simulation results are compared with experimental results.



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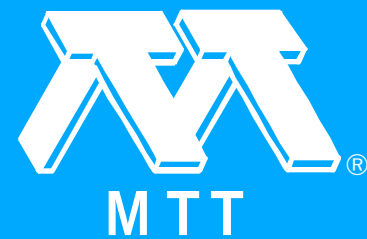


Abstracts

Simulation and Experimental Results of Source Harmonic Tuning on Linearity of Power GaAs FET Under Class AB Operation

S. Watanabe, S. Takatuka, K. Takagi, H. Kuroda and Y. Oda. "Simulation and Experimental Results of Source Harmonic Tuning on Linearity of Power GaAs FET Under Class AB Operation." 1996 MTT-S International Microwave Symposium Digest 96.3 (1996 Vol. III [MWSYM]): 1771-1774.

Nonlinearity of GaAs FET amplifiers under class AB operation such as abrupt increase of the output power against the input power can be effectively reduced by suppressing even-order harmonic distortion in gate RF voltage. In this paper, we demonstrate the effect of the source harmonic tuning and condition for improving the linearity of power GaAs FET's under class AB operation by the source harmonic tuning technique.



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Design Study of Linearized AlGaAs/GaAs HBTs Using Volterra Series

J. Lee, W. Kim, Y. Kim, T. Roh and B. Kim. "Design Study of Linearized AlGaAs/GaAs HBTs Using Volterra Series." 1996 MTT-S International Microwave Symposium Digest 96.3 (1996 Vol. III [MWSYM]): 1775-1778.

The intermodulation (IM) mechanism of HBT has been studied theoretically and experimentally. Volterra Series analysis with an analytical nonlinear HBT model shows that IP3 can be greatly enhanced by using a punch-through collector structure. It is also found that the high linearity of HBT stems mainly from the almost exact cancellation between base-emitter and base-collector nonlinear current components. The fabricated HBT with a punch through collector has the IP3 of 31 dBm at a dc power consumption of 150 mW, which is 3 dB higher than those of HBTs with normal collector.

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Circuit Models for Plastic Packaged Microwave Diodes

B. Brown and G. Hiller. "Circuit Models for Plastic Packaged Microwave Diodes." 1996 MTT-S International Microwave Symposium Digest 96.3 (1996 Vol. III [MWSYM]): 1779-1782.

This paper reports on the measurement and establishment of circuit models for SOT-23 and SOD-323 packaged diodes. Results indicate that the 1.5 nH estimate for the SOT-23 is a useful result as is 1.2 nH for SOD-323 single packaged diodes. It was also determined that the effective inductance of the SOT-23 may be reduced to approximately 0.4 nH by adding a second bond wire and modifying the microstrip line. Other lead configurations including parallel bond wires and common cathode configurations were also studied.

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Performance Comparison of MODFET and MESFET Using Combined Electromagnetic and Solid-State Simulator

S.M.S. Imtiaz, M.A. Alsunaidi and S.M. El-Ghazaly. "Performance Comparison of MODFET and MESFET Using Combined Electromagnetic and Solid-State Simulator." 1996 MTT-S International Microwave Symposium Digest 96.3 (1996 Vol. III [MWSYM]): 1783-1786.

A Combined Electromagnetic and Solid-State (CESS) simulation model for the analysis of electromagnetic wave effects on the behavior of the submicron semiconductor devices is presented. The CESS simulation model couples a 3D time-domain solution of Maxwell's equations to the semiconductor model. The performance comparison of two important high frequency devices, MODFET and MESFET, are discussed. The electromagnetic wave effects on the two devices are thoroughly analyzed. The simulation uses the electromagnetic wave concept to emphasize the better performance of MODFET over MESFET. The transfer of energy takes place between the electrons and the electromagnetic wave at high frequencies.

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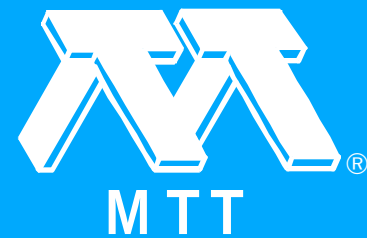


Abstracts

FDTD Modeling of Switching Noise in Multi-Layered Digital Circuits with CMOS Inverters and Passive Lumped Elements

M. Fujii, H. Murase and S. Kobayashi. "FDTD Modeling of Switching Noise in Multi-Layered Digital Circuits with CMOS Inverters and Passive Lumped Elements." 1996 MTT-S International Microwave Symposium Digest 96.3 (1996 Vol. III [MWSYM]): 1787-1790.

Multi-layered digital circuits such as LSI packages, has been analyzed by using a Finite-Difference Time-Domain (FDTD) method. Linear lumped elements, resistors and capacitors, and nonlinear lumped elements, CMOS drivers, are included in the analyses. Various noises as well as digital pulse propagation in multi-layered circuits are effectively analyzed by this technique.



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Spectral-Domain Analysis of Complex Characteristic Impedance of a Leaky Conductor-Backed Slotline

N.K. Das. "Spectral-Domain Analysis of Complex Characteristic Impedance of a Leaky Conductor-Backed Slotline." 1996 MTT-S International Microwave Symposium Digest 96.3 (1996 Vol. III [MWSYM]): 1791-1794.

We define an "equivalent complex characteristic impedance" for a conductor-backed slotline, that can be useful for circuit modeling purposes. Standard methods for computing the characteristic impedance of non-leaky transmission lines would not apply to a conductor-backed slotline due to its non-standard leakage behavior. Two alternate methods are proposed, that are compared with each other, as well as validated by comparing with rigorous 3D simulations of a practical circuit geometry.

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Abstracts

Modeling and Analysis of Guided-Wave Structures Involving Both Bi-Isotropic and Bi-Anisotropic Media

J. Huang and K. Wu. "Modeling and Analysis of Guided-Wave Structures Involving Both Bi-Isotropic and Bi-Anisotropic Media." 1996 MTT-S International Microwave Symposium Digest 96.3 (1996 Vol. III [MWSYM]): 1795-1798.

A new strategy of modeling and analysis with transmission line matrix (TLM) algorithm is developed to account for dynamic effects of both bi-isotropic and bi-anisotropic media on propagation and scattering characteristics. First, the symmetrical condensed node in the frequency-domain is generalized to involving bi-anisotropic media. The nodal scattering matrix is derived directly from Maxwell's equations using the centered finite difference and the transformation of variable. With the proposed node, a frequency-domain TLM algorithm is then established for analysis of propagation and scattering of arbitrary waveguiding structures including discontinuities such as chiral-filled rectangular waveguide, microstrip on a bi-isotropic non-reciprocal or chiral substrate. It is shown that the proposed TLM modeling provides a powerful tool for theoretical study of a new class of complex materials.



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Modal Behavior of Dominant Modes on Gyromagnetic Asymmetric Coupled Lines in Both Leaky and Nonradiation Regions

K.-F. Fuh, C.-K.C. Tzuang, C.-C. Liu and Y.-C. Lin. "Modal Behavior of Dominant Modes on Gyromagnetic Asymmetric Coupled Lines in Both Leaky and Nonradiation Regions." 1996 MTT-S International Microwave Symposium Digest 96.3 (1996 Vol. III [MWSYM]): 1799-1802.

By employing rigorous full-wave spectral domain approach, the complex propagation constants of the dominant modes on gyromagnetic asymmetric coupled lines are shown to support both complex modes and leaky modes. As one gradually increases the dielectric loading of the gyromagnetic lines, the transformation of dominant complex modes into a pair of a forward leaky mode and a backward leaky mode is observed. All the dominant modes reported here have been verified by examining their corresponding transverse field plots.



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Comparative Studies of Discontinuities in Single and Double Layered Conductor-Backed Coplanar Waveguides

Z. Ma and E. Yamashita. "Comparative Studies of Discontinuities in Single and Double Layered Conductor-Backed Coplanar Waveguides." 1996 MTT-S International Microwave Symposium Digest 96.3 (1996 Vol. III [MWSYM]): 1803-1806.

Comparative studies of discontinuities in conductor-backed coplanar waveguides (CBCPWs) with single and double layered dielectric substrates are implemented by using the FDTD method. Frequency dependence of the scattering parameters and losses associated with a variety of discontinuities are investigated, with emphasis on the comparison between the loss characteristics of the studied two types of CBCPWs. The presented results indicate clearly that losses associated with discontinuities in non-leaky coplanar (NLC) waveguides are significantly smaller than those in conventional CBCPWs over a certain frequency range. The leakage control theory of NLC waveguides is examined in all of the three-dimensional discontinuities under consideration, and the application potential of NLC waveguides at high frequencies is validated.





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Propagation of Gaussian Pulses in Lossy Coplanar Waveguides

C.-L. Liao, Y.-M. Tu, J.-Y. Ke and C.H. Chen. "Propagation of Gaussian Pulses in Lossy Coplanar Waveguides." 1996 MTT-S International Microwave Symposium Digest 96.3 (1996 Vol. III [MWSYM]): 1807-1810.

By comparing the results by the modified spectral-domain approach with those by the previous empirical formulas, a new attenuation constant empirical formula is proposed in discussing the conductor and leaky-wave losses associated with a practical coplanar waveguide (CPW) in which the thickness and conductivity of signal strip and ground planes are finite. Based on this new empirical formula, the transient propagation characteristics of Gaussian pulses along a lossy coplanar waveguide are investigated in detail. In particular, the transient propagated pulses calculated by different empirical formulas are discussed and compared with those of the experimental data.

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Abstracts

Analysis of High-Speed Interconnects in the Presence of Electromagnetic Interference (1996 Vol. III [MWSYM])

R. Khazaka and M. Nakhla. "Analysis of High-Speed Interconnects in the Presence of Electromagnetic Interference (1996 Vol. III [MWSYM])." 1996 MTT-S International Microwave Symposium Digest 96.3 (1996 Vol. III [MWSYM]): 1811-1814.

The recently developed complex frequency hopping technique for interconnect analysis is expanded to include the effects of incident electromagnetic fields. The generalized technique is important for susceptibility analysis and is 2 to 3 orders of magnitude faster than conventional simulation techniques. In addition it can be easily extended to the analysis of interconnects with frequency dependent parameters and nonlinear terminations.



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Compact Equivalent Circuit Model for the Skin Effect

S. Kim and D.P. Neikirk. "Compact Equivalent Circuit Model for the Skin Effect." 1996 MTT-S International Microwave Symposium Digest 96.3 (1996 Vol. III [MWSYM]): 1815-1818.

Rules for determining a compact circuit model consisting of four resistors and three inductors to accurately predict the skin effect have been developed. The circuit is easily constructed from the geometry, producing a response that matches exact results over a frequency range from dc to very high frequencies.

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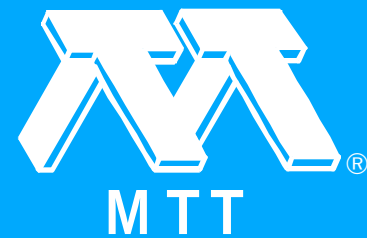


Abstracts

EM-ANN Models for via Interconnects in Microstrip Circuits

P. Watson and K.C. Gupta. "EM-ANN Models for via Interconnects in Microstrip Circuits." 1996 MTT-S International Microwave Symposium Digest 96.3 (1996 Vol. III [MWSYM]): 1819-1822.

A novel approach for accurate and efficient modeling of MMIC components by using electromagnetically-trained Artificial Neural Network (EM-ANN) software modules is presented. The approach has been verified by developing models for microstrip via and stripline-to-stripline interconnects in multilayer circuits. Implementation of the approach is demonstrated by integrating the EM-ANN models in a commercial microwave circuit simulator.



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Effect of Package Shape on Spurious Coupling Among Microstrip Discontinuities

H. Cebi and K.C. Gupta. "Effect of Package Shape on Spurious Coupling Among Microstrip Discontinuities." 1996 MTT-S International Microwave Symposium Digest 96.3 (1996 Vol. III [MWSYM]): 1823-1826.

Effects of a metallic package on the performance of a microstrip circuit are attributed mainly to the modifications of spurious couplings among various discontinuities. This paper describes a method for computing the effect of the package shape on the interactions among discontinuities. It is shown that chamfering of the corners of a rectangular package can reduce the spurious coupling between two microstrip open-end stubs.

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An Accurate Equivalent Circuit Model of Flip Chip Interconnects

H.H.M. Ghouz and E.-B. El-Sharawy. "An Accurate Equivalent Circuit Model of Flip Chip Interconnects." 1996 MTT-S International Microwave Symposium Digest 96.3 (1996 Vol. III [MWSYM]): 1827-1830.

In this paper, a general and accurate circuit model of the flip chip interconnect has been investigated and presented. In this circuit model, statistical analysis is used to compute the value of the circuit elements. Also, losses in the flip chip package are represented by a simple function vs frequency. These losses include substrate loss of the chip and the mother board due to excitation of surface wave and radiation loss due to the pump. Good agreement has been obtained between the s-parameters of the FD-TD model and the equivalent circuit model over a wide frequency band of up to 50 GHz. This equivalent circuit can be used in commercial circuit simulators to predict MMIC performance including the package.

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Improved CPW to Slotline Transitions

K. Hettak, J.P. Coupez, T. Le Gouguec, S. Toutain, P. Legaud and E. Penard. "Improved CPW to Slotline Transitions." 1996 MTT-S International Microwave Symposium Digest 96.3 (1996 Vol. III [MWSYM]): 1831-1834.

The paper presents a new approach for designing an ultra broadband coplanar to slotline transition. The procedure is carried out in three steps: design, modeling and fabrication of two new broadband uniplanar CPW to slotline transitions, in the 1 GHz to 50 GHz frequency range. The advantages of these transitions are discussed. Both transitions are modeled using one approach which consists of building a model, based on physical considerations, that is compatible with usual CAD software (discontinuities effects are not taken into account except short/open circuits-end effects). This allows the design and optimization of very broadband transitions in uniplanar technology. The overall agreement between the measured and modeled insertion-loss and return-loss of two back-to-back transitions is good. A maximum relative bandwidth of 7.7:1 is achieved with 10 dB return loss, and the corresponding insertion loss is less than or equal to 2 dB.

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FDTD Simulation of Signal Degradation in Lossy and Dispersive Coplanar Waveguides for High-Speed Digital Circuits

A.S. Rong, V.K. Tripathi and Z.L. Sun. "FDTD Simulation of Signal Degradation in Lossy and Dispersive Coplanar Waveguides for High-Speed Digital Circuits." 1996 MTT-S International Microwave Symposium Digest 96.3 (1996 Vol. III [MWSYM]): 1835-1838.

The signal degradation stemming from the conductor loss and the substrate dispersion of coplanar waveguides for the high-speed digital circuits is analyzed by a combination of the original and frequency-dependent versions of the FDTD method. The metallic strips with the finite thickness are described by the equivalent Z-parameters. The backed conductor, if any, is modelled by the surface impedance. The dispersive property of the GaAs substrate is formulated by using the Kronig-Kramers relationship. The simulation results demonstrate the signal degradation due to modal dispersion, conductor loss, substrate dispersion and leakage effects in a conductor backed CPW structure.

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Electromagnetic Scattering from Heterogeneous MEDIA - A Comparison Between Numerical Computations and Experimental Results

J.P. Parneix, V. Vigneras-Lefebvre, F. Pessan and M.D. du Rau. "Electromagnetic Scattering from Heterogeneous MEDIA - A Comparison Between Numerical Computations and Experimental Results." 1996 MTT-S International Microwave Symposium Digest 96.3 (1996 Vol. III [MWSYM]): 1839-1842.

In a view of its possible use for control of absorption, Radar Cross Section (RCS) and shielding, heterogeneous material coatings have received considerable attention recently. An analytical approach to the investigation of the scattering of electromagnetic waves by heterogeneous materials made of spherical inclusions is presented. The theory takes into account the coupling between the inclusion. Computed and experimental results in the range 1 to 100 GHz are given.

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Abstracts

Jacobian Elliptic Function Solution of Characteristics of Rectangular Groove Wave-Guide with Rounded Internal Corners

W. Lin, E.K.N. Yung and K.M. Luk. "Jacobian Elliptic Function Solution of Characteristics of Rectangular Groove Wave-Guide with Rounded Internal Corners." 1996 MTT-S International Microwave Symposium Digest 96.3 (1996 Vol. III [MWSYM]): 1843-1844.

To enhance the power carrying capacity and the efficiency of the rectangular groove wave guide, presented is such a guide with rounded internal corners, by means of Jacobian Elliptic Functions to transform the unbounded waveguide region onto the interior of a rectangle in w -plane with sides $2K(k) \times 2K(k)$.



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W-Band Finite Ground Coplanar (FGC) Line Circuit Elements

F. Brauchler, S. Robertson, J. East and L.P.B. Katehi. "W-Band Finite Ground Coplanar (FGC) Line Circuit Elements." 1996 MTT-S International Microwave Symposium Digest 96.3 (1996 Vol. III [MWSYM]): 1845-1848.

This paper describes the modeling and experimental evaluation of Finite Ground Coplanar (FGC) lines, stubs, and filters between 2 and 110 GHz. These lines provide a very low loss alternative to microstrip or coplanar waveguide for millimeter- and submillimeter-wave applications without the use of vias. Their mode free operation allows excellent agreement between measured data and LIBRA modeling to 110 GHz. The lines have very low loss at W-band and filters have a loss comparable with the best mem-brane filters reported recently. The paper includes details of analytic and FDTD investigations of the lines, a description of the fabrication and measurement calibration and measured data on lines, tuning stubs, and a variety of low-pass filters.

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Boundary Integral Equation Approach to Multi-Mode Y-Matrix Characterization of Multi-Ridged Sections in Circular Waveguide

W. Schroeder and M. Guglielmi. "Boundary Integral Equation Approach to Multi-Mode Y-Matrix Characterization of Multi-Ridged Sections in Circular Waveguide." 1996 MTT-S International Microwave Symposium Digest 96.3 (1996 Vol. III [MWSYM]): 1849-1852.

Aiming at an accurate and effective CAD procedure for Circular Waveguide (CW) dual-mode filters without tuning screws, the Boundary Integral Equation Method (BIEM) is applied to TM/TE mode analysis of Multi-Ridge Circular Waveguide (MRCW) and evaluation of CW-MRCW mode coupling coefficients to obtain the Multi-Mode Network (Y-Matrix) Representation (MMNR) of CW-MRCW transitions. A novel Multiple Eigenvalue Search Algorithm assures completeness of the modal spectrum up to large mode indices (> 100) in the presence of accidental degeneracies and clusters of eigenvalues.

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Field Theory Based S-Parameter Analysis of Circular Ridged Waveguide Discontinuities

U. Balaji and R. Vahldieck. "Field Theory Based S-Parameter Analysis of Circular Ridged Waveguide Discontinuities." 1996 MTT-S International Microwave Symposium Digest 96.3 (1996 Vol. III [MWSYM]): 1853-1856.

This paper describes a radial mode matching algorithm for the S-parameter computation of circular ridged waveguide (CRW) discontinuities. By shaping the ridge section conically, the coupling integrals in the discontinuity region can be solved analytically. This approach avoids the use of a mixed coordinate system and leads to a fast algorithm which is suitable for computer-aided design of CRW components like filters, septum polarizers and waveguide transformers. A comparison between measured and computed S-parameters shows excellent agreement. To illustrate the capability of the algorithm, a circular double ridged waveguide filter in a below cutoff waveguide and a CRW transformer have been optimized.

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Abstracts

A Configuration Oriented SPICE Model for Multiconductor Transmission Lines in an Inhomogeneous Medium

A. Tripathi and V.K. Tripathi. "A Configuration Oriented SPICE Model for Multiconductor Transmission Lines in an Inhomogeneous Medium." 1996 MTT-S International Microwave Symposium Digest 96.3 (1996 Vol. III [MWSYM]): 1857-1860.

A configuration oriented Spice model for multiple coupled lines in an inhomogeneous medium is presented. The model is useful for modelling general single and multilayer coupled line structure. The system consists of a network of uncoupled transmission lines and is readily modelled with simulation tools like Libra and SPICE and provides an equivalent circuit representation which is simpler and more versatile as compared to the model based on modal decomposition.



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MRTD Analysis of Dielectric Cavity Structures

R. Robertson, E. Tentzeris, M. Krumpholz and L.P.B. Katehi. "MRTD Analysis of Dielectric Cavity Structures." 1996 MTT-S International Microwave Symposium Digest 96.3 (1996 Vol. III [MWSYM]): 1861-1864.

Multiresolution time domain (MRTD) analysis is applied to model anisotropic dielectric material. In particular, an MRTD scheme based on scaling functions only is used to analyze different types of resonant cavity structures. The results agree very well with those obtained by FDTD, FEM and integral equation methods. MRTD allows for considerable savings in memory and computational time in comparison to FDTD, while maintaining the same accuracy of the results.

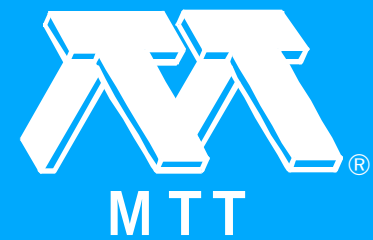
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Abstracts

Session TH4B -- Chaos in Microwave Systems

"Session TH4B -- Chaos in Microwave Systems." 1996 MTT-S International Microwave Symposium Digest 96.3 (1996 Vol. III [MWSYM]): 1865-1866.



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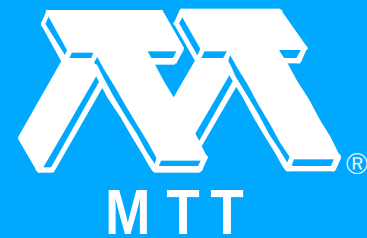


Abstracts

Observations of Chaos in Microwave Circuits

R. Kaul. "Observations of Chaos in Microwave Circuits." 1996 MTT-S International Microwave Symposium Digest 96.3 (1996 Vol. III [MWSYM]): 1867-1870.

This paper summarizes observations of chaotic behavior in some microwave circuits that have been reported over the last 10 years. Also, it extends results previously reported for a PIN diode limiter in order to identify the nonlinearities in the diode that allow for chaotic behavior. Further knowledge of chaotic microwave parameters will allow system designers to make use of these properties in future applications.



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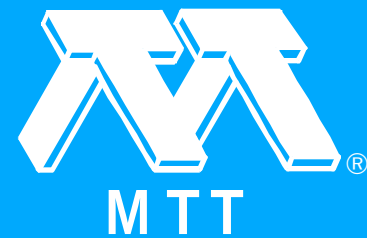


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A Survey of Chaos and its Applications

C.P. Silva. "A Survey of Chaos and its Applications." 1996 MTT-S International Microwave Symposium Digest 96.3 (1996 Vol. III [MWSYM]): 1871-1874.

The relatively new science of chaos has now entered an exciting stage of practical application to real-world problems, impacting such diverse areas as communications, fluid mechanics, and physiology. This paper will introduce the basics of dynamical systems, provide a beginner's guide to chaos and the closely related disciplines of fractals and wavelets, and discuss several novel communications/signal processing applications of interest to microwave engineers.



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Chaos in Microwave Antenna Arrays

R.J. Ram, R. Sporer, H.-R. Blank, P. Maccarini, H.-C. Chang and R.A. York. "Chaos in Microwave Antenna Arrays." 1996 MTT-S International Microwave Symposium Digest 96.3 (1996 Vol. III [MWSYM]): 1875-1878.

This paper considers a chaotic microwave transmitter consisting of a quasi-optical antenna array. When the coupling strength between array elements is too small to allow phase-locking, the antenna arrays exhibit low-dimensional chaos. These arrays show potential for use in inexpensive, high-power and high-speed wireless communication channels.

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Using Controlled Chaos for Digital Signaling: A Physical Principle for 1-Stage Waveform Synthesis

S. Hayes and C. Grebogi. "Using Controlled Chaos for Digital Signaling: A Physical Principle for 1-Stage Waveform Synthesis." 1996 MTT-S International Microwave Symposium Digest 96.3 (1996 Vol. III [MWSYM]): 1879-1882.

We consider the possibility of using controlled chaotic operation to produce complex signals directly at the high-power level in a microwave source. By implementing symbolic dynamics control, a high-power source could be guided through complex pulsed, frequency hopped, or digital information bearing sequences with negligible control power. This possibility arises because chaotic behavior is naturally complex and sensitive to small perturbations, and we can gently guide the signal through a preexisting chaotic orbit with tiny controlling perturbations. We have done this in an audio-frequency circuit, and the basic control technique could be extended to high frequencies.

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Abstracts

Weak Signal Detection by Small-Perturbation Control of Chaotic Orbits

C.M. Glenn and S. Hayes. "Weak Signal Detection by Small-Perturbation Control of Chaotic Orbits." 1996 MTT-S International Microwave Symposium Digest 96.3 (1996 Vol. III [MWSYM]): 1883-1886.

We have developed a method of detecting extremely weak signals using fundamental principles of chaotic dynamics. We calculate the time-dependent coupling of the disturbance signal to the stable and unstable manifolds of the system and derive a relationship between the disturbance and the error on the Poincare surface of section thus relating the disturbance signal to the perturbations needed to control a periodic orbit. We demonstrate the algorithm in a computer model of a chaotic system and discuss its implementation in high-frequency devices.



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Micro-Machining in Submillimeter-Wave Circuits

D. Rutledge. "Micro-Machining in Submillimeter-Wave Circuits." 1996 MTT-S International Microwave Symposium Digest 96.3 (1996 Vol. III [MWSYM]): 1889-1892.

Micro-machining technology has been used in submillimeter-wave circuits for more than ten years, but it is just beginning to appear in receivers on radio telescopes. A variety of rod, membrane, slot, and horn antennas have been demonstrated, together with hollow-metal guides and sliding shorts. Recently, a micro-machined waveguide receiver with a SIS junction on a 1- μ m membrane has been demonstrated at 850 GHz with a DSB noise temperature of 450 K.

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100 GHz Wide-Band HTS Mixer Antenna with Phase Control

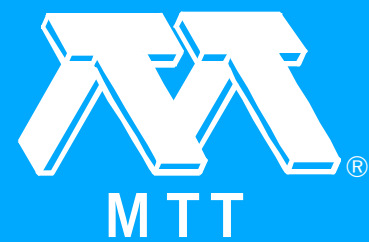
K. Suzuki, M. Ban, S. Tokunaga, M. Ohtsuka, K. Hayashi and Y. Enomoto. "100 GHz Wide-Band HTS Mixer Antenna with Phase Control." 1996 MTT-S International Microwave Symposium Digest 96.3 (1996 Vol. III [MWSYM]): 1893-1896.

Here we report on a millimeter-wave performance of high-T_c superconducting (HTS) Josephson junctions on MgO substrates using a focused Ga ion beam (FIB). The 6 junctions with 1.5 μ m space apart from each other occupied 7.5 μ m. The 6 junctions can modulate even the 1000GHz electromagnetic wave with nearly equal phase. We applied the YBCO series junction to millimeter wave mixer with a log-periodic antenna. The HTS junction mixer and the log-periodic antenna are expected to have a function of flat frequency response up to THz. First, we measure wide frequency band responsibility for mixing function below 100 GHz. Next, we observe the HTS mixer-antenna performance as fundamental and harmonic mixers in the wide frequency range up to 100 GHz. Finally, the IF output phases can be changed within 1dB of IF output power differences.

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Multipoint™: A Millimeter Wave System for Quick Access to the Information Super-Highway

J.L. Langston. "Multipoint™: A Millimeter Wave System for Quick Access to the Information Super-Highway." 1996 MTT-S International Microwave Symposium Digest 96.3 (1996 Vol. III [MWSYM]): 1897-1900.

Broadband wireless service is a natural progression of wireless technology. First cellular and then Personal Communications Services (PCS) demonstrated the advantages of wireless communications for mobile users. However with the deployment of wireless technology, other advantages of wireless systems became apparent. The first advantage is the rapidity with which wireless systems can be deployed compared to wired solutions. This was demonstrated through the deployment of not one, but two cellular systems in just over ten years to provide coverage to over 800% of the U.S. population. The second advantage is the lower cost per subscriber for low take rates for the service. These advantages are independent of the mobility aspect of cellular systems. This was demonstrated by the rapid deployment of cellular systems in some countries as the preferred telephony system. The demand for broadband services such as interactive entertainment, video conferencing, high-speed data, etc., has created the need for the Information Super-Highway. The obvious transmission medium of choice is Fiber Optic networks such as Hybrid Fiber/Coax (HFC), Fiber-to-the-Curb (FTTC) and Fiber-to-the-Home (FTTH). However the time and cost to deploy a wired solution, particularly during the early stages of low take rates in a competitive environment, make the economics of a wired broadband digital solution uncertain. A broadband wireless solution provides an alternative which offers the advantages of quick deployment and good economics in low take-rate environments. This paper describes how a 27-30 GHz system can offer a wireless alternative for broadband digital services.

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Focus Sessions, Panel and Rump Sessions, Workshops, μ APS Technical Program and MMWMC Symposium Schedule (1996 Vol. III [MWSYM])

"Focus Sessions, Panel and Rump Sessions, Workshops, μ APS Technical Program and MMWMC Symposium Schedule (1996 Vol. III [MWSYM])." 1996 MTT-S International Microwave Symposium Digest 96.3 (1996 Vol. III [MWSYM]): 1901-1902.



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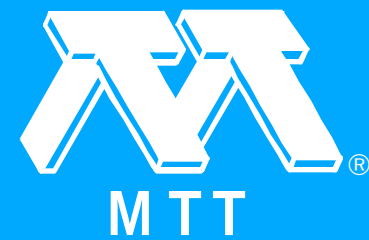
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MTT-S Panel Sessions (1996 Vol. III [MWSYM])

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Message from the 1996 μ APS Chairman (1996 Vol. III [MWYSM])

M.I. Grace, B.D. Bakner and G.L. Koker. "Message from the 1996 μ APS Chairman (1996 Vol. III [MWYSM])." 1996 MTT-S International Microwave Symposium Digest 96.3 (1996 Vol. III [MWSYM]): 1916-1917.

On behalf of the Industry Participation Committee, welcome to the 1996 IMS in San Francisco and to the first Microwave Application & Product Seminars (μ APS) presented by the Symposium Exhibitors. The purpose of the new Microwave Application & Product Seminars is to provide a forum for topical presentations on microwave products, applications, services and markets at the level of the microwave practitioner, including design and manufacturing engineers and marketing and management professionals.



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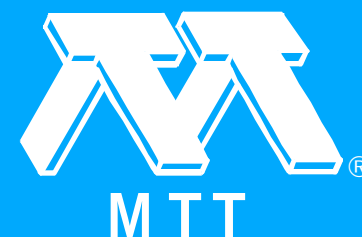
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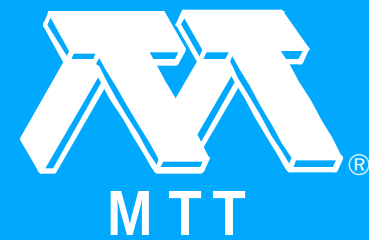
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