

Microwave Digital Archive

IEEE Microwave Theory and Techniques Society

1986-1987

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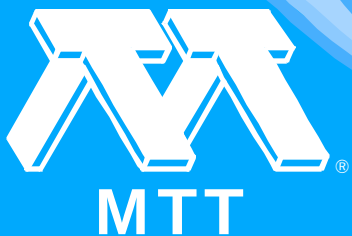
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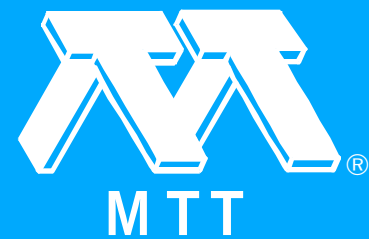
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The section "Getting Started" tells you how to optimize the Acrobat Reader Preferences to improve the readability of the document. If you need customer support before January 2001, call 831.657.2420 or 800.447.9100. If you find errors in the CD-ROM,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

Remember that the quality of the old journals is not perfect, and that some photographs will not be as clear as Technicolor. Also, the optical character recognition is good, but not perfect, so some spelling errors will occur. None the less, you can copy and paste the material for your own uses and personal study.

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Thank You and Enjoy!



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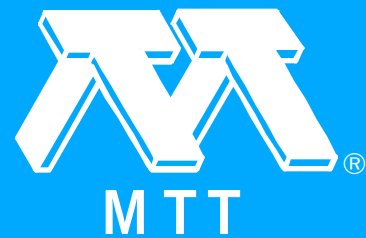
ACKNOWLEDGMENTS

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

REFERENCES

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ISBN: 0-7803-9906-4



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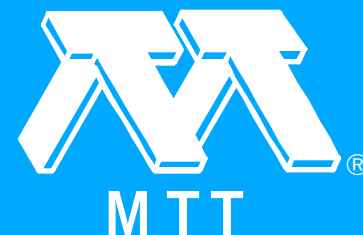
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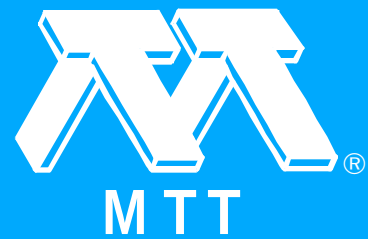
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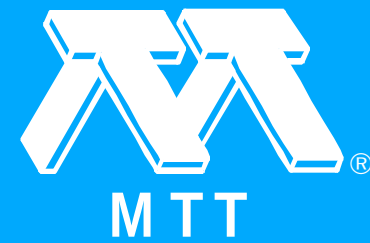
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INTRODUCTION

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

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

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



ACROBAT PREFERENCES

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



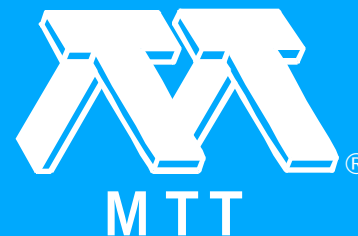
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In the dialog box shown for **General** Preferences, turn OFF the “Open Cross-Document Links in Same Window” option; this will keep the Guide file open when you view article files and allows you to return to the same page in the Guide when you close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

In the dialog box shown for **Search** Preferences, turn ON the “Show Fields” option so that Title, Author, Keywords, and Subject fields are visible when specifying search criteria. If for some reason this preference option is not present on your system, check to see that you have the Search plug-in installed. The Search icon  will be present on the Acrobat Toolbar if the function is properly installed. Specifics of the Search function are described later in this section.

EXITING AN ARTICLE

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

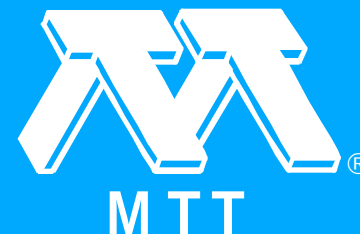


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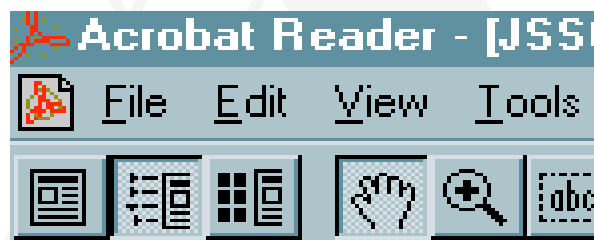
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USING BOOKMARKS

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



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

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

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PRINTING ARTICLES

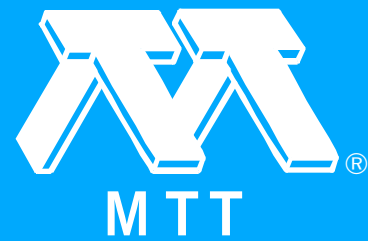
Articles may have text outside normal print-area defaults. We recommend selecting “Shrink to Fit” in the print menu (File > Print) to capture the complete image for your printout. This setting will become your new default.

SELECTING GRAPHICS

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

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

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



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NAVIGATION BUTTONS

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

Section Map

The Electronic Guide is constructed in sections: e.g. Sessions, Authors, Getting Started. The current section is shown at the top of each page. The “path” to this section is shown at the right. Clicking these text buttons moves you to the start of that section.

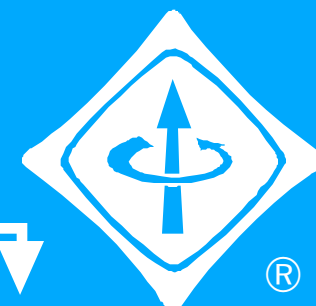
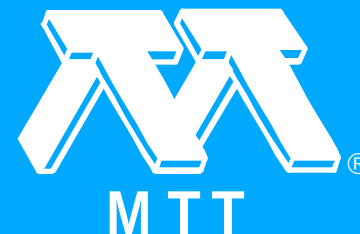
Next Page button

Click to advance to the next page in the section.

Previous Page button

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

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

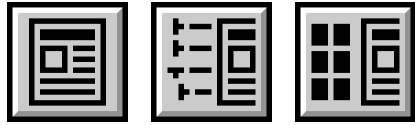


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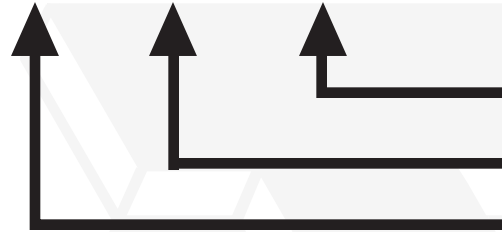


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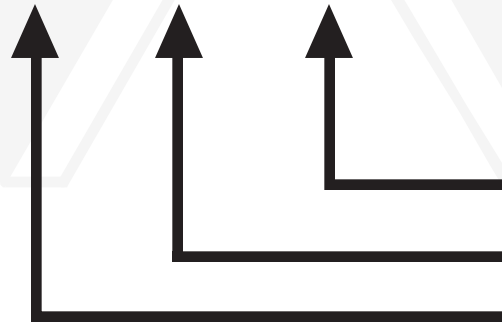
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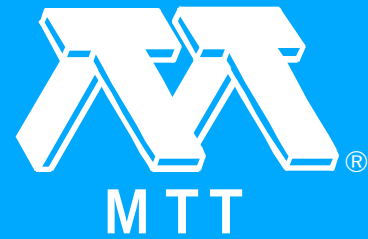
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Display Page



Zoom/Selection



Select Text
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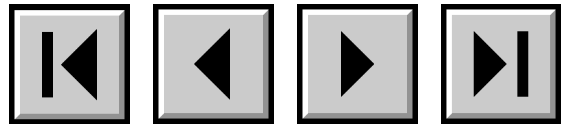
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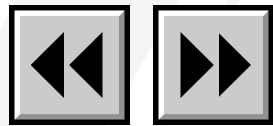
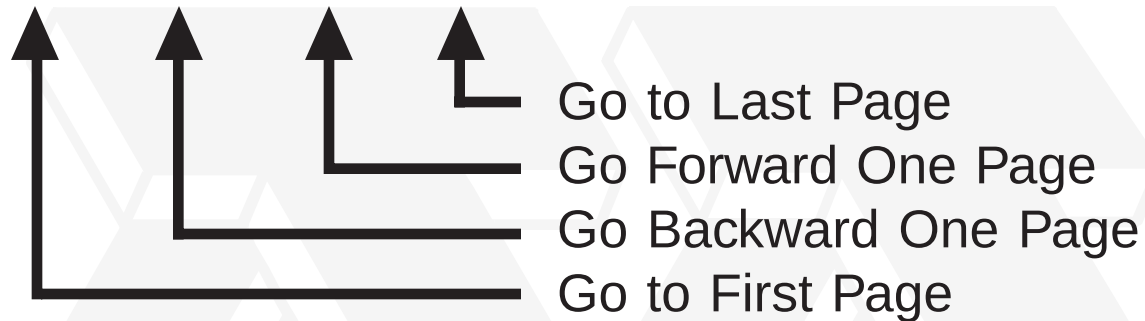


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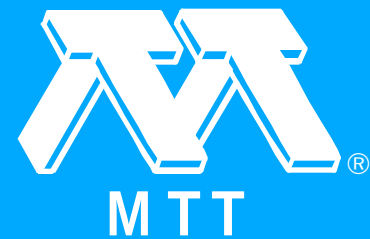
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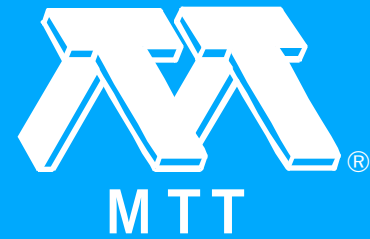
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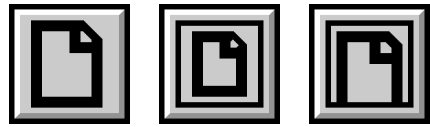
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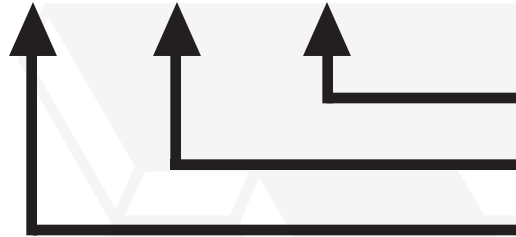
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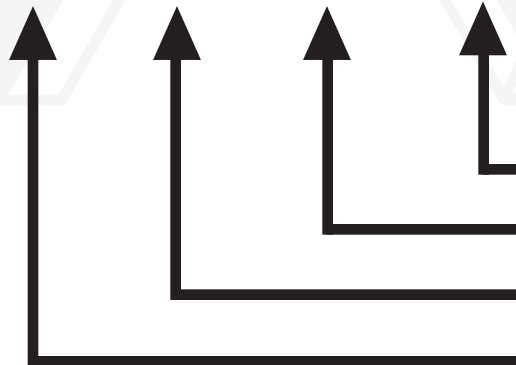
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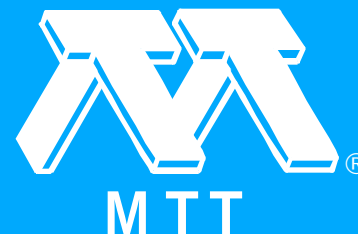
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SEARCHING

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

Choosing the Search button or Search menu item (Tools > Search), selecting the Query item, opens a dialog box from which you can access the more powerful full-text search engine (if you installed Acrobat with the Search plug-in from this CD-ROM). Its dialog box is shown on the next page.

Typing a term in the text box at the top of the Search dialog box and pressing the “Search” button causes a full-text search of all words in the body of papers in the collection. Entering a term in one or more of the fixed fields (Title, Author, Subject or Keywords) will cause a search for hits in only those fields.



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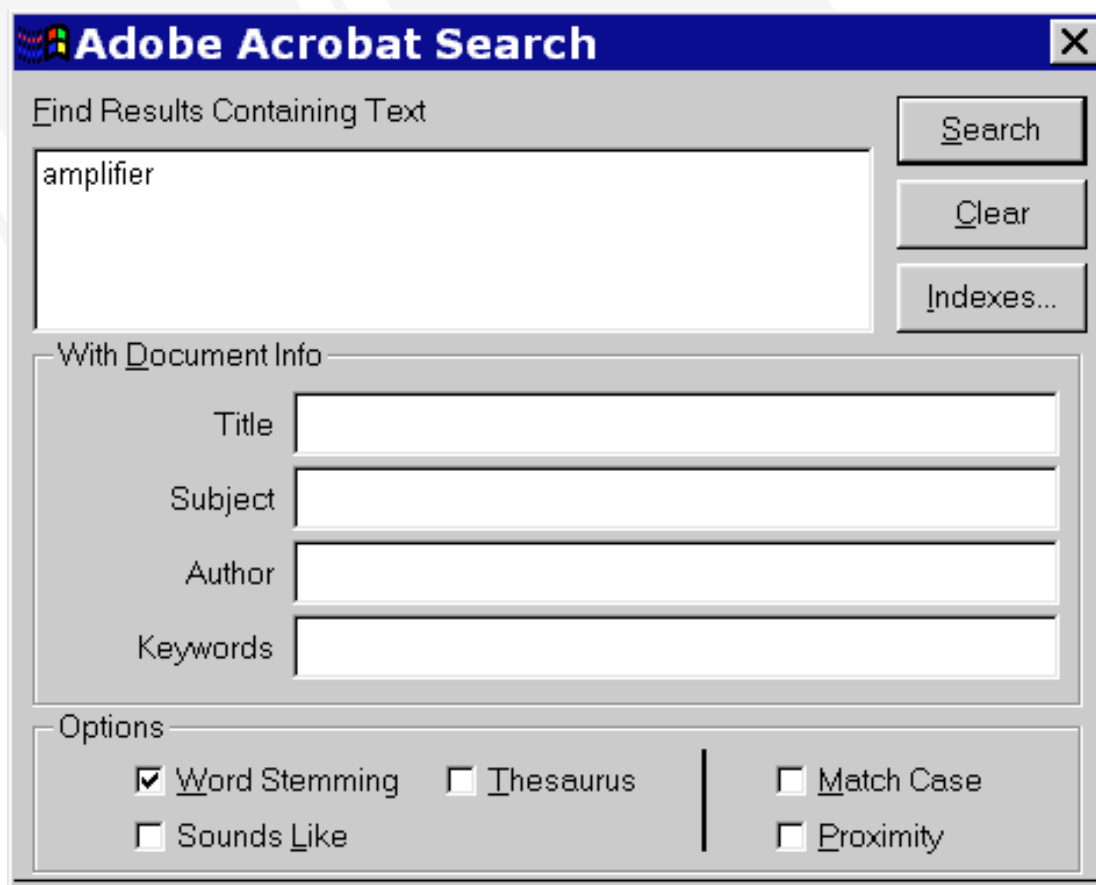
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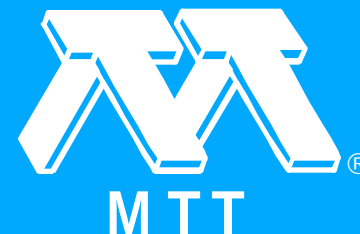
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If you are not finding files you think should show in the results list, Acrobat may not be attached to the correct index file. To check, press the “Indexes...” button for a list of available indexes. If this title is not listed, press the “Add...” button and look in the root directory of the CD-ROM for a file called “index.pdx”. Click on that file to add it to the list. If none exists, this title was not indexed.

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



The screenshot shows the 'Adobe Acrobat Search' dialog box. It has a title bar with the Adobe logo and the text 'Adobe Acrobat Search'. The main area is titled 'Find Results Containing Text' and contains a text input field with the word 'amplifier'. To the right of this field are three buttons: 'Search', 'Clear', and 'Indexes...'. Below 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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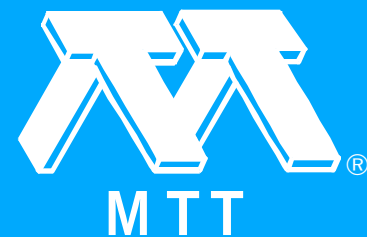
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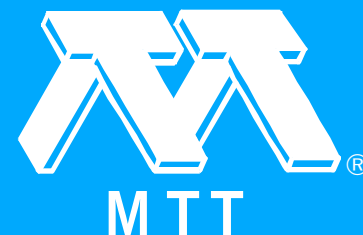
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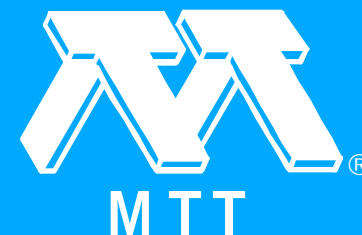
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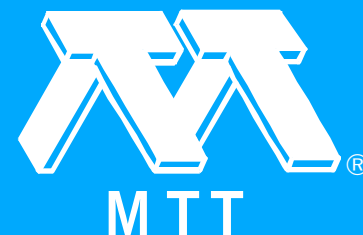
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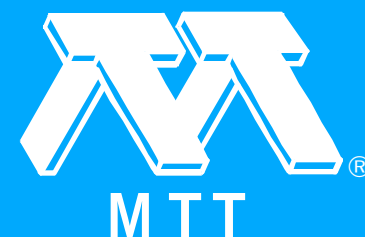
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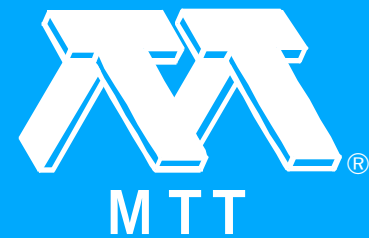
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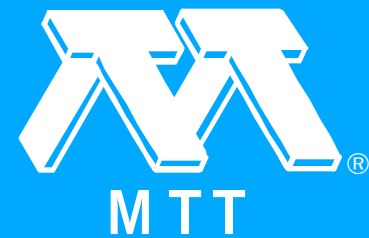
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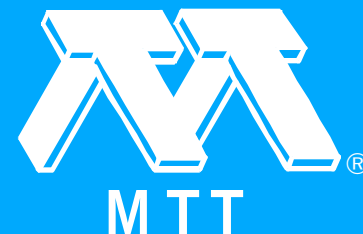
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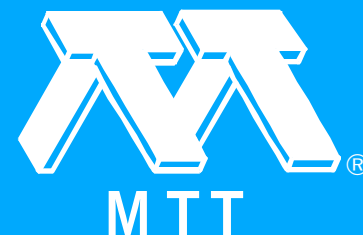
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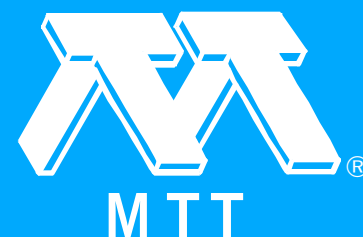
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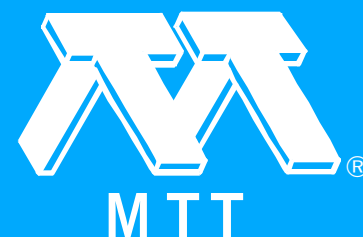
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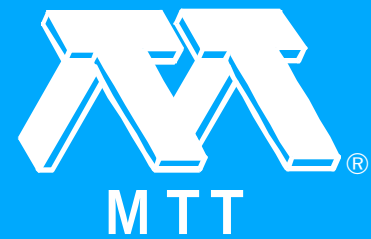
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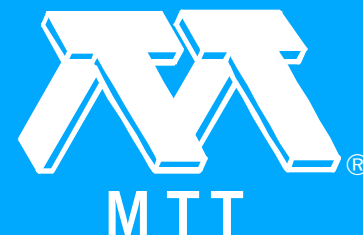
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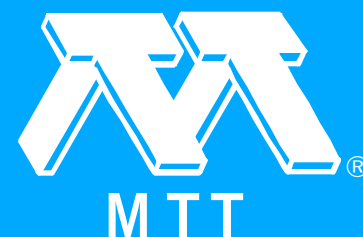
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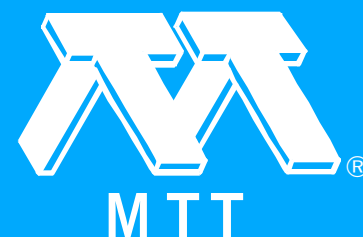
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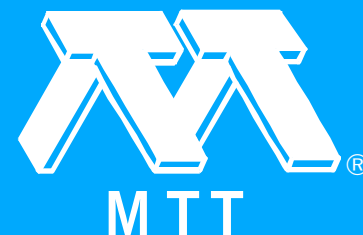


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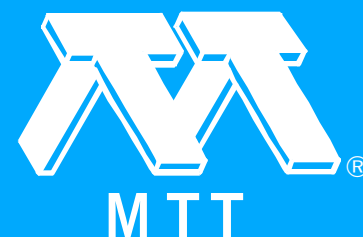
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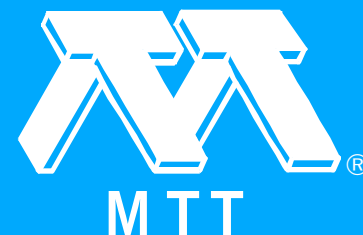
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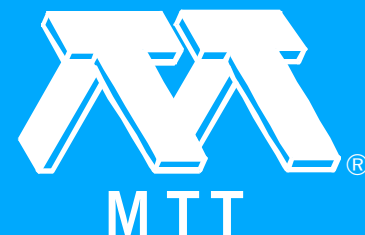
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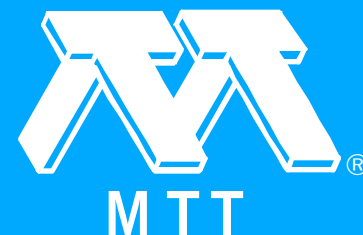
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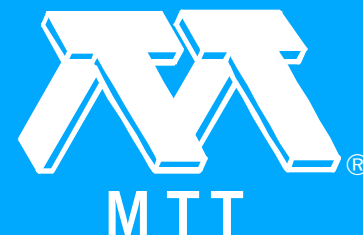
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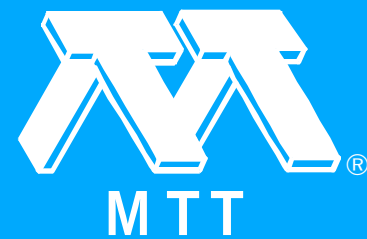
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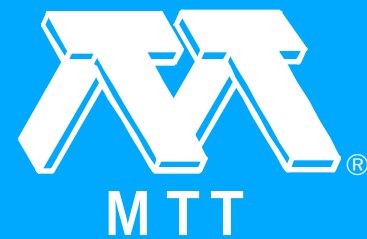
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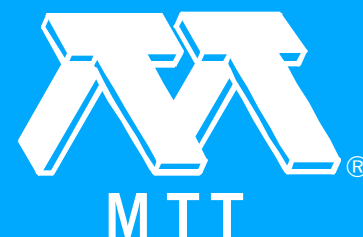
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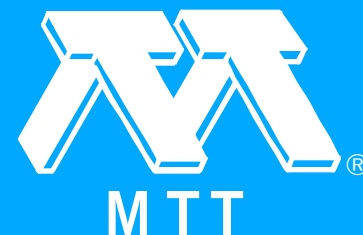
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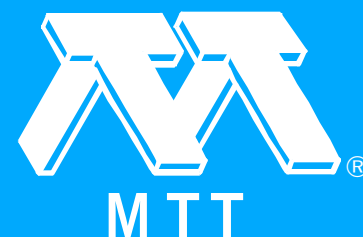
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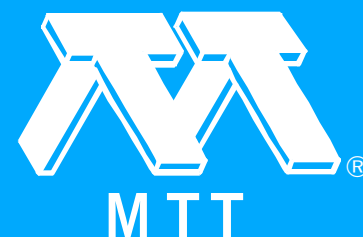
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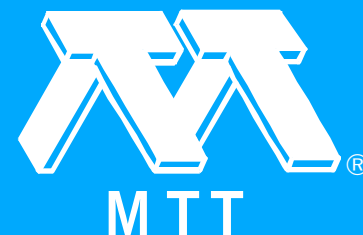
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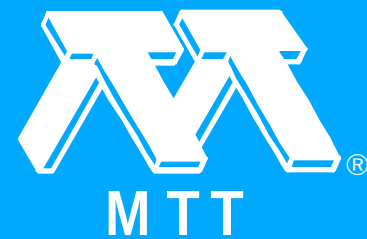
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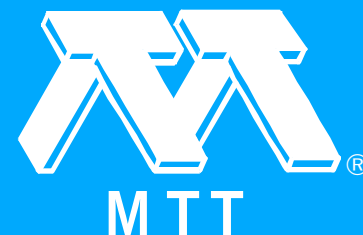
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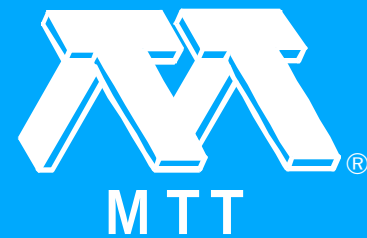
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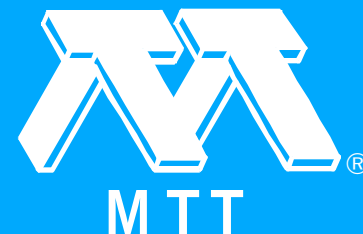
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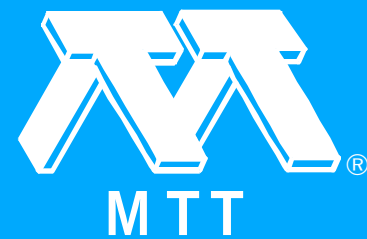
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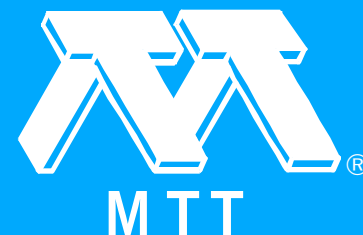
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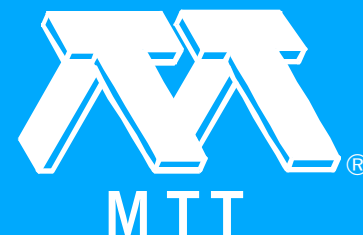
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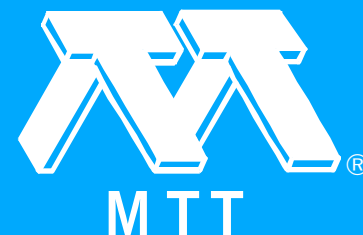
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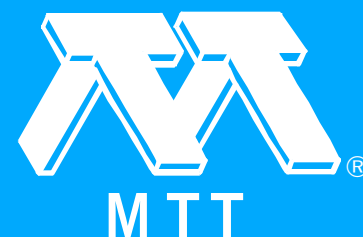
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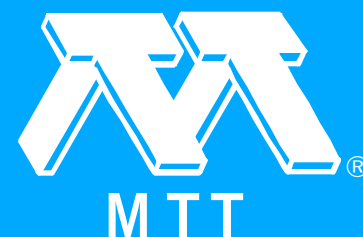
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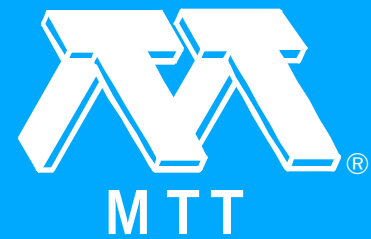
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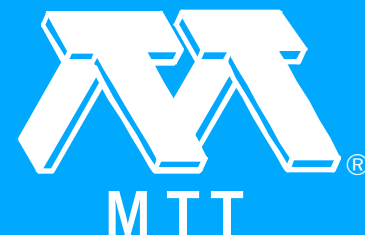
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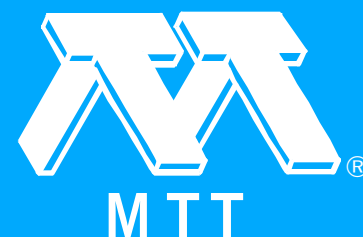
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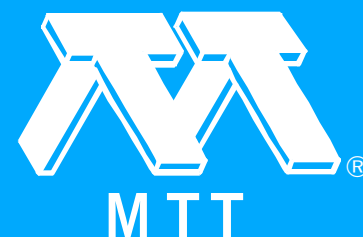
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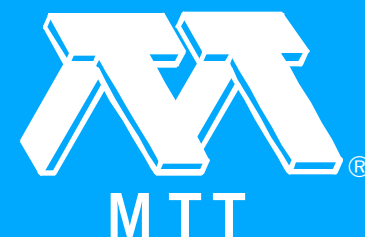
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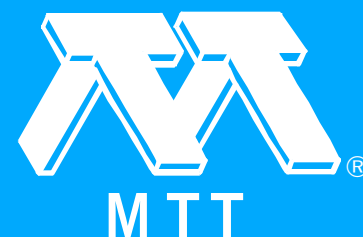
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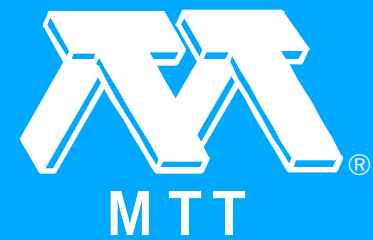
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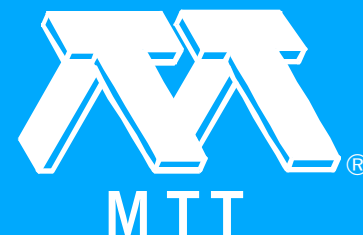
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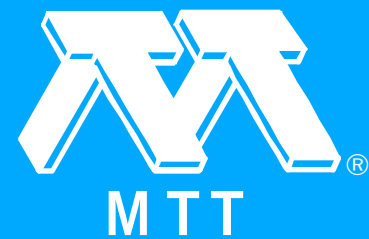
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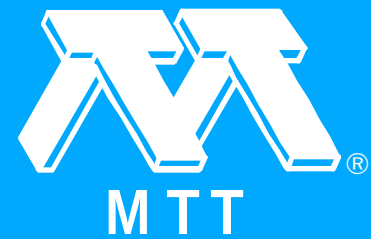
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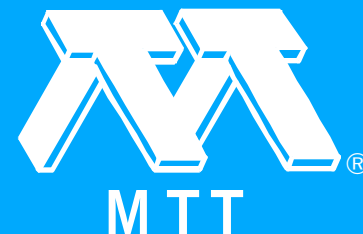
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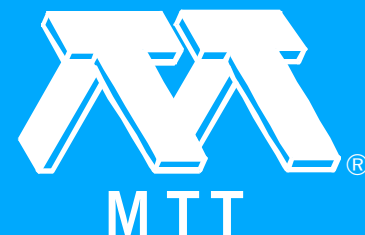
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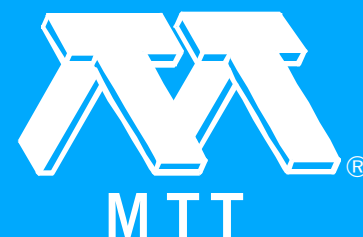
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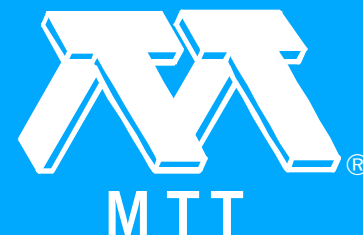
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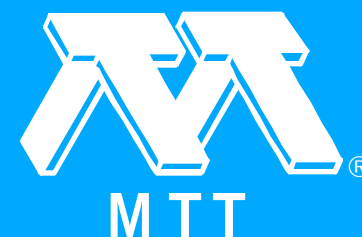
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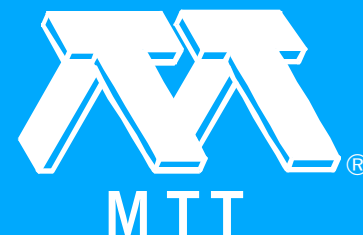
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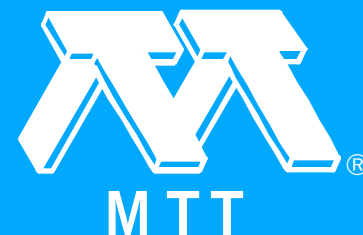
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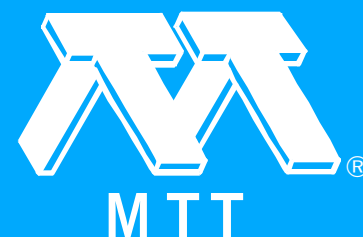
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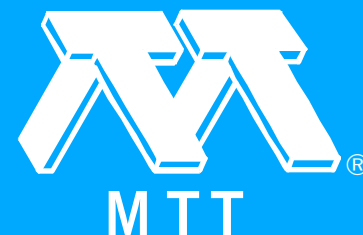
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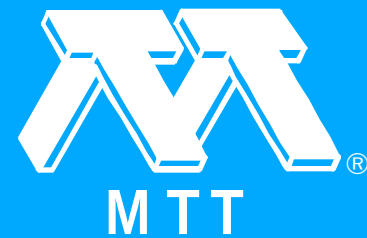
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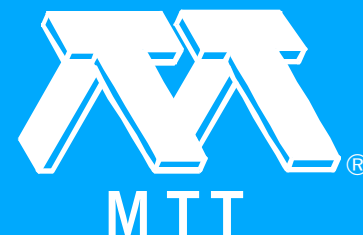


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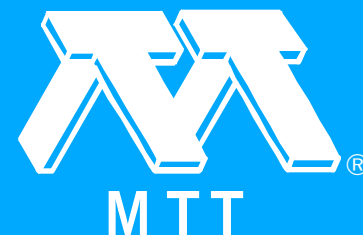
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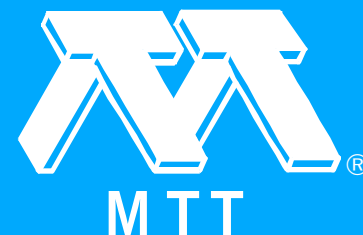
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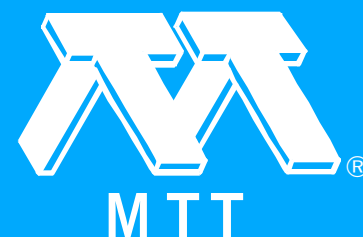
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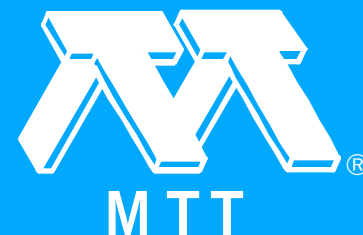
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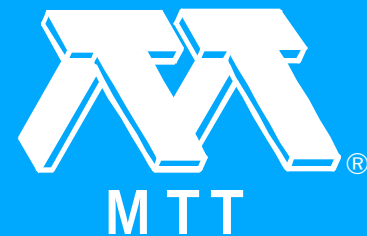
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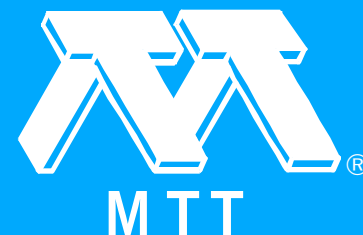
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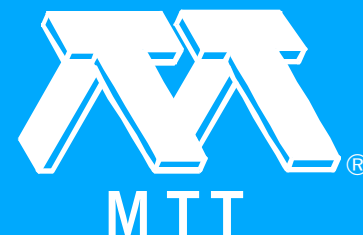
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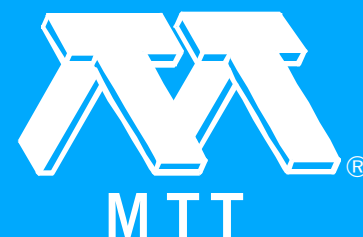
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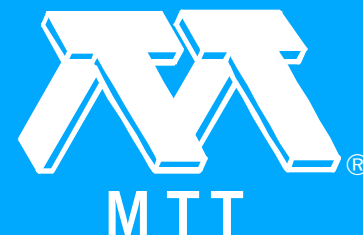
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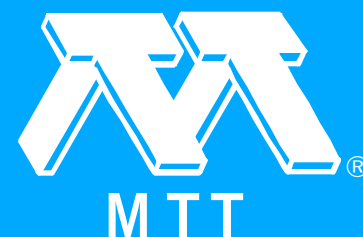
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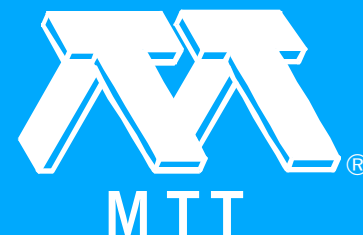
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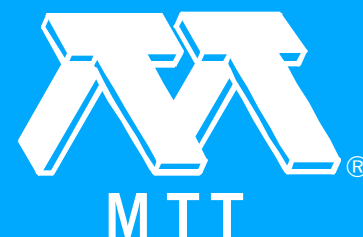
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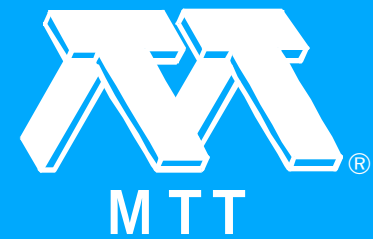
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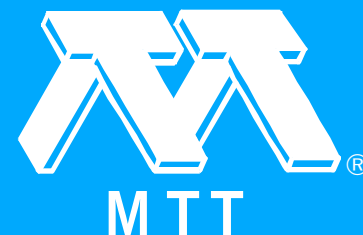
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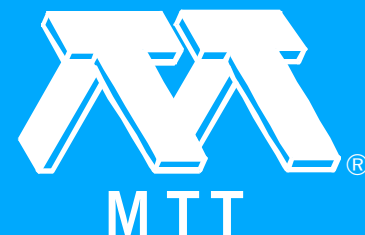
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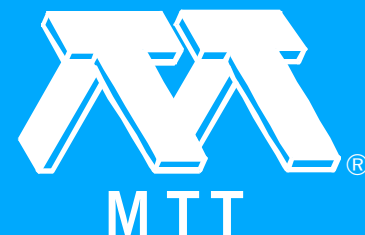
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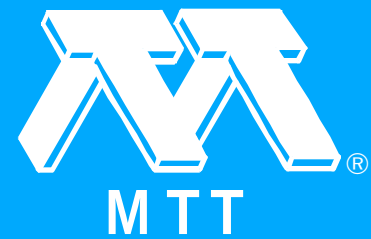
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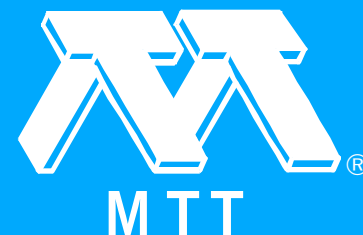
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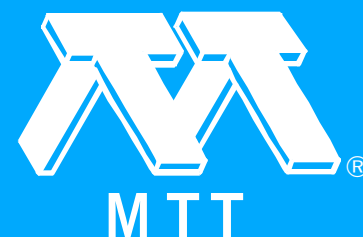
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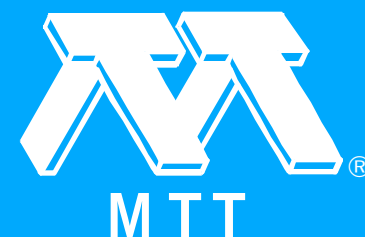
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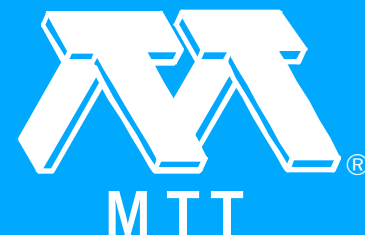
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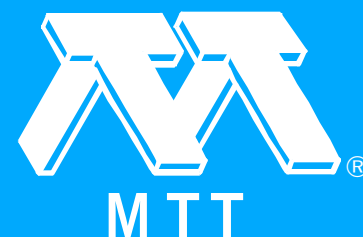
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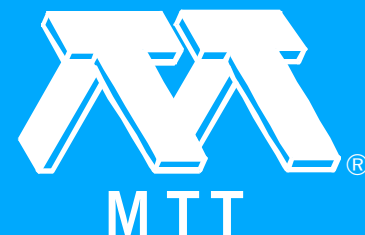
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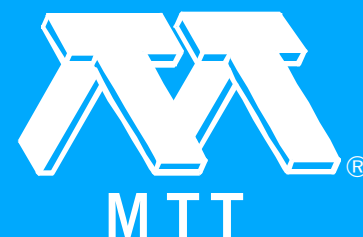
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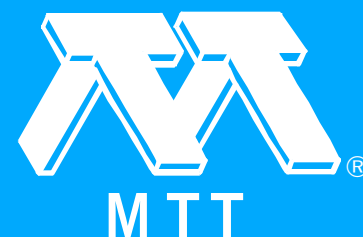
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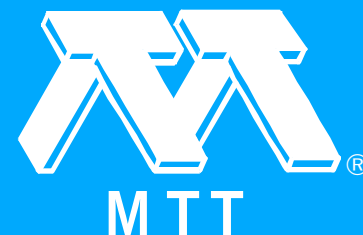
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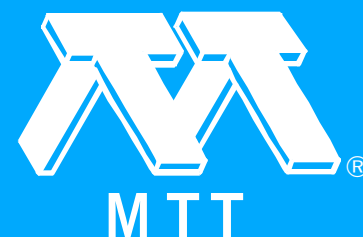
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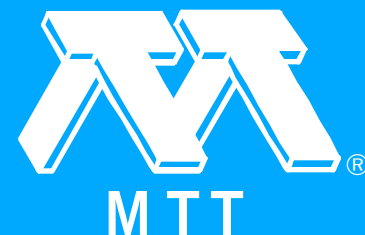
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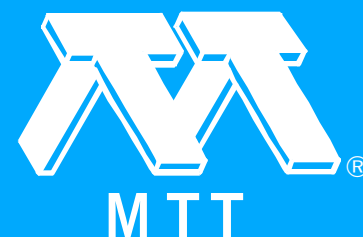
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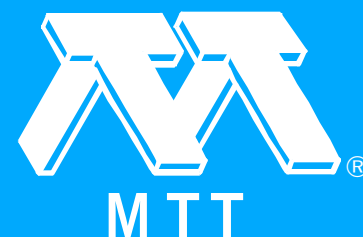
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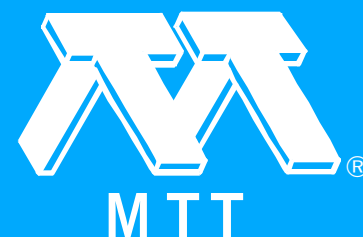
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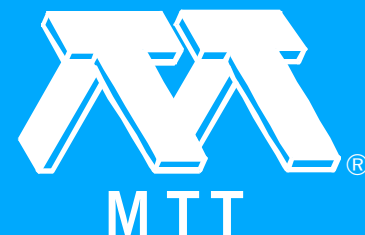
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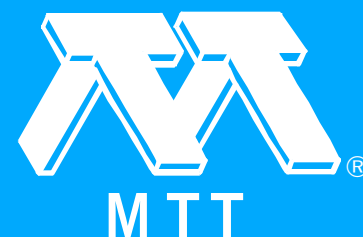
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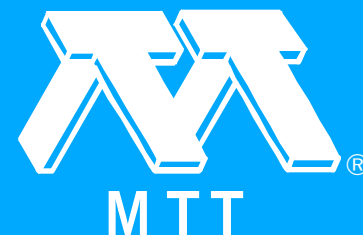
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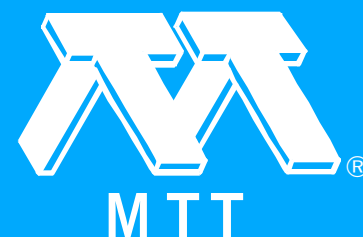
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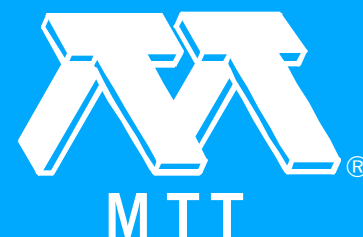
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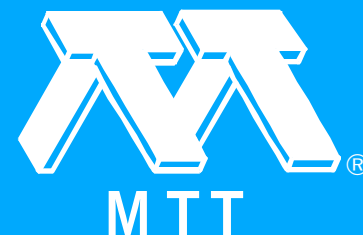
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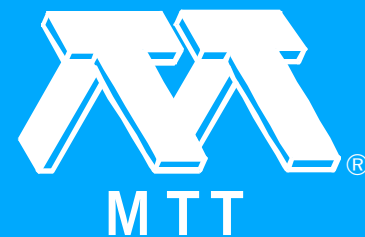
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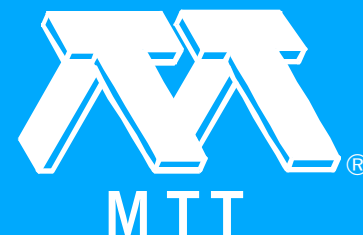
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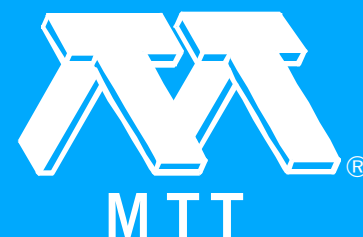
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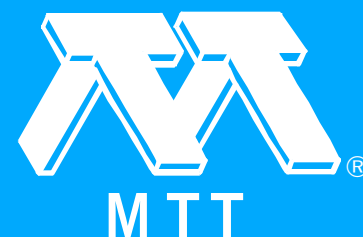
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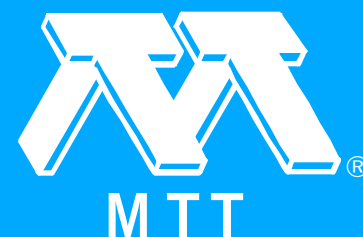
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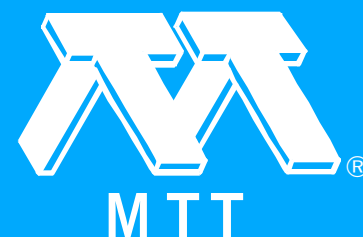
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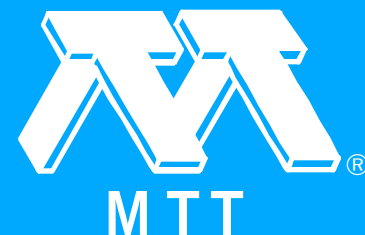
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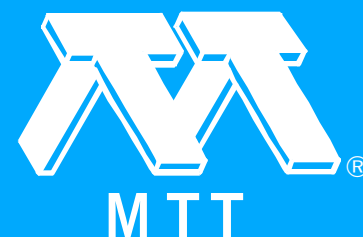
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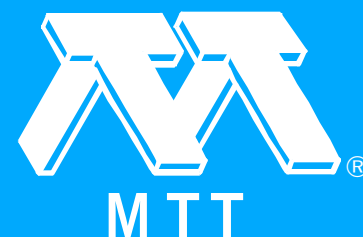
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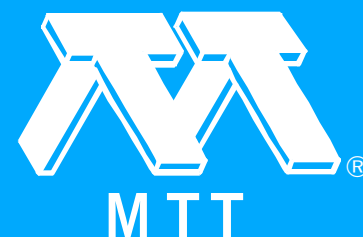
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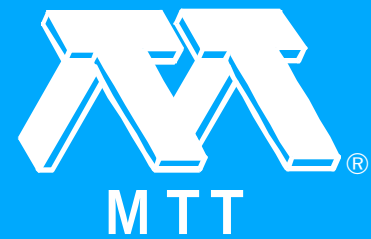
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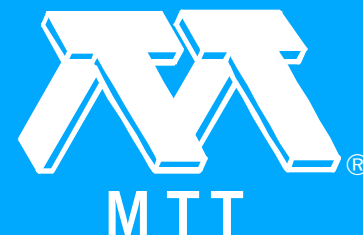
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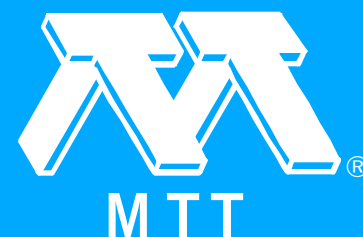
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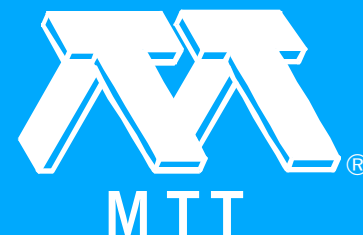
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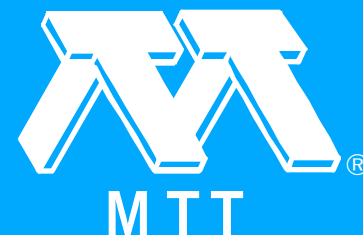
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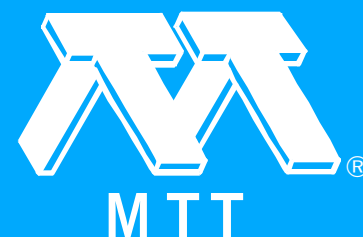
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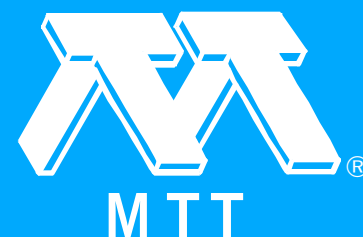
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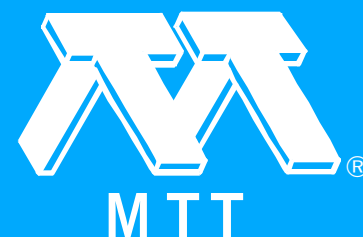
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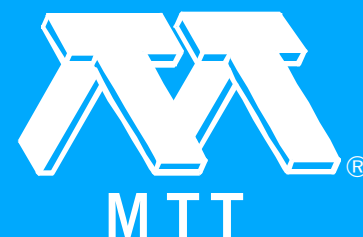
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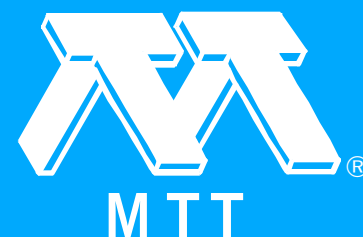
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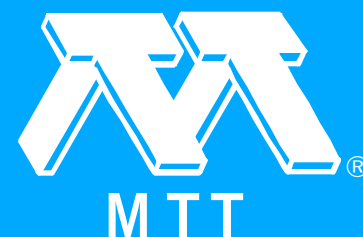
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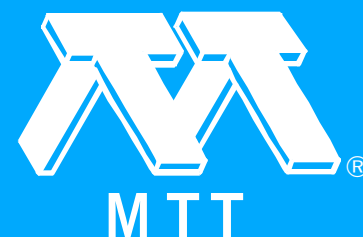
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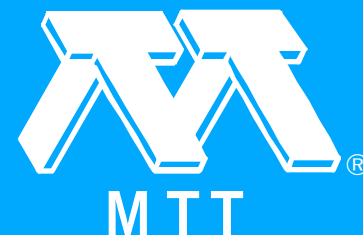
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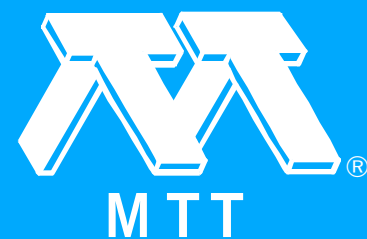
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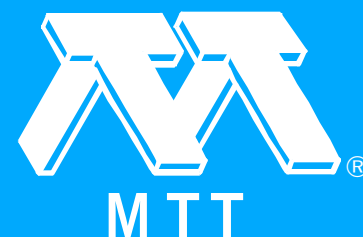
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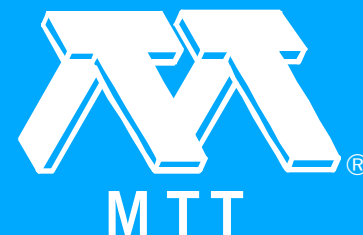
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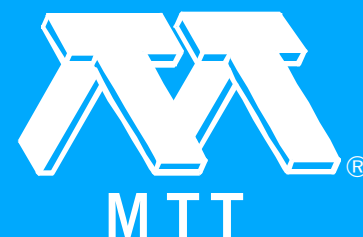
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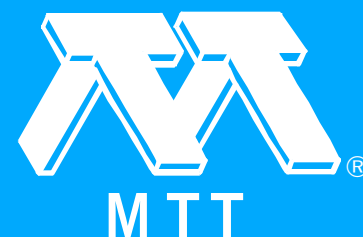
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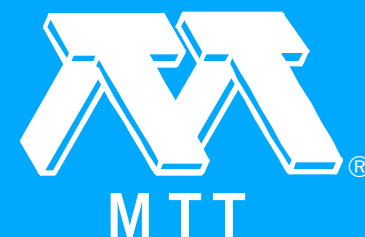
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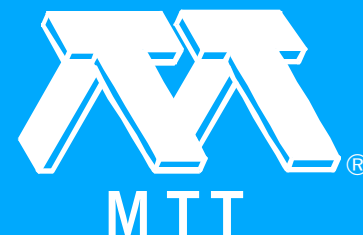
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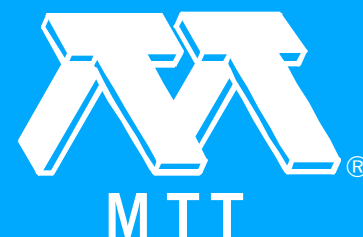
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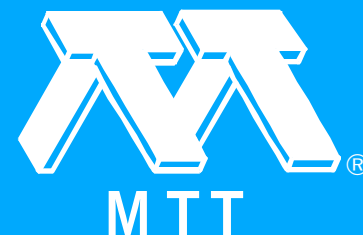
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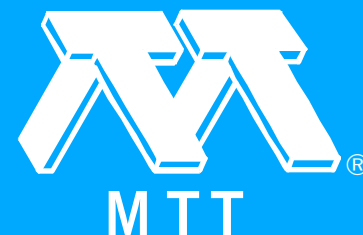
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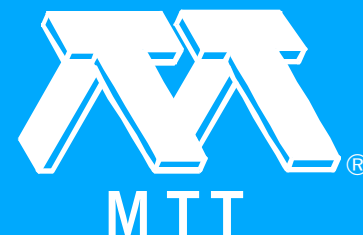
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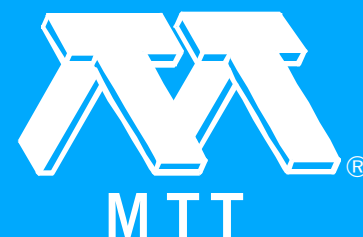
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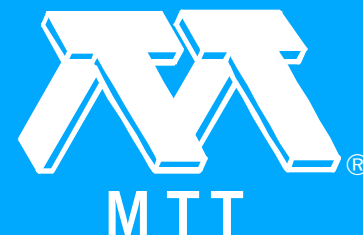
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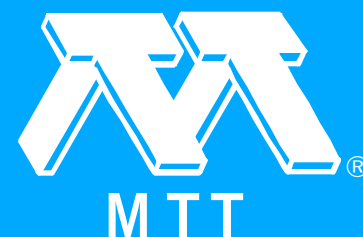
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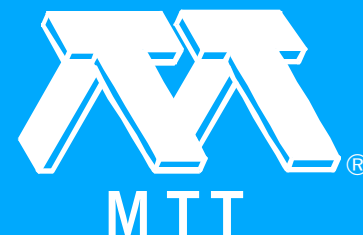
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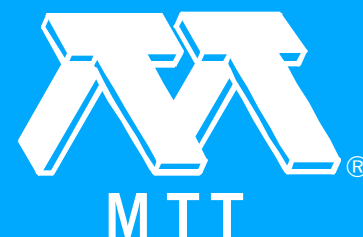
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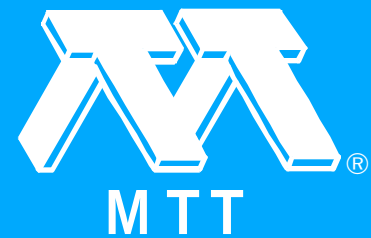
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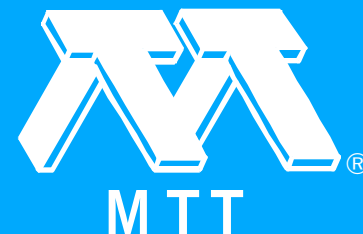
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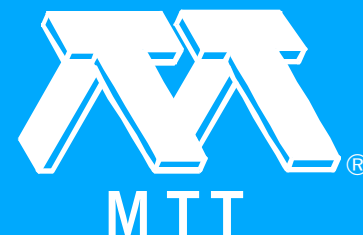
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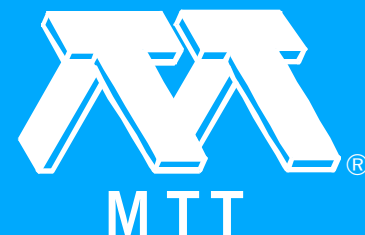
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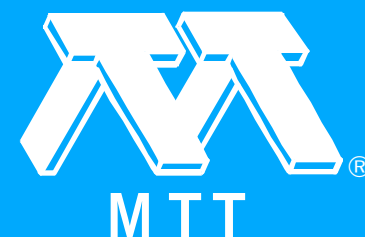
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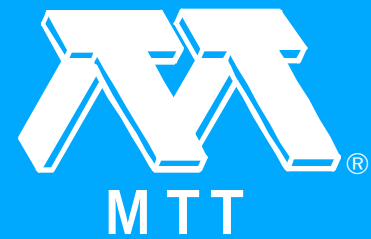
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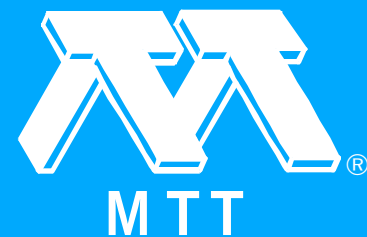
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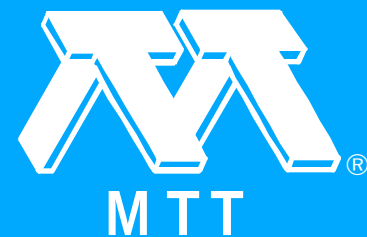
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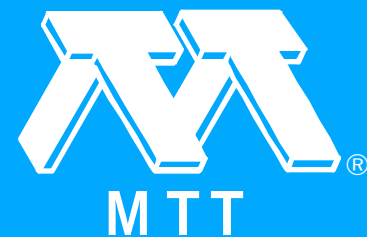
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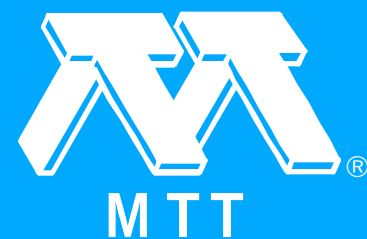
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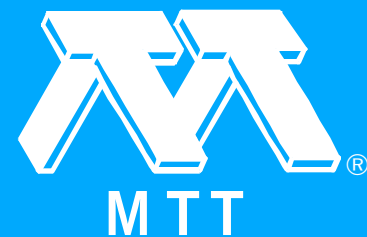
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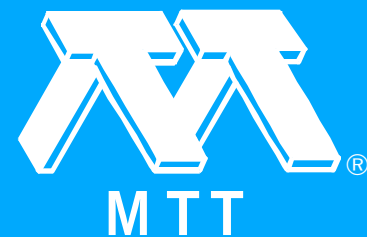
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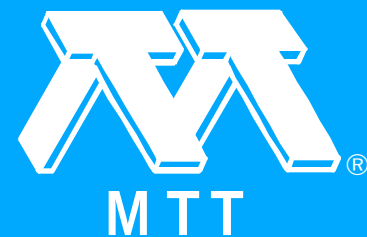
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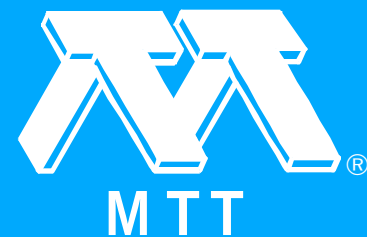
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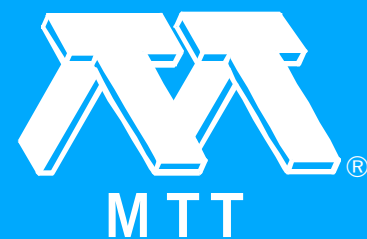
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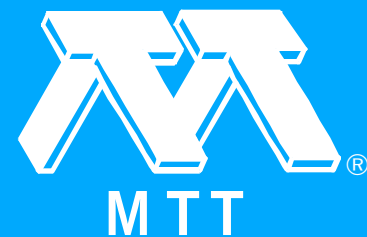
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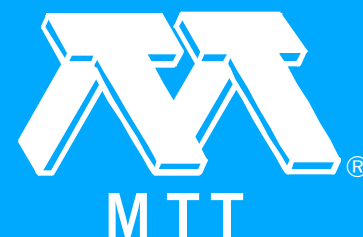
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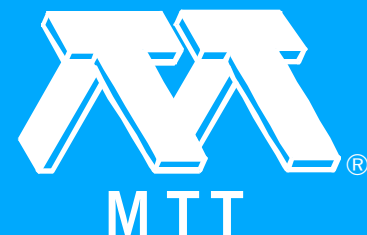
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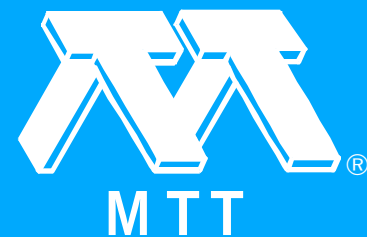
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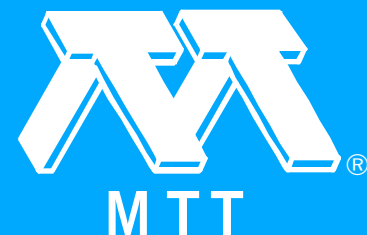
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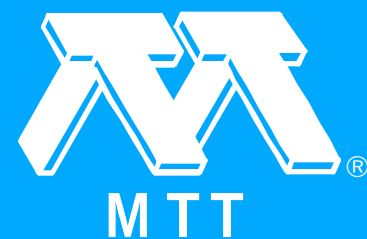
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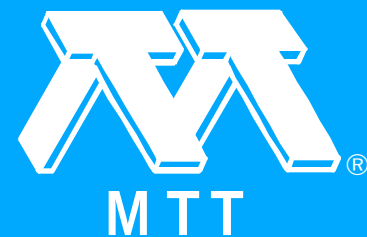
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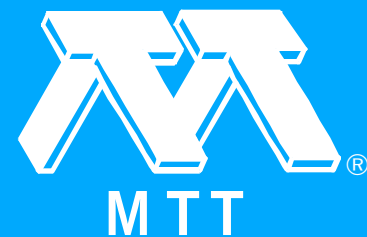
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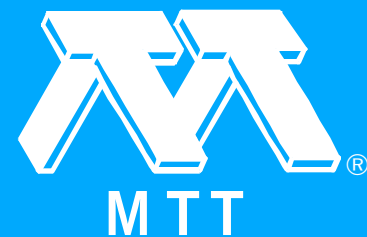
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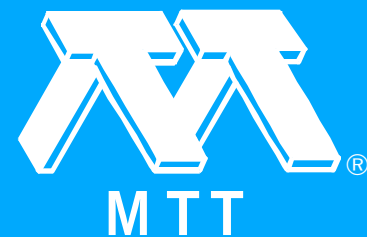
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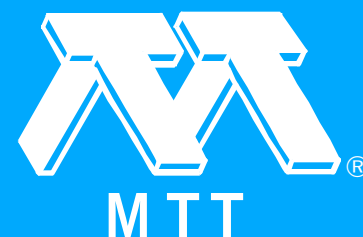
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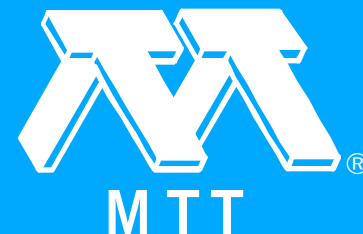
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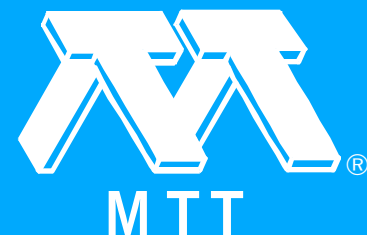
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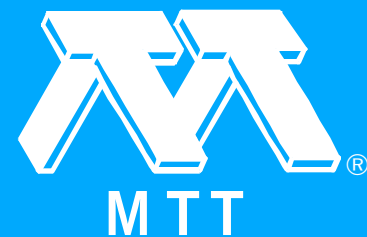
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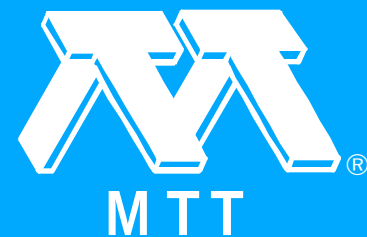
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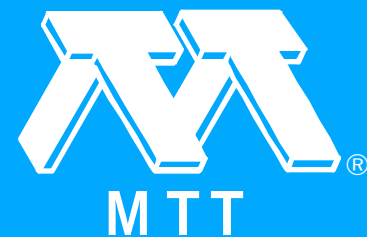
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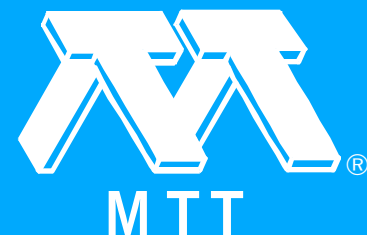
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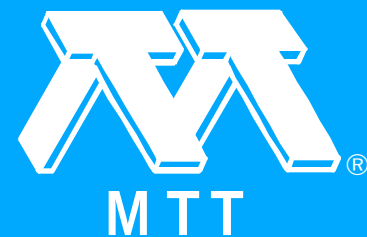
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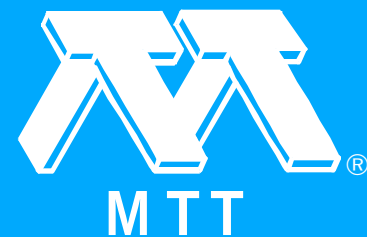
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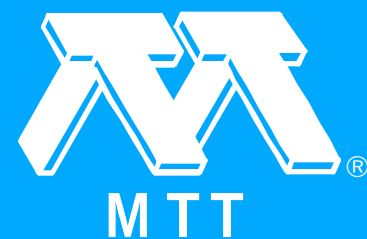
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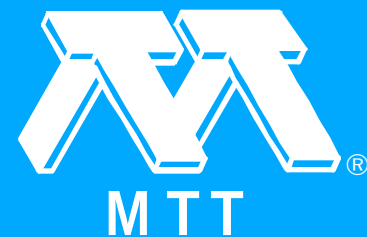
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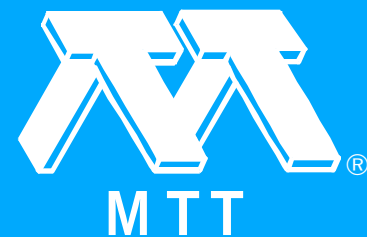
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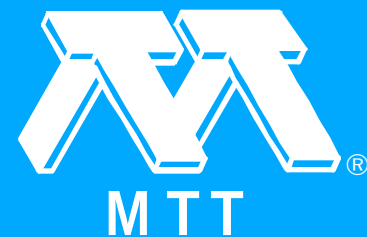
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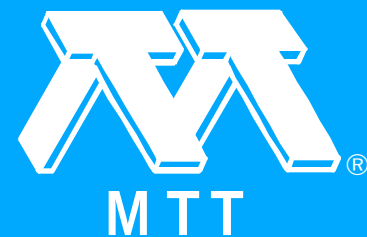
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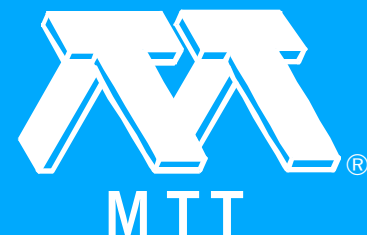
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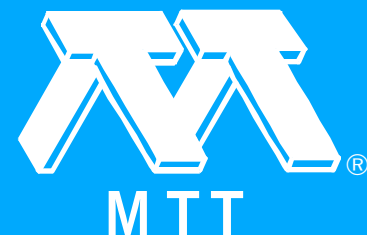
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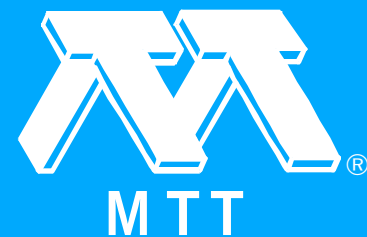
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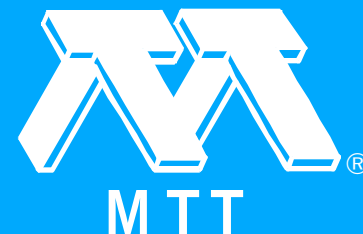
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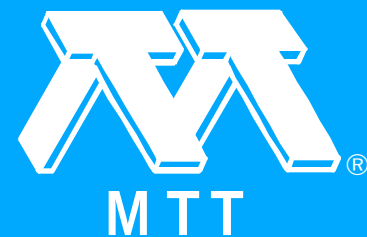
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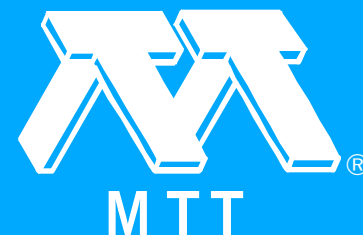
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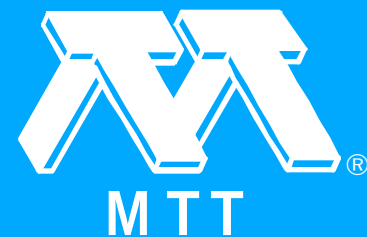
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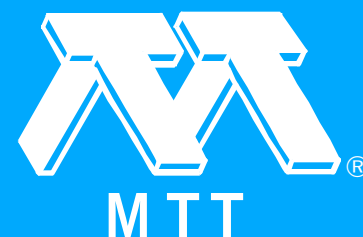
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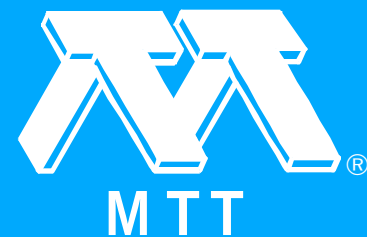
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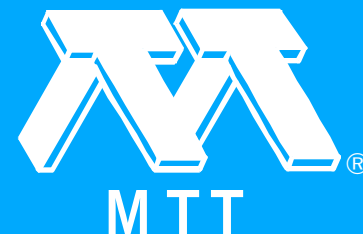
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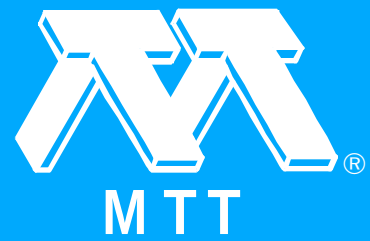
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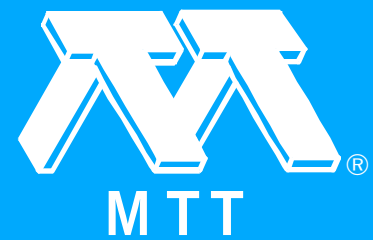
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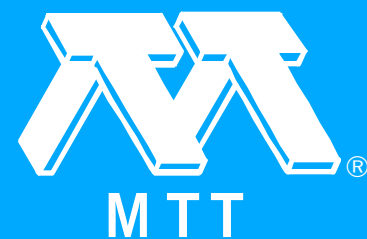
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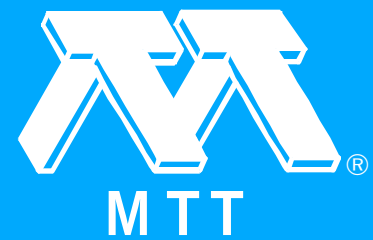
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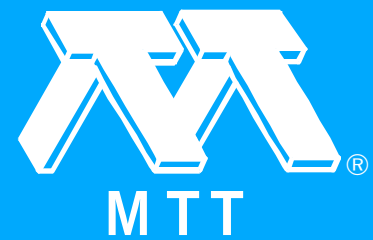
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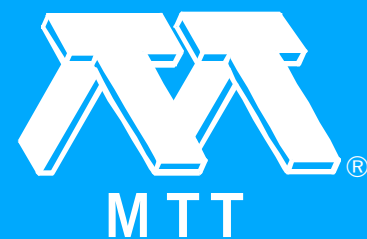
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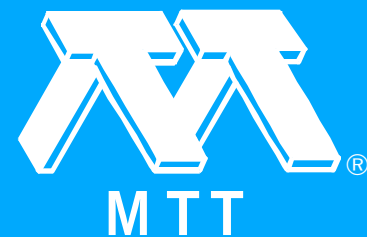
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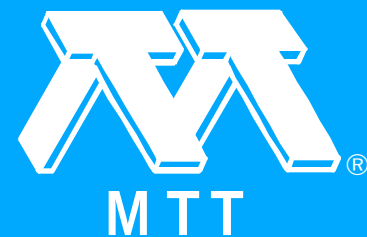
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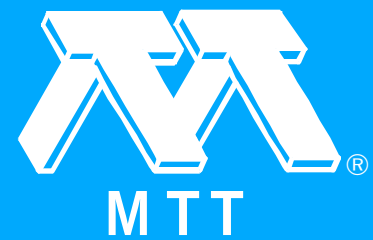
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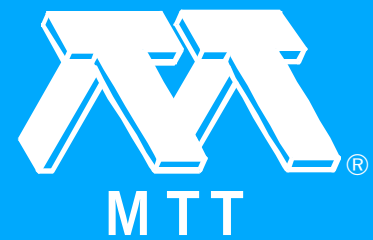
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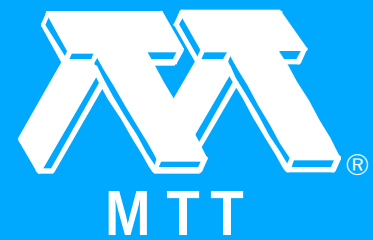
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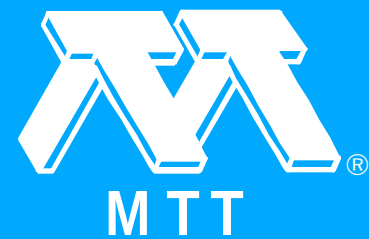
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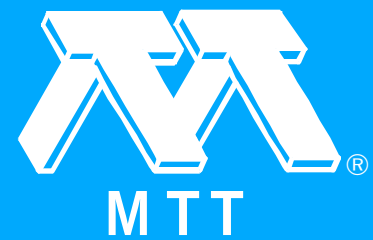
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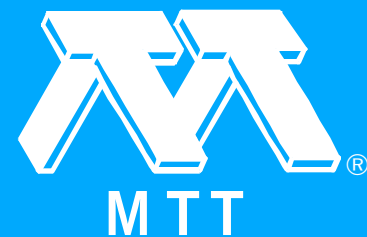
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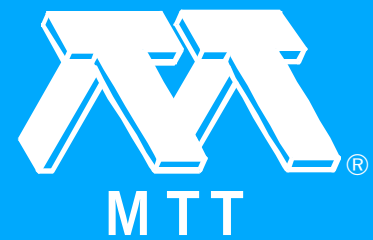
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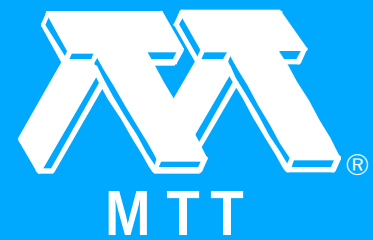
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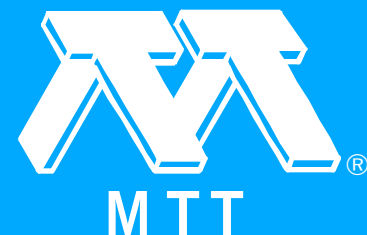
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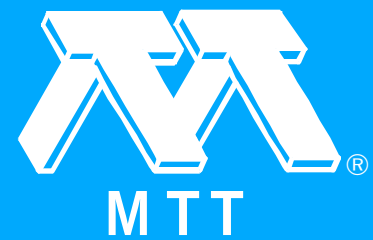
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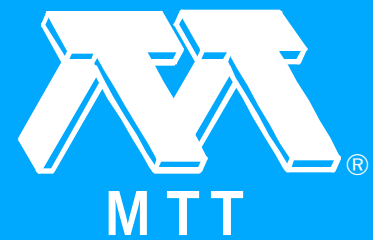
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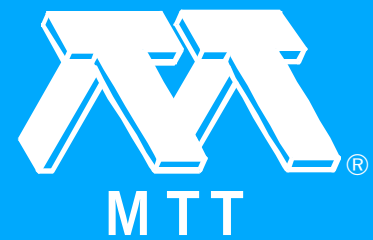
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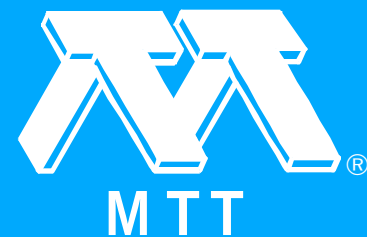
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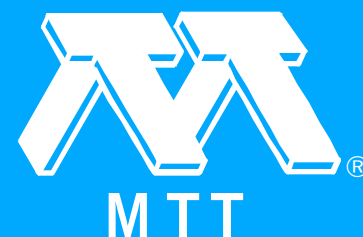
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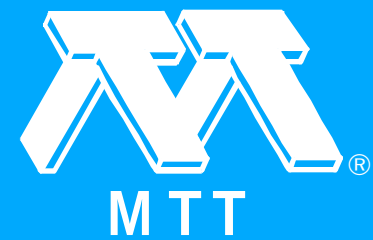
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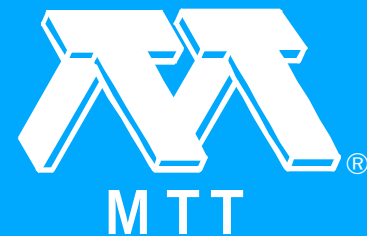
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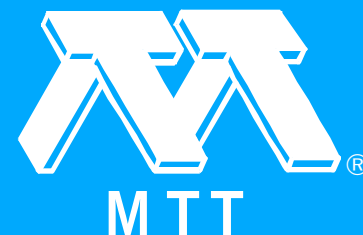
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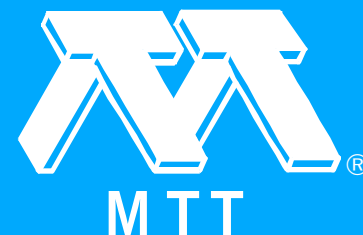
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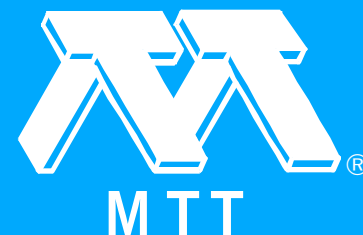
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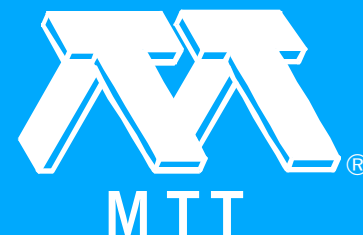


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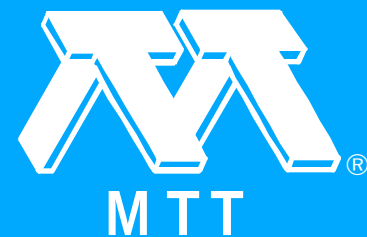
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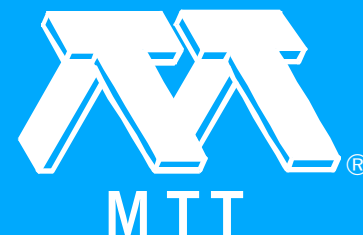


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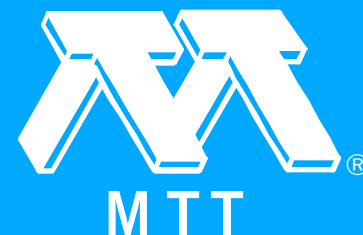
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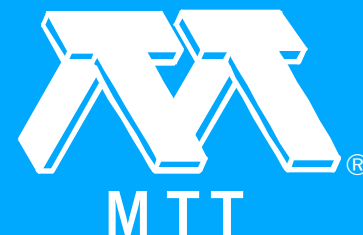
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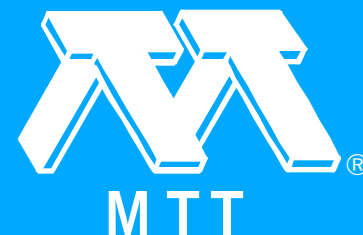
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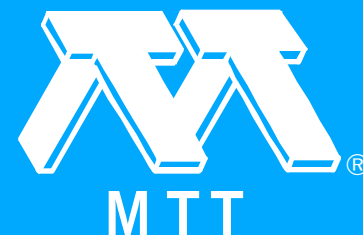
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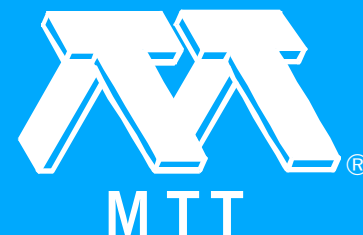
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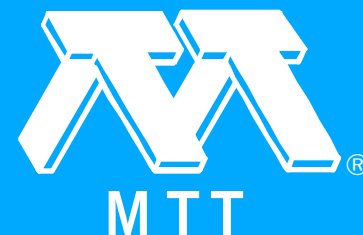
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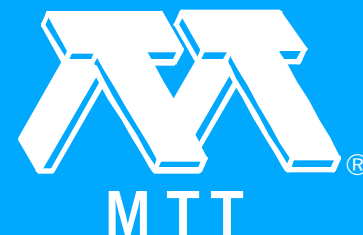
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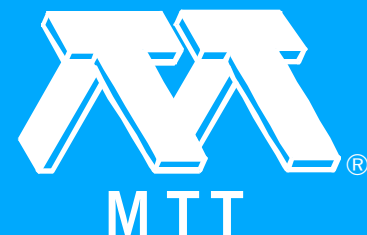
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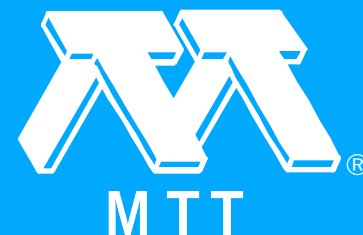
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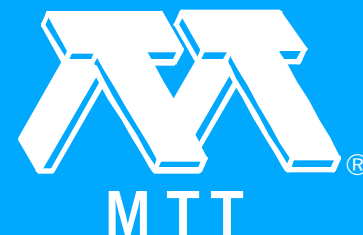
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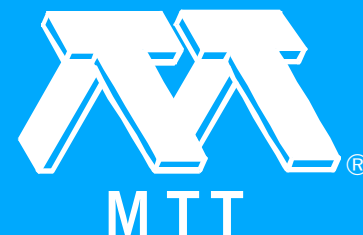
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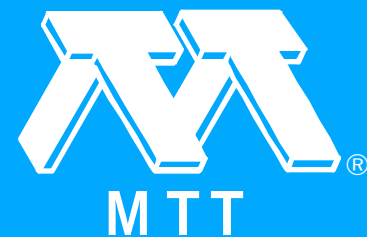
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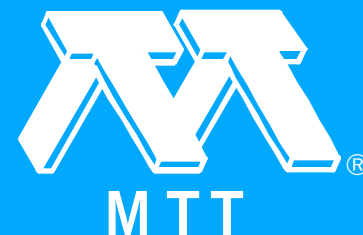
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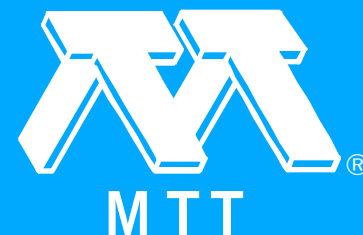
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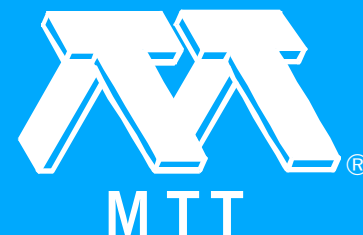
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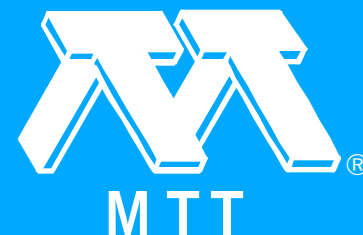
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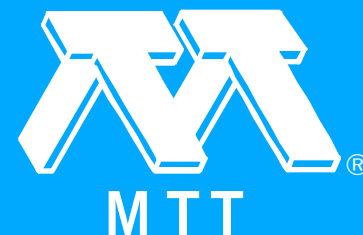
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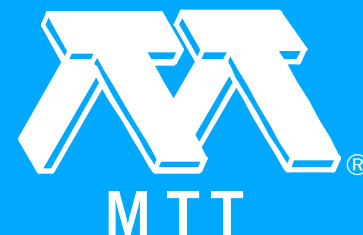
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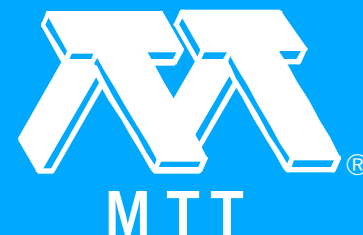
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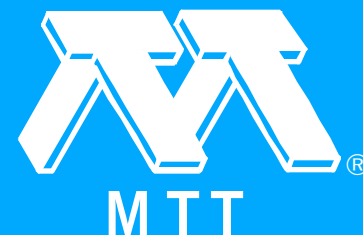
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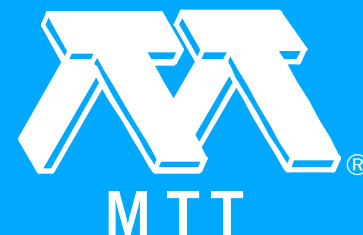
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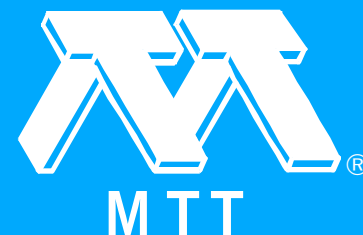
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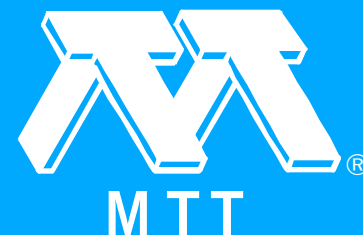
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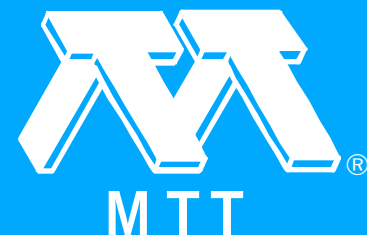
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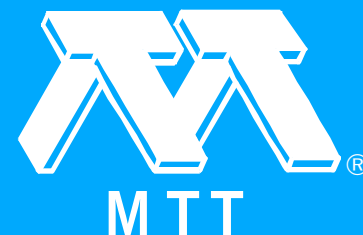
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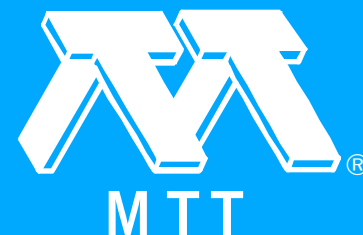
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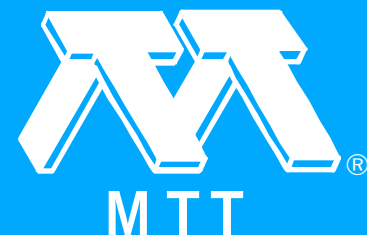
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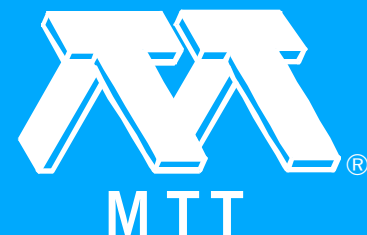
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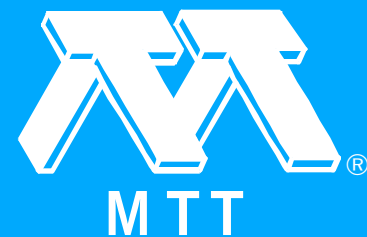
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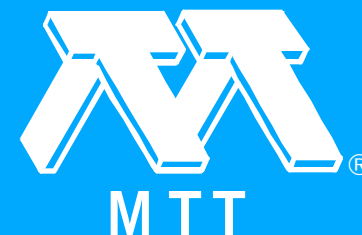
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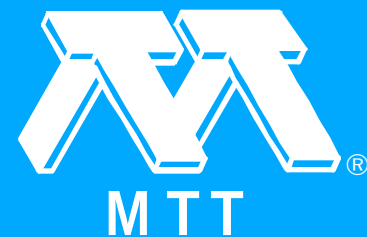
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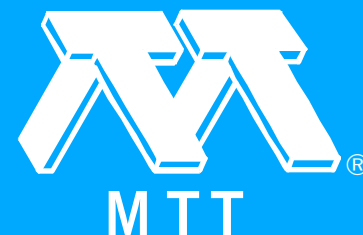
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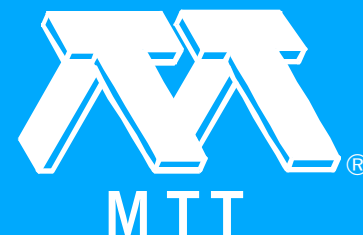
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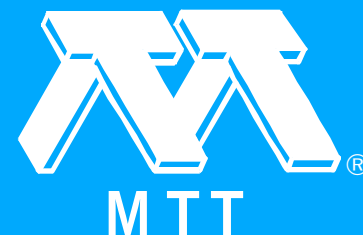
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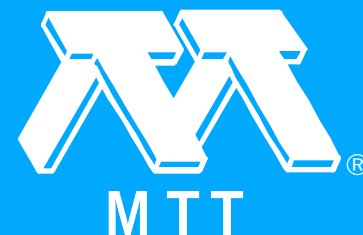
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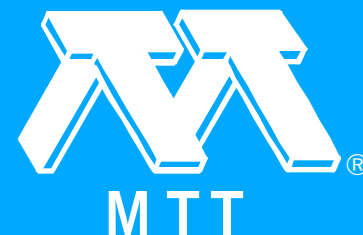
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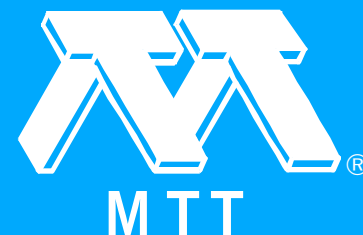
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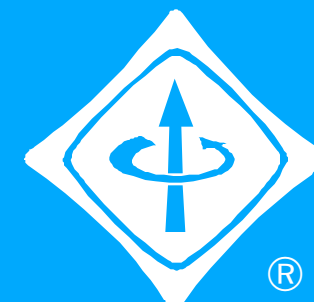
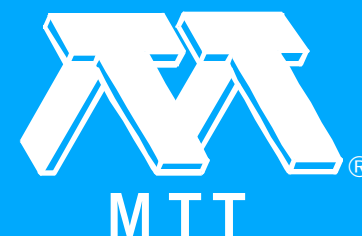
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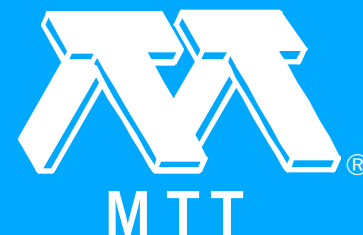
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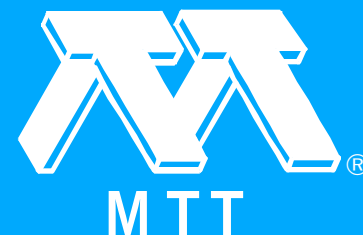
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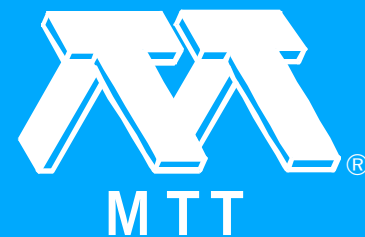
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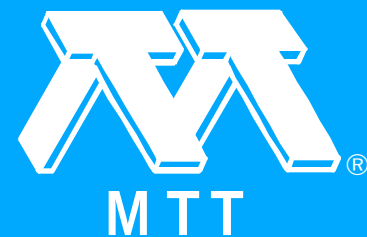
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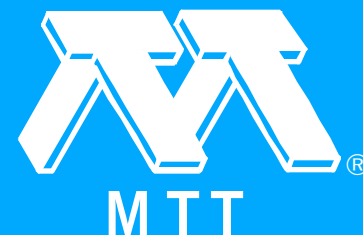
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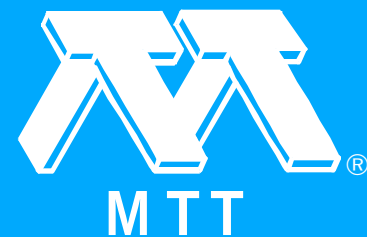
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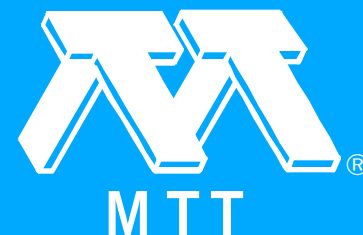
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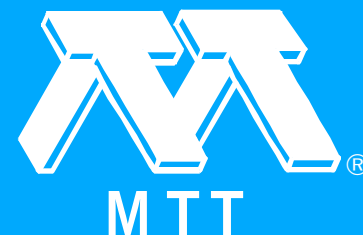
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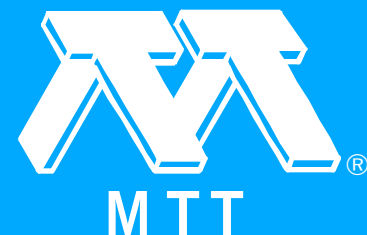
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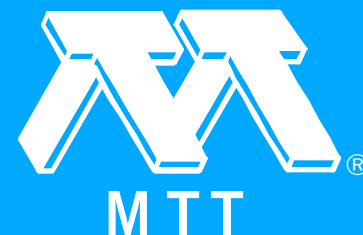
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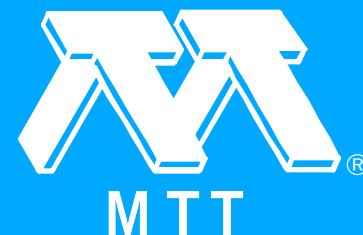
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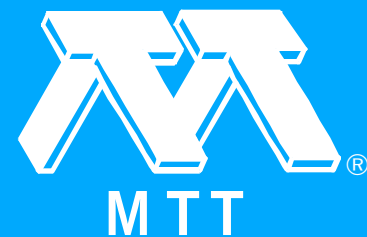
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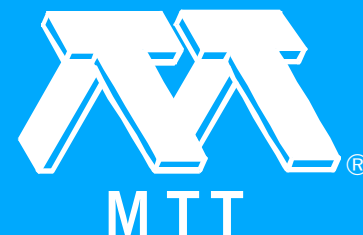
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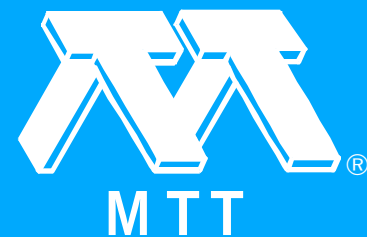
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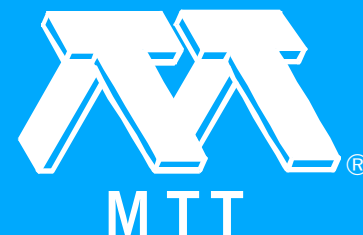
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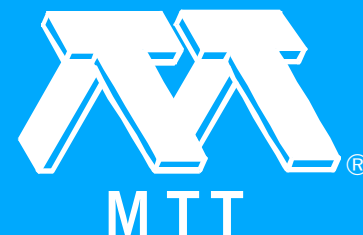
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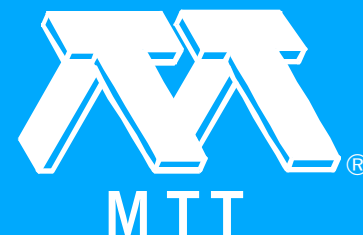
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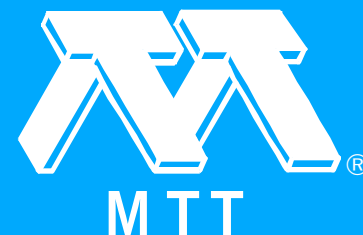
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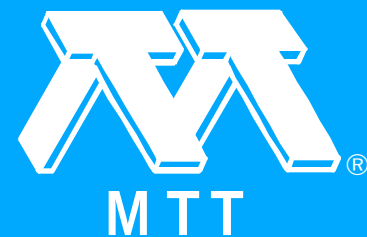
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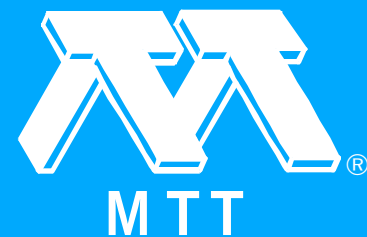
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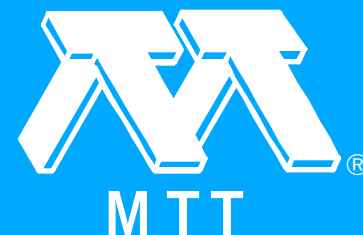
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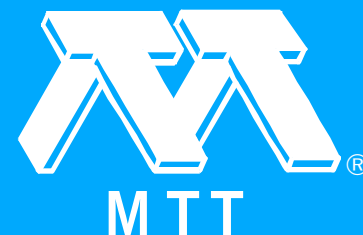
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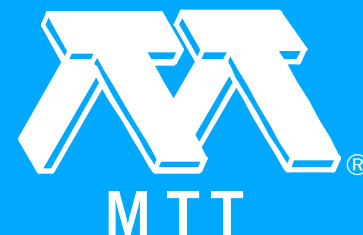
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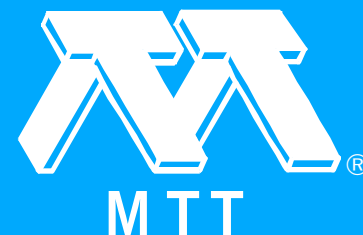
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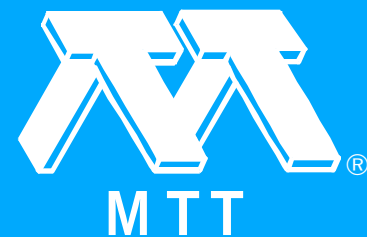
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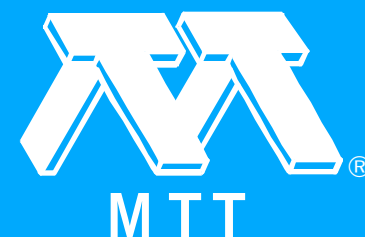
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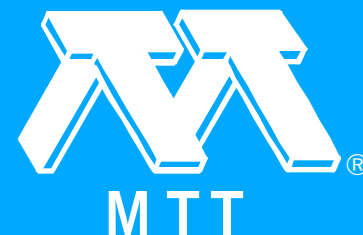
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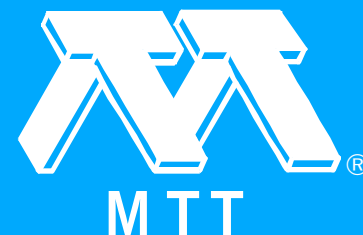
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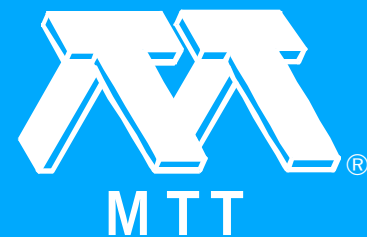
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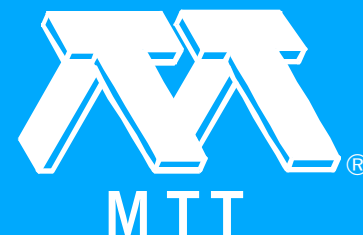
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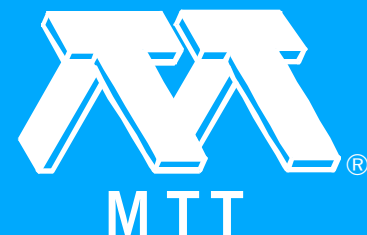
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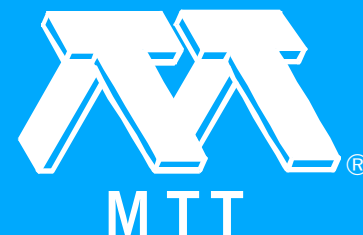
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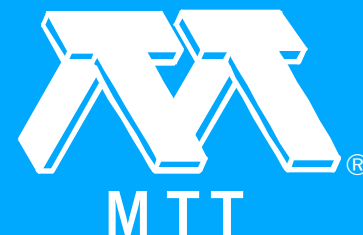
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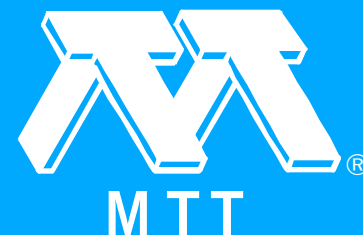
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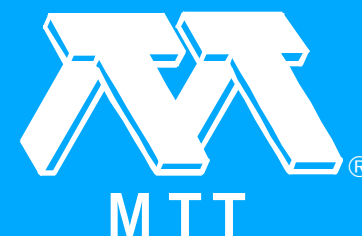
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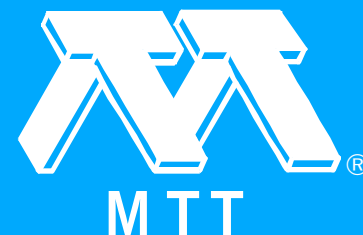
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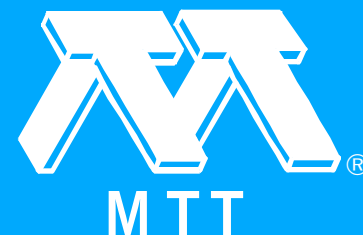
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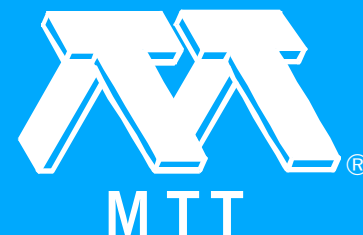
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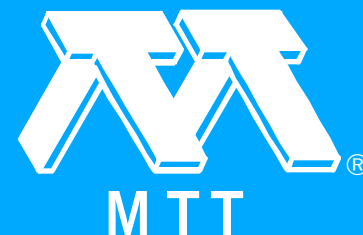
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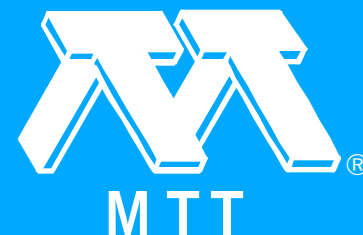
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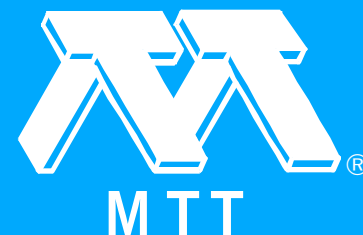
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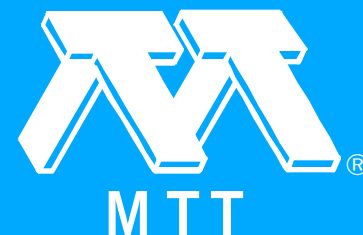
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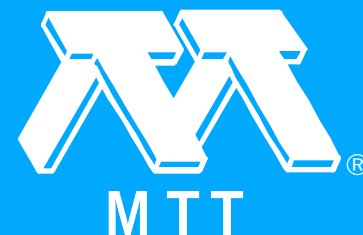
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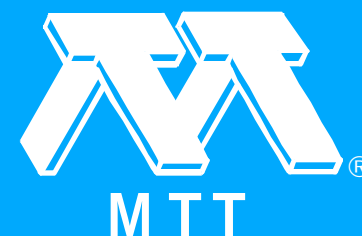
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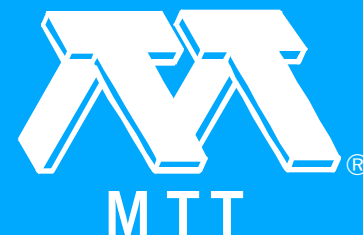
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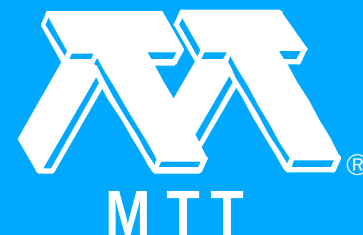
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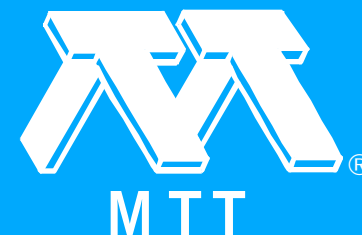
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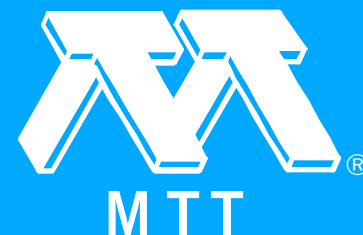
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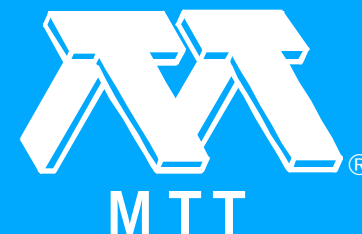
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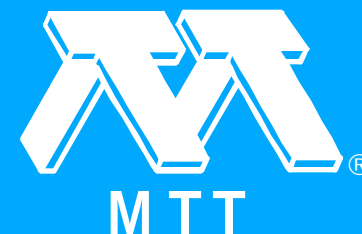
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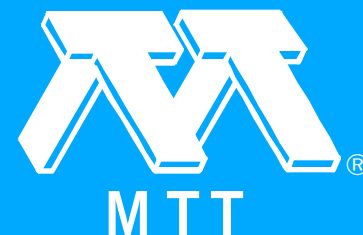
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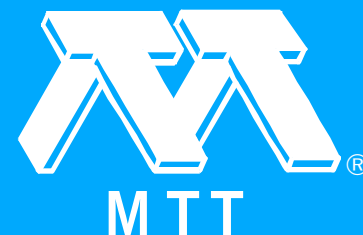
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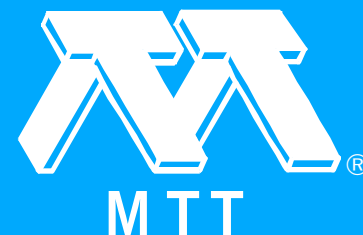
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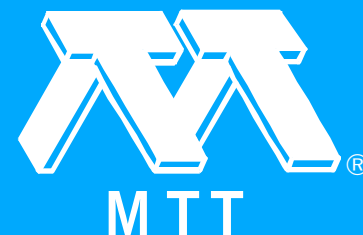
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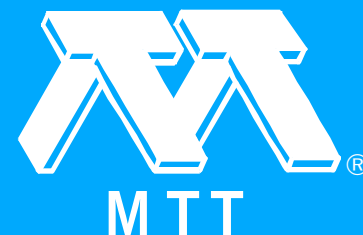
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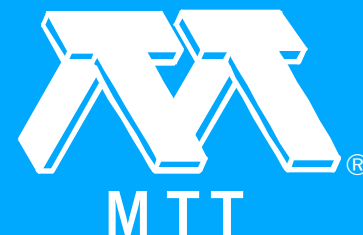
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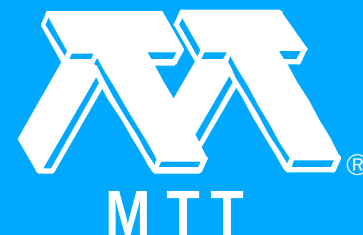
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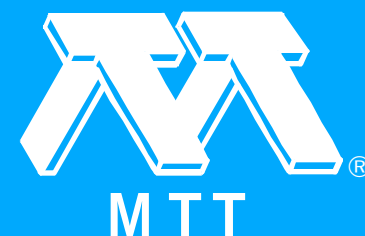
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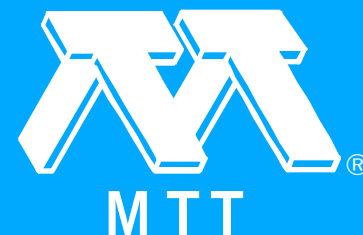
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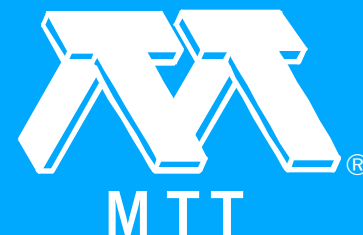
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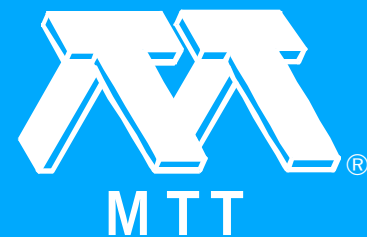
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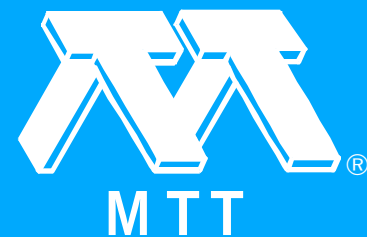
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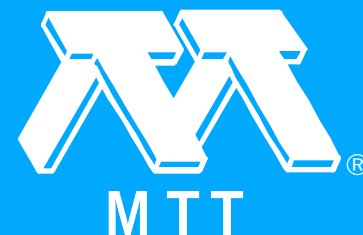
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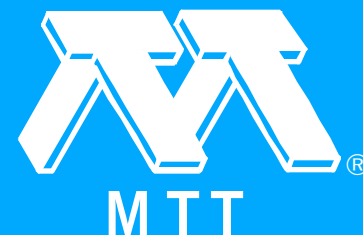
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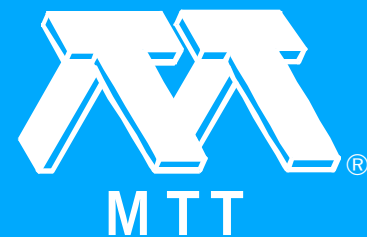
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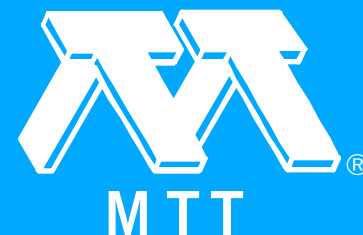


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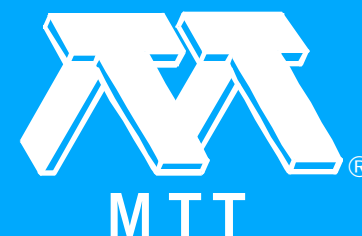
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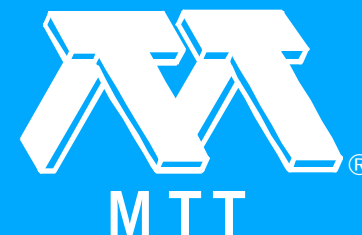
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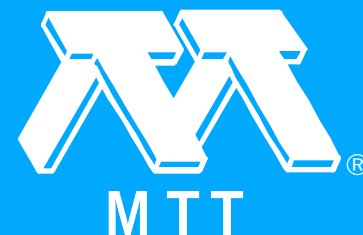
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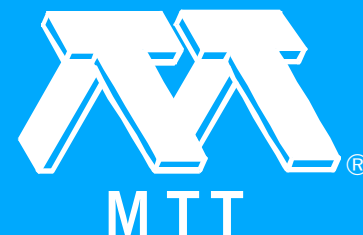
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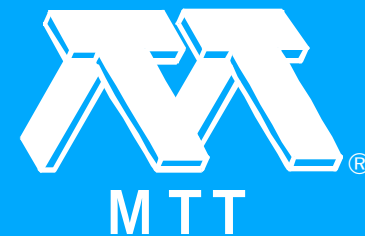
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Symmetrical and Asymmetrical Edge-Coupled-Line Impedance Transformers with a Prescribed Insertion Loss Design

A. Podcameni. "Symmetrical and Asymmetrical Edge-Coupled-Line Impedance Transformers with a Prescribed Insertion Loss Design." 1986 Transactions on Microwave Theory and Techniques 34.1 (Jan. 1986 [T-MTT]): 1-6.

Distributed element synthesis is used for obtaining edge-coupled-line impedance transformers. A gain factor is introduced in a characteristic transfer function representing a line and stub network. A redundant form of this network is identified with the equivalent circuit of the edge-coupled line pair. The transfer function is then used to synthesize Butterworth and Chebyshev coupled-line transformers. Design tables are presented for the symmetrical transformer. Transformation ratios different from unity are obtained only if the symmetrical structure is reflective. Asymmetrical transformers may exhibit nonunitary transformation ratios while being perfectly matched. Finally, applicability range is discussed.

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Excitation and Scattering of Guided Modes on a Helically Corrugated Dielectric Cylinder

M.T. Wlodarczyk and S.R. Seshadri. "Excitation and Scattering of Guided Modes on a Helically Corrugated Dielectric Cylinder." 1986 Transactions on Microwave Theory and Techniques 34.1 (Jan. 1986 [T-MTT]): 8-18.

The excitation and scattering of guided modes on a dielectric cylinder with a helical corrugation are investigated. A finite number of radiation modes and an infinite number of surface modes are considered, with the consequence that both the amplitude and phase of the interacting modes can be evaluated. The effect of the pitch angle on the coupling and conversion between the guided modes and the radiation modes of various polarizations is investigated. It is found that TE/sub 0/ guided modes undergo a Brewster phenomenon in the low permittivity dielectrics. The power conservation relation is developed and the reciprocity relations are treated. The aperture fields are used to study the radiation characteristics of a novel dielectric-helix antenna capable of yielding a circularly, elliptically, or linearly polarized radiation.

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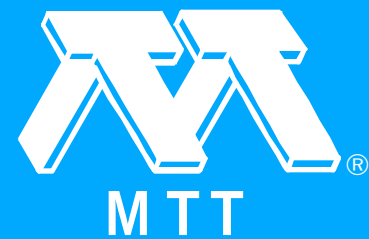


A GaAs MESFET Oscillator Quasi-Linear Design Method

H. Abe. "A GaAs MESFET Oscillator Quasi-Linear Design Method." 1986 Transactions on Microwave Theory and Techniques 34.1 (Jan. 1986 [T-MTT]): 19-25.

A simplified quasi-linear method is proposed to design a GaAs MESFET oscillator. By expressing the generated power $P_{\text{sub gen}}$ as a function of FET gate and drain RF voltages, it is possible to maximize $P_{\text{sub gen}}$ under the limiting conditions on intrinsic FET terminal voltage amplitudes. The feedback circuit elements to realize a GaAs MESFET oscillator are derived. An X-band GaAs MESFET oscillator was designed by the quasi-linear method and was fabricated by using microwave integrated-circuit technology.





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Exposure of Man in the Near-Field of a Resonant Dipole: Comparison Between Theory and Measurements

M.A. Stuchly, R.J. Spiegel, S.S. Stuchly and A. Kraszewski. "Exposure of Man in the Near-Field of a Resonant Dipole: Comparison Between Theory and Measurements." 1986 Transactions on Microwave Theory and Techniques 34.1 (Jan. 1986 [T-MTT]): 26-31.

The rate of the radio frequency energy deposition in a block model of the human body exposed in the near-field of a resonant dipole at 350 MHz was calculated using the moment method. Detailed maps of the electric field strength in a homogeneous model of a realistic shape under the same exposure conditions were obtained using a computer-controlled scanning system and an implantable electric field probe. A comparison of the measurement data with the calculations shows a relatively good agreement when average values over relatively large volumes are concerned; however, the calculations do not show large spatial gradients and tend to underestimate the magnitude of "hot spots" observed experimentally.

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Propagation of Waves through Magnetoplasma Slab within a Parallel-Plate Guide

H.-C. Chang, S.-K. Jeng, R.-B. Wu and C.H. Chen. "Propagation of Waves through Magnetoplasma Slab within a Parallel-Plate Guide." 1986 Transactions on Microwave Theory and Techniques 34.1 (Jan. 1986 [T-MTT]): 32-37.

By applying the variational equation is established for handling wave reaction theory, a variational propagation in a parallel-plate guide within which a magnetized inhomogeneous lossy plasma slab is inserted. The equation is then solved by the finite-element method along with the frontal solution algorithm. With such an approach, the reflection coefficient and the field distribution in the slab are obtained. In this study, the factors which may influence the propagation characteristics of the guide are studied. These factors include the plasma electron density, the strength and the direction of the static magnetic field, the width and the thickness of the slab, and the electron collision losses. A special modal expansion solution is also incorporated to investigate an anomalous numerical instability associated with the present numerical algorithm.

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In Situ Permittivity of Canine Brain: Regional Variations and Postmortem Changes

E.C. Burdette, P.G. Friederich, R.L. Seaman and L.E. Larsen. "In Situ Permittivity of Canine Brain: Regional Variations and Postmortem Changes." 1986 Transactions on Microwave Theory and Techniques 34.1 (Jan. 1986 [T-MTT]): 38-50.

A new probe-based measurements system was used to study dielectric properties of brain in situ, under conditions of induced physiological and pathological changes. Comparative measurements were made as function of time for 30 min prior to euthanasia and for 90-min post-mortem on the pia, the dura (both normal and anoxic), and in grey and white matter. All measurements were performed at 2450 MHz using a probe of diameter comparable to a 16-gauge hypodermic needle. Both conductivity and dielectric constant gradually decrease with time following $\text{CaCl}/\text{sub } 2/$ or KCl injection; however, following $\text{CaCl}/\text{sub } 2/$ induced cardiac arrest, values increased transiently upon injection, with subsequent decrease similar to KCl euthanasia. This indicates that the $\text{CaCl}/\text{sub } 2/$ injection causes a stronger and more abrupt change in blood flow to the brain, as expected from the different mechanisms by which the $\text{K}/\text{sup } +/$ and $\text{Ca}/\text{sup } 2+/$ ions cause cardiovascular arrest. Values of dielectric properties in homogenized brain--containing all tissue types--lay within the range of values recorded for different tissue types. Lower values for deeper tissue (white matter) reflect the reduced blood flow in comparison to that of the cortex (grey matter) and possible tissue differences. These regional differences are significant in determining absorption patterns for microwave exposure of the head.

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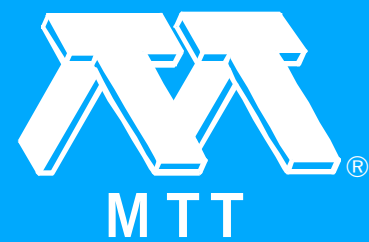
Slot-Coupled T-junction of TE/sub 11/ Coaxial to TE/sub 10/ Rectangular Waveguide

S.M. Saad. "Slot-Coupled T-junction of TE/sub 11/ Coaxial to TE/sub 10/ Rectangular Waveguide." 1986 Transactions on Microwave Theory and Techniques 34.1 (Jan. 1986 [T-MTT]): 51-57.

A solution is presented to the problem of a slot-coupled T-junction of a TE/sub 11/ -mode coaxial to a TE/sub 10/ -mode rectangular waveguide. A variational technique is employed which combines the reaction concept with the field representation of a waveguide slot and leads to a closed-form solution for the junction scattering matrix. Numerical examples illustrate the characteristics of such a junction in practical applications. Good agreement between theory and experiment is obtained. Design criteria and examples are presented and discussed.

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Image Parameter Design of Noncommensurate Distributed Structures: An Application to Microstrip Low-Pass Filters

M. Salerno, R. Sorrentino and F. Giannini. "Image Parameter Design of Noncommensurate Distributed Structures: An Application to Microstrip Low-Pass Filters." 1986 Transactions on Microwave Theory and Techniques 34.1 (Jan. 1986 [T-MTT]): 58-65.

The direct application of the image parameter method (IPM) to distributed structures is suggested in order to overcome some limitations of classical design methods for microwave filters. Several advantages are pointed out: 1) Wider degrees of freedom are obtained using noncommensurate structures. 2) The IPM can be applied directly to a microwave structure without any use of lumped prototypes. 3) Possible technological constraints can be easily incorporated in the design procedure. 4) Filters designed according to the IPM can be cascaded together in order to improve their characteristics. An application to the design of a class of microstrip low-pass filters, which have been previously designed on a low-frequency approximation basis, is illustrated in detail. The IPM is shown to provide an effective control of both the passband and stopband, leading to filters with improved characteristics, as demonstrated by the experimental results.

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A Dispersion Model for Coupled Microstrips

V.K. Tripathi. "A Dispersion Model for Coupled Microstrips." 1986 Transactions on Microwave Theory and Techniques 34.1 (Jan. 1986 [T-MTT]): 66-71.

The frequency-dependent propagation characteristics of symmetrical, nonsymmetrical, and multiple coupled microstrips are evaluated by utilizing a directly coupled parallel-plate ideal waveguide model. The closed-form expressions for the frequency-dependent parameters of this proposed semi-empirical utility model are derived in terms of the quasi-static parameters of the coupled microstrip structure. These model parameters are then used to evaluate the frequency-dependent propagation characteristics, including the normal-mode effective dielectric constants and impedances of the coupled microstrips. These results are found to be in good agreement with all the published experimental results and the numerically computed values for symmetrical and nonsymmetrical coupled microstrips. The model should be useful in the computer-aided design of coupled microstrip structures at higher frequencies where the dispersion effects become important.



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Study of a Noise Amplification Mechanism in Gyrotrons

K.R. Chen and K.R. Chu. "Study of a Noise Amplification Mechanism in Gyrotrons." 1986 Transactions on Microwave Theory and Techniques 34.1 (Jan. 1986 [T-MTT]): 72-79.

The electrostatic cyclotron instability driven by a relativistic mechanism is analyzed with a small-signal theory and is shown to be a significant noise amplification mechanism in gyrotrons. The mode is localized in the electrotron beam, with a growth rate strongly dependent on the wavelength and electron density but insensitive to the velocity spread.

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Abstracts

A Broad-Band, Automated, Stripline Technique for the Simultaneous Measurement of Complex Permittivity and Permeability

W. Barry. "A Broad-Band, Automated, Stripline Technique for the Simultaneous Measurement of Complex Permittivity and Permeability." 1986 Transactions on Microwave Theory and Techniques 34.1 (Jan. 1986 [T-MTT]): 80-84.

A broad-band automated technique for making frequency-swept measurements of complex permittivity and permeability simultaneously is described. ϵ_r and μ_r are computed from S-parameter measurements made on a strip transmission-line device loaded with the material under test. The derivation of ϵ_r and μ_r as functions of S_{11} and S_{21} is included, as well as a practical design for a stripline sample holder. Measured ϵ_r and μ_r data for several dielectrics and ceramic ferrites is also presented. The technique has been found to have an overall accuracy of better than ± 5 percent.



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Calculating the Characteristic Impedance of Finlines by Transverse Resonance Method

J. Bornemann and F. Arndt. "Calculating the Characteristic Impedance of Finlines by Transverse Resonance Method." 1986 Transactions on Microwave Theory and Techniques 34.1 (Jan. 1986 [T-MTT]): 85-92.

The characteristic impedance of finlines with up to three slots is calculated by a rigorous hybrid-mode analysis which includes the finite metallization thickness and finite depth of the mounting grooves. The transverse resonance principle utilized reduces considerably the order of the involved matrix eigenvalue problem. The propagation constants for the fundamental HE/sub 1/ mode (and EH/sub 0/ mode at related structures), as well as for the higher order modes (up to HE/sub 7/), and the characteristic impedances for the fundamental modes are computed as a function of frequency for the bilateral and unilateral finline, as well as for the unilateral finline with two coupled slots, and an additional slot on the opposite side of the substrate surface. The finite metallization thickness and mounting groove depth considered show significant influence on the behavior of the characteristic impedance.

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Exact Simulation and Sensitivity Analysis of Multiplexing Networks

J.W. Bandler, S. Daijavad and Q.-J. Zhang. "Exact Simulation and Sensitivity Analysis of Multiplexing Networks." 1986 Transactions on Microwave Theory and Techniques 34.1 (Jan. 1986 [T-MTT]): 93-102.

This paper presents a novel approach to the simulation and sensitivity analysis of multiplexing networks. All computations are performed efficiently utilizing the concept of forward and reverse analysis which is elegant and effective in cascaded circuit analysis. Formulas are derived for such responses as input or output reflection coefficient, common port and channel output port return losses, insertion loss, gain slope, and group delay. Exact sensitivities w.r.t. all variables of interest, including frequency, are evaluated. The fundamental assumption is that the transmission matrices for the individual components of the network and their sensitivities w.r.t. possible variables inside them are available. An explicit algorithm is provided describing the details of the computational aspects of our theory. The formulas are applied to the optimal design of practical contiguous or noncontiguous band multiplexer consisting of multicavity filters distributed along a waveguide manifold. An example of optimizing a practical 12 channel, 12-GHz contiguous band multiplexer without dummy channels, which is the state-of-the-art structure used as the output multiplexer in satellite transponders, is presented.

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Finite-Element Analysis of H-Plane Waveguide Junction with Arbitrarily Shaped Ferrite Post

M. Koshiba and M. Suzuki. "Finite-Element Analysis of H-Plane Waveguide Junction with Arbitrarily Shaped Ferrite Post." 1986 Transactions on Microwave Theory and Techniques 34.1 (Jan. 1986 [T-MTT]): 103-109.

A numerical approach for solving the problem of H-plane waveguide junctions with lossy ferrite posts of arbitrary shape is proposed. The junctions are allowed to have arbitrary cross section. The approach is a combination of the finite-element method and the analytical method. To show the validity and usefulness of the method, Y-junction circulators with a circular ferrite post are considered. Our results agree well with earlier experimental and theoretical results. The performances of Y-junction circulators with a triangular equilateral ferrite post or a triangular ferrite post having depressed sides are investigated. The influences of the ferrite losses on the performance are examined.

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



Abstracts

A Fast and Reliable Method for Computer Analysis of Microwave Mixers

B. Schuppert. "A Fast and Reliable Method for Computer Analysis of Microwave Mixers." 1986 Transactions on Microwave Theory and Techniques 34.1 (Jan. 1986 [T-MTT]): 110-119.

In this paper, a numerical method is presented for analyzing microwave mixers. Particular consideration is given to the solution of the nonlinear pumping problem of real Schottky-barrier diodes. The new technique has a significantly improved convergence rate, which is demonstrated by means of direct comparisons with other methods. A convergence test procedure is proposed and applied which uses randomly generated harmonic impedances. The proposed numerical technique for solving the nonlinear and linear problem is extended to the analysis of balanced mixers. Fabricated planar balanced mixers are analyzed, both theoretically and experimentally, in a separate paper.



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Analysis and Design of Microwave Balanced Mixers

B. Schuppert. "Analysis and Design of Microwave Balanced Mixers." 1986 Transactions on Microwave Theory and Techniques 34.1 (Jan. 1986 [T-MTT]): 120-128.

Based on the theory given in [1], planar balanced mixers are analyzed for fundamental and harmonic mixing, mixing product recovery, and the effect of circuit and diode parameters on the conversion loss. The successful incorporation of the proposed method in a CAD procedure is demonstrated through the development of a multioctave balanced mixer with $L = 6 \text{ dB} \pm 1 \text{ dB}$ from 1.5 to 12.75 GHz.

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Abstracts

Self-Adjoint Vector Variational Formulation for Lossy Anisotropic Dielectric Waveguide

S.R. Cvetkovic and J.B. Davies. "Self-Adjoint Vector Variational Formulation for Lossy Anisotropic Dielectric Waveguide." 1986 Transactions on Microwave Theory and Techniques 34.1 (Jan. 1986 [T-MTT]): 129-134.

This paper presents the derivation of a new self-adjoint variational formula for complex propagation constant in a lossy anisotropic dielectric waveguide, in terms of the magnetic field and real frequency. The ability to include loss and anisotropy (into the permittivity tensor) while preserving the self-adjointness of the system is achieved by using the less common real-type inner product. When used as a basis of Rayleigh-Ritz or finite-element methods, the formula leads to the canonical eigenvalue equation of the form $Ax = \gamma^2 Bx$.



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Abstracts

Vectorized Program Architectures for Supercomputer-Aided Circuit Design

V. Rizzoli, M. Ferlito and A. Neri. "Vectorized Program Architectures for Supercomputer-Aided Circuit Design." 1986 Transactions on Microwave Theory and Techniques 34.1 (Jan. 1986 [T-MTT]): 135-141.

Vector processors (supercomputers) can be effectively employed in MIC or MMIC applications to solve problems of large numerical size such as broad-band nonlinear design or statistical design (yield optimization). In order to fully exploit the capabilities of a vector hardware, any program architecture must be structured accordingly. This paper presents a possible approach to the "semantic" vectorization of microwave circuit design software. Speed-up factors of the order of 50 can be obtained on a typical vector processor (Cray X-MP), with respect to the most powerful scalar computers (CDC 7600), with cost reductions of more than one order of magnitude. This could broaden the horizon of microwave CAD techniques to include problems that are practically out of the reach of conventional systems.



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High-Speed and Low-Power GaAs Phase Frequency Comparator

K. Osafune, K. Ohwada and N. Kato. "High-Speed and Low-Power GaAs Phase Frequency Comparator." 1986 Transactions on Microwave Theory and Techniques 34.1 (Jan. 1986 [T-MTT]): 142-146.

A high-speed and low-power consumption phase frequency comparator (PFC) for a phase lock stable oscillator was designed and fabricated with a GaAs MESFET BFL circuit for the first time. The threshold voltage, gate width, and gate length of GaAs MESFET's in the PFC were determined by circuit simulations for a high-speed and low-power operation. The fabrication process used buried p-layer SAINT-FET's with 0.5- μ m gate length. The fabricated PFC performed stable phase and frequency comparison up to 600 MHz at only 60 mW. Using dislocation-free wafers, the fabrication yield in the laboratory was more than 90 percent.

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Nonuniform Layer Model of a Millimeter-Wave Phase Shifter

J.K. Butler, T.-F. Wu and M.W. Scott. "Nonuniform Layer Model of a Millimeter-Wave Phase Shifter." 1986 Transactions on Microwave Theory and Techniques 34.1 (Jan. 1986 [T-MTT]): 147-155.

The electromagnetic wave propagation of millimeter waves in dielectric waveguides with thin surface plasma layers is characterized. The phase and attenuation of a 94-GHz wave are computed for various surface plasma layer thicknesses as a function of carrier density levels. The electron/hole pairs generated in the vicinity of the dielectric waveguide surface by photo excitation are assumed to have an exponential profile due to either carrier diffusion or the exponential absorption of the optical field. Field computations made for a uniform plasma layer are compared with those of the nonuniform plasma to illustrate the effects of the exponential tails of the carrier profiles on both the phase and attenuation of the millimeter wave. The thin plasma layers slightly affect the field profile of the transverse electric modes (fields polarized parallel to the plasma layer). The transverse magnetic fields are highly distorted at plasma densities greater than 10^{16} cm⁻³.

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Field Theory Design of Square Waveguide Iris Polarizers

U. Tucholke, F. Arndt and T. Wriedt. "Field Theory Design of Square Waveguide Iris Polarizers." 1986 Transactions on Microwave Theory and Techniques 34.1 (Jan. 1986 [T-MTT]): 156-160.

Profiled depth corrugated square waveguide polarizers are designed with the method of field expansion into eigenmodes, which includes higher order mode interaction between the step discontinuities. Computer-optimized design data are given for a compact Ku-band prototype with an exponentially varying depth function that achieves $90^\circ \pm 1^\circ$ differential phase shift within the separate 11.9-12.3-GHz and 17.5-17.9-GHz frequency bands. The maximum VSWR is only about 1.02. Further design examples include a linearly profiled depth function, which provides a short design, and a polarizer with iris thicknesses suitable for metal-etching manufacturing technique. The theory is verified by comparison with available measured results.

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Abstracts

TE and TM Modes of Some Triangular Cross-Section Waveguides Using Superposition of Plane Waves (Short Papers)

P.L. Overfelt and D.J. White. "TE and TM Modes of Some Triangular Cross-Section Waveguides Using Superposition of Plane Waves (Short Papers)." 1986 Transactions on Microwave Theory and Techniques 34.1 (Jan. 1986 [T-MTT]): 161-167.

Exact transverse electric and magnetic mode solutions of four triangular cross-section waveguides have been found via a new general method using Snell's law and superposition of plane waves. This paper presents results for 1) equilateral, 2) 30°, 30°, 120°, 3) isosceles right, and 4) 30°, 60° right triangular waveguides. The electric and magnetic field solutions form finite sums of separable rectangular harmonics and are the only waveguides of triangular cross section for which such solutions have been found.



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A GaAs MESFET Self-Bias Mode Oscillator (Short Papers)

H. Abe. "A GaAs MESFET Self-Bias Mode Oscillator (Short Papers)." 1986 Transactions on Microwave Theory and Techniques 34.1 (Jan. 1986 [T-MTT]): 167-172.

A self-bias mode oscillation in a GaAs MESFET, with the gate terminal kept open in a dc manner, has been analyzed by a large-signal MESFET circuit model. The circuit simulation demonstrates that the gate-source Schottky barrier becomes self-biased along with the microwave oscillation build-up and that a stable self-bias gate voltage is observed with a steady-state oscillation. A self-bias mode oscillator, operable with a single positive dc bias, is realized by rising microwave integrated circuit technology.



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Abstracts

TM Modes in Oversized Planar Metallic Waveguides (Short Papers)

D. Pasquet, J.-L. Gautier and P. Pouvil. "TM Modes in Oversized Planar Metallic Waveguides (Short Papers)." 1986 Transactions on Microwave Theory and Techniques 34.1 (Jan. 1986 [T-MTT]): 172-175.

The propagation properties of transverse magnetic (TM) and hybrid modes in plane and circular metallic waveguides are considered when their dimensions are great with regard to the wavelength. When the oversizing is not too great, the behavior is the same as those of conventional metallic waveguides. For high frequencies (greater oversizing), we describe an unexpected behavior for these modes. The aim of this work is mainly to derive asymptotic expressions useful for the design of for infrared (FIR) waveguide lasers.



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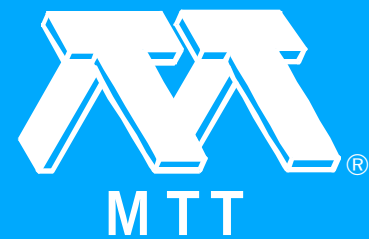
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Response of Waveguides Terminated in a Tapered Metallic Wall (Short Papers)

J.M. Rebollar. "Response of Waveguides Terminated in a Tapered Metallic Wall (Short Papers)." 1986 Transactions on Microwave Theory and Techniques 34.1 (Jan. 1986 [T-MTT]): 175-178.

The characteristics of waveguides terminated in a tapered metallic wall are analyzed by means of the modal analysis and scattering matrix concept of discontinuities. Several applications of this kind of termination are suggested. The results can be very useful in evaluating the phase errors produced due to the use of a short-circuited waveguide with a metallic wall not placed in an exact transverse plane ($z = \text{constant}$).

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Abstracts

A Method for the Calculation of Exact Capacitances of Circular Rod Arrays (Short Papers)

S. Caspi. "A Method for the Calculation of Exact Capacitances of Circular Rod Arrays (Short Papers)." 1986 Transactions on Microwave Theory and Techniques 34.1 (Jan. 1986 [T-MTT]): 178-180.

An exact solution of the capacitance matrix of circular rods located inside a grounded rectangle is presented. The capacitances were determined by solving the integral equation for the charge densities on the conductors using the Green function. The results are compared to E. G. Cristal's data. Examples of the computing capacitance matrix for some unsymmetrical configurations are given.



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Abstracts

End Effect in Open-Circuited Two-Wire Transmission Lines (Short Papers)

H.E. Green and J.D. Cashman. "End Effect in Open-Circuited Two-Wire Transmission Lines (Short Papers)." 1986 Transactions on Microwave Theory and Techniques 34.1 (Jan. 1986 [T-MTT]): 180-182.

This paper gives the parameters of an equivalent circuit representing the end effect in an open-circuited two-wire transmission line. The complete equivalent circuit requires termination of the line in a parallel combination of capacitance and conductance, but it is shown that in all practical cases, capacitive effects dominate.



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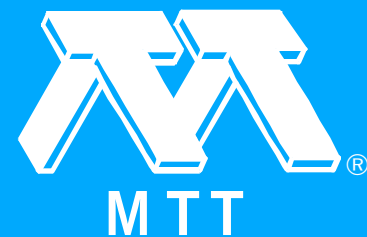


Abstracts

An Estimate of the Interaction Impedance of a Vane-Loaded Helix Using Equivalent-Circuit Analysis (Short Papers)

V.P. Singh, B.N. Basu and R.K. Jha. "An Estimate of the Interaction Impedance of a Vane-Loaded Helix Using Equivalent-Circuit Analysis (Short Papers)." 1986 Transactions on Microwave Theory and Techniques 34.1 (Jan. 1986 [T-MTT]): 182-183.

The expression for the interaction impedance of a broad-band vane-loaded helical slow-wave structure has been found using Pierce's simple theory for a helix in free space, and the results of the equivalent-circuit analysis of the loaded structure. The interaction impedance has been found to be of the order of half the characteristic impedance in a typical loaded structure. The dependence of the small-signal gain on the thickness of the helix wire, the size of the vanes, and the location of the metal envelope has been predicted.



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Conversion Losses in GaAs Schottky-Barrier Diodes (Short Papers)

O. Von Roos and K.-L. Wang. "Conversion Losses in GaAs Schottky-Barrier Diodes (Short Papers)." 1986 Transactions on Microwave Theory and Techniques 34.1 (Jan. 1986 [T-MTT]): 183-188.

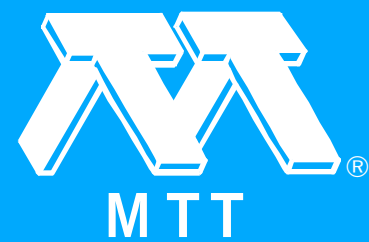
The conversion losses of a Schottky-barrier diode have been calculated for a set of realistic diode parameters. It is found that previous work overestimated the substrate losses by 30 percent. It is also shown that a lightly doped epitaxial layer will decrease the barrier capacitance and with properly designed thickness will avoid any resistance losses due to this layer. Parasitic losses can thus be reduced substantially.



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Analysis of Unsymmetrical Broadside-Coupled Striplines with Anisotropic Substrates (Short Papers)

T. Kitazawa and Y. Hayashi. "Analysis of Unsymmetrical Broadside-Coupled Striplines with Anisotropic Substrates (Short Papers)." 1986 Transactions on Microwave Theory and Techniques 34.1 (Jan. 1986 [T-MTT]): 188-191.

A variational method of the analysis is described for the broadside-coupled striplines of unequal width. A compliance matrix is introduced for the unsymmetrical structure, and variational expressions are derived for the matrix elements for the first time. This method is applicable to the case with uniaxially anisotropic media, and it gives the transformation from the anisotropic to the equivalent isotropic problem. Numerical examples are obtained by using the Ritz procedure. Characteristics of this structure are influenced considerably by the configuration of line conductors.

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Abstracts

Calculation of the Interaction Between the Fringing Capacitance of Symmetrical Stripline Using the Finite Element Method (Short Papers)

J.R. Nortier. "Calculation of the Interaction Between the Fringing Capacitance of Symmetrical Stripline Using the Finite Element Method (Short Papers)." 1986 Transactions on Microwave Theory and Techniques 34.1 (Jan. 1986 [T-MTT]): 191-193.

This paper calculates the interaction between the fringing capacitance of symmetrical stripline using the finite-element method. The fringing capacitance interaction is presented as a function of T/B and W/B . This enables the characteristic impedance of narrow, high-impedance lines to be accurately and simply calculated.



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Design of Microwave GaAs MESFET's for Broad-Band, Low-Noise Amplifier (Comments)

M.W. Pospieszalski and W. Wiatr. "Design of Microwave GaAs MESFET's for Broad-Band, Low-Noise Amplifier (Comments)." 1986 Transactions on Microwave Theory and Techniques 34.1 (Jan. 1986 [T-MTT]): 194-194.

In the above widely-referenced paper, the empirical formulas for four noise parameters of microwave GaAs FET's are given. It was assumed that the four noise parameters could be expressed in terms of the equivalent circuit elements by simple formulas (2)-(5) of the subject paper. Four fitting factors in these formulas were determined from the measured values of the noise parameters and the equivalent circuit elements of sample GaAs MESFET's given in Table II. It is the point of this letter to demonstrate that, in some cases, the measured noise parameters, as well as those determined from the semi-empirical formulas, may not represent the noise of any physical two-port.

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Abstracts

Polygonal Coaxial Line with Round Center Conductor (Comments)

M.D. Abouzahra. "Polygonal Coaxial Line with Round Center Conductor (Comments)." 1986 Transactions on Microwave Theory and Techniques 34.1 (Jan. 1986 [T-MTT]): 195-196.

In the above paper, the author presented an expression for the attenuation constant α of a polygonal coaxial line with round center conductor.



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Abstracts

Formulation of the Singular Integral Equation Technique for Planar Transmission Lines (Correction)

A.S. Omar and K. Schunemann. "Formulation of the Singular Integral Equation Technique for Planar Transmission Lines (Correction)." 1986 Transactions on Microwave Theory and Techniques 34.1 (Jan. 1986 [T-MTT]): 196-196.

In the above paper, it has been wrongly concluded that (17) and (18), which represent the energy coupling between a pair of complex modes, mean that each mode cannot exist alone.



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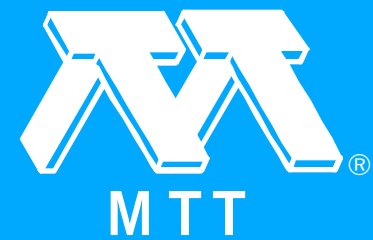
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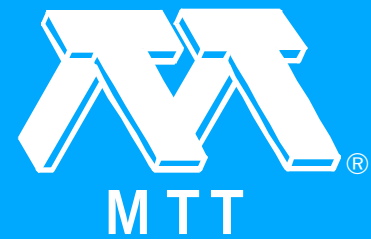
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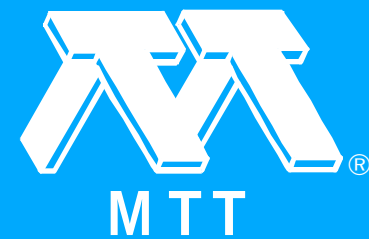
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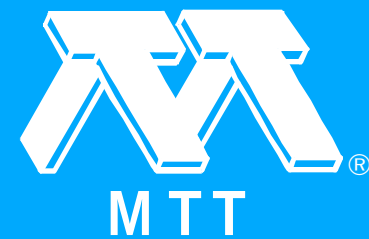
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Abstracts

Mode Propagation Through a Step Discontinuity in Dielectric Planar Waveguide (Feb. 1986 [T-MTT])

H. Shigesawa and M. Tsuji. "Mode Propagation Through a Step Discontinuity in Dielectric Planar Waveguide (Feb. 1986 [T-MTT])." 1986 Transactions on Microwave Theory and Techniques 34.2 (Feb. 1986 [T-MTT]): 205-212.

This paper presents two methods for dealing with wave propagation through a dielectric step discontinuity at normal incidence. One method helps to accelerate the convergence of solutions, especially for the TM-mode problem, and the other treats efficiently the continuous mode spectrum by introducing the Legendre transform in the case of open waveguides. As for the former, the singular fields around the dielectric edges are introduced in terms of direct use of their functional forms to the boundary condition, which is fulfilled in the sense of least squares. As for the latter, the expansion in terms of the Legendre functions is performed for optimally divided ranges of a continuous spectrum. A number of numerical examples prove that the methods presented herein are quite powerful for solving the TM-mode discontinuity problems in dielectric waveguides of both closed and open types.



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The Microstrip Step Discontinuity: A Revised Description

N.H.L. Koster and R.H. Jansen. "The Microstrip Step Discontinuity: A Revised Description." 1986 Transactions on Microwave Theory and Techniques 34.2 (Feb. 1986 [T-MTT]): 213-223.

A systematic variety of frequency-dependent numerical results hitherto unavailable are presented for the shielded microstrip impedance step. The computational method used is a rigorous full-wave spectral-domain approach developed by Jansen. The given data describe the steps for two very common groups of dielectric substrates as a function of stepwidth ratio in the range of normalized frequencies where it behaves like a two-port. They represent new MIC design information and are compared with quasi-static results and the widely used magnetic-wall waveguide approximation. Beyond this, they are validated against the sparse step-discontinuity data available from previous rigorous approaches.

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Abstracts

On the Reduction of the Number of Spurious Modes in the Vectorial Finite-Element Solution of Three-Dimensional Cavities and Waveguides

A. Konrad. "On the Reduction of the Number of Spurious Modes in the Vectorial Finite-Element Solution of Three-Dimensional Cavities and Waveguides." 1986 Transactions on Microwave Theory and Techniques 34.2 (Feb. 1986 [T-MTT]): 224-227.

A novel approach to the solution of three-dimensional micro-wave cavity and waveguide problems by finite elements reduces the number of spurious, nonphysical modes. Solutions are obtained in terms of the field vector H . Three-dimensional vector boundary conditions are implemented in a way that allows arbitrarily-shaped curved boundaries to be modeled. The formulation is based on a subparametric finite element with 27 interpolation nodes.



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Absorption of Millimeter Waves by Human Beings and its Biological Implications

O.P. Gandhi and A. Riazi. "Absorption of Millimeter Waves by Human Beings and its Biological Implications." 1986 Transactions on Microwave Theory and Techniques 34.2 (Feb. 1986 [T-MTT]): 228-235.

With recent advances in millimeter-wave technology, including the availability of high-power sources in this band, it has become necessary to understand the biological implications of this energy for human beings. This paper gives the millimeter-wave absorption efficiency for the human body with and without clothing. Ninety to ninety-five percent of the incident energy may be absorbed in the skin with dry clothing, with or without an intervening air gap, acting as an impedance transformer. On account of the submillimeter depths of penetration in the skin, superficial SAR's as high as 65-357 W/Kg have been calculated for power density of incident radiation corresponding to the ANSI guideline of 5 mW/cm². Because most of the millimeter-wave absorption is in the region of the cutaneous thermal receptors (0.1 - 1.0 mm), the sensations of absorbed energy are likely to be similar to those of IR. For the latter, threshold of heat perception is near 0.67 mW/cm², with power densities on the order of 8.7 mW/cm² likely to cause sensations of "very warm to hot" with a latency of 1.0±0.6s. Calculations are made for thresholds of hearing of pulsed millimeter waves. Pulsed energy densities of 143-579 µJ/cm² are obtained for the frequency band 30-300 GHz. These are 8-28 times larger than the threshold for microwaves below 3 GHz. The paper also points to the need for evaluation of ocular effects of millimeter-wave irradiation because of high SAR's in the cornea.





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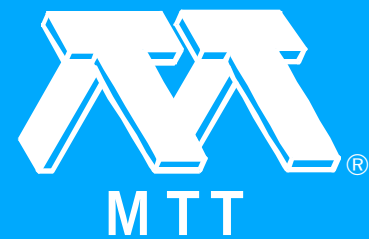
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Lower and Upper Bound Calculations on the Capacitance of Multiconductor Printed Transmission Line Using the Spectral-Domain Approach and Variational Method

A. Sawicki and K. Sachse. "Lower and Upper Bound Calculations on the Capacitance of Multiconductor Printed Transmission Line Using the Spectral-Domain Approach and Variational Method." 1986 Transactions on Microwave Theory and Techniques 34.2 (Feb. 1986 [T-MTT]): 236-244.

A unified spectral-domain method is developed for accurate evaluation of the parameters of single and coupled microstripline-type structures containing a number of additional conducting strips with induced and/or zero potentials, located on several interfaces of dielectric layers. The Green's function technique in the spectral domain and the superposition principle for solutions of simple Dirichlet's problems are applied for the first step of the analysis in which a set of algebraic equations is to be derived. Extreme values of two variational functional are found for estimation of the upper and lower bounds on the line capacitance. Specific computations, carried out for new coupled coplanar lines with additional tuning conductive septums, illustrate the validity and efficiency of the presented method. It has been shown that equalization of the even- and odd-mode phase velocities can be achieved in this structure.





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A New Method of Third-Order Intermodulation Reduction in Nonlinear Microwave Systems

Y. Hu, J.C. Mollier and J. Obregon. "A New Method of Third-Order Intermodulation Reduction in Nonlinear Microwave Systems." 1986 Transactions on Microwave Theory and Techniques 34.2 (Feb. 1986 [T-MTT]): 245-250.

Third-order intermodulation distortion (IMD (3)) of some microwave systems has been analyzed using Volterra series. In this paper, theoretical results which have been calculated with a nonlinear FET model show that third-order intermodulation products of two input signals at $f_{\text{sub } 1/}$ and $f_{\text{sub } 2/}$ can be reduced by several orders of magnitude (in fact, theoretically, IMD (3) should be reduced to zero), with a low-frequency feedback at $f_{\text{sub } 1/} - f_{\text{sub } 2/}$, when the amplitude and the phase of this feedback are correctly chosen. To verify this prediction, a circuit has been realized and measurements have been made on a one-stage FET amplifier. First results confirm our analysis. Experimental measurements show a 12-dB decrease of intermodulation products with our method.

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Design of Ferrite-Impregnated Plastics (PVC) as Microwave Absorbers

V.K. Varadan, V.V. Varadan, Y. Ma and W.F. Hall. "Design of Ferrite-Impregnated Plastics (PVC) as Microwave Absorbers." 1986 Transactions on Microwave Theory and Techniques 34.2 (Feb. 1986 [T-MTT]): 251-258.

This paper is concerned with the modeling of absorption of microwaves in a composite containing a random distribution of Fe_3O_4 particles embedded in PVC. The theoretical model based on a self-consistent multiple scattering formalism, including the effect of statistical correlations in the positions of the particles. A T-matrix is used to characterize the response of individual ferrite particles to any incident excitation. An analytical expression is obtained for the complex propagation constant in the composite in the long wavelength limit. In addition to presenting results for a variety of materials including Ni ferrite compounds, it is shown that a particular set of assumed values of the complex magnetic permeability and dielectric function leads to very good agreement with the experimental data of Ueno et al.

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Abstracts

Accurate Solutions of Elliptical and Cylindrical Striplines and Microstrip Lines

L.-R. Zeng and Y. Wang. "Accurate Solutions of Elliptical and Cylindrical Striplines and Microstrip Lines." 1986 Transactions on Microwave Theory and Techniques 34.2 (Feb. 1986 [T-MTT]): 259-265.

By the transformation methods, elliptical and cylindrical striplines and microstrip lines are theoretically analyzed. Rigorous derivations lead to the exact expressions of the characteristic impedance in closed-form. Elliptical microstrip lines are explored for the first time. For practical applications, elliptical and cylindrical striplines with finite thickness are also analyzed.



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Scattering by Material and Conducting Bodies Inside Waveguides, Part I: Theoretical Formulations

A.S. Omar and K. Schunemann. "Scattering by Material and Conducting Bodies Inside Waveguides, Part I: Theoretical Formulations." 1986 Transactions on Microwave Theory and Techniques 34.2 (Feb. 1986 [T-MTT]): 266-272.

A general theoretical formulation of the problem of scattering by material and conducting bodies inside homogeneously filled waveguides is presented. It is based on a reformulation of the existing techniques for free-space scattering in order to adapt them for scattering inside waveguides. This gives rise to two basic alternatives. The first is the volume integral equation formulation (VIEF) and the second is the surface integral equation formulation (SIEF).

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Quasi-Optical Power Combining of Solid-State Millimeter-Wave Sources

J.W. Mink. "Quasi-Optical Power Combining of Solid-State Millimeter-Wave Sources." 1986 Transactions on Microwave Theory and Techniques 34.2 (Feb. 1986 [T-MTT]): 273-279.

Very efficient power combining of solid-state millimeter-wave sources may be obtained through the application of quasi-optical resonators and monolithic source arrays. Through the theory of reiterative wavebeams (beam modes) with application of the Lorentz reciprocity theorem, it is shown that planar source arrays containing 25 individual elements or more result in very efficient power transfer of energy from the source arrays to the fundamental wave-beam mode. It is further shown that for identical sources within a properly designed quasi-optical power combiner, the output power tends to increase much faster than number of source elements.

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Abstracts

Generalized Scattering Matrix Method for Analysis of Cascaded and Offset Microstrip Step Discontinuities

T.S. Chu and T. Itoh. "Generalized Scattering Matrix Method for Analysis of Cascaded and Offset Microstrip Step Discontinuities." 1986 Transactions on Microwave Theory and Techniques 34.2 (Feb. 1986 [T-MTT]): 280-284.

Detailed algorithms are presented for characterizations of cascaded microstrip step discontinuities, symmetric stubs, and offset step. The analysis is based on the generalized scattering matrix techniques after the equivalent waveguide model is introduced for the microstrip line.



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Millimeter-Wave Oscillators Using Image-Line or Microstrip Waveguides (Short Papers)

R.E. Horn, H. Jacobs and E. Freibergs. "Millimeter-Wave Oscillators Using Image-Line or Microstrip Waveguides (Short Papers)." 1986 Transactions on Microwave Theory and Techniques 34.2 (Feb. 1986 [T-MTT]): 285-288.

A low-cost Gunn oscillator using a coaxial cavity coupled into either dielectric image guide or microstrip line has been developed. A unique feature is the broad frequency range of mechanical tunability of 10 to 11 GHz centered around 56 GHz. This range of tunability is beyond the range of standard metal waveguide cavities. Power levels up to 43 mW have been observed in image-line structures and 20 mW for microstrip lines. The construction allows an easy and quick replacement of diodes, when necessary hence, the structure is easily modified to operate in different ranges.

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Abstracts

A Simple Numerical Method for Studying the Propagation Characteristics of Single-Mode Graded-Index Planar Optical Waveguides (Short Papers)

A.N. Kaul, S.I. Hosain and K. Thyagarajan. "A Simple Numerical Method for Studying the Propagation Characteristics of Single-Mode Graded-Index Planar Optical Waveguides (Short Papers)." 1986 Transactions on Microwave Theory and Techniques 34.2 (Feb. 1986 [T-MTT]): 288-292.

A simple numerical method based on the Runge-Kutta method is presented to compute the propagation constant, the modal field, and the cutoff wavelength corresponding to the fundamental TE/sub 0/ and TM/sub 0/ modes of a planar optical waveguide with an arbitrary refractive index profile. The method is much simpler and requires less computational effort than the earlier reported numerical methods. We have also used the technique for an estimation of the effect of the $\nabla^2 \epsilon$ term in TM modes.



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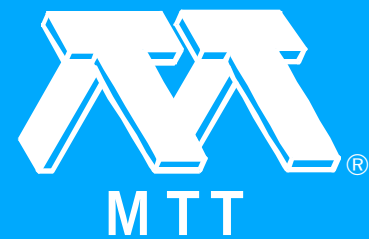
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Calculation of Cutoff Wavenumbers for TE and TM Modes in Tubular Lines with Offset Center Conductor (Short Papers)

A. Vishen, G.P. Srivastava, G.S. Singh and F. Gardiol. "Calculation of Cutoff Wavenumbers for TE and TM Modes in Tubular Lines with Offset Center Conductor (Short Papers)." 1986 Transactions on Microwave Theory and Techniques 34.2 (Feb. 1986 [T-MTT]): 292-294.

The cutoff wavenumbers of TE and TM modes (higher order modes) in a tubular line having an offset center conductor have been calculated. Whereas most previous methods used to study this structure were of an approximate nature, the analytical method developed by Singh and Kothari leads to a rigorous analytical formulation. The boundary conditions on both conductor boundaries, assumed to be perfectly conducting, are satisfied exactly. The cutoff values calculated show that some results previously reported are inaccurate.

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Abstracts

Fully Computer-Aided Synthesis of a Planar Circulator (Short Papers)

T. Miyoshi and T. Shinham. "Fully Computer-Aided Synthesis of a Planar Circulator (Short Papers)." 1986 Transactions on Microwave Theory and Techniques 34.2 (Feb. 1986 [T-MTT]): 294-297.

A planar junction circulator consists, in general, of a three-fold symmetric resonator of arbitrary shape to which three transmission lines are connected. So far, the circulators having disk, triangle, and hexagonal resonators, have been studied in detail. In the analysis of the circuit parameters of circulators, two general methods which were presented in 1977 are used widely. One is based upon a contour-integral solution of the wave equation. In the other approach, the circuit parameters of the junction are expanded in terms of the eigenmodes of the magnetized planar resonator. Since both methods have been applied successfully to various circulators, there is no doubt as to the usefulness of the methods at present.



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Abstracts

On Mode Classification in Rectangular Waveguides Partially Filled with Dielectric Slabs (Short Papers)

V. Bilik and R.N. Simons. "On Mode Classification in Rectangular Waveguides Partially Filled with Dielectric Slabs (Short Papers)." 1986 Transactions on Microwave Theory and Techniques 34.2 (Feb. 1986 [T-MTT]): 297-298.

Arguments are given for the designation of the lowest order longitudinal-section magnetic mode in a dielectrically loaded rectangular waveguide as LSM/sub 01/ rather than LSM/sub 11/.



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Abstracts

Analysis of Some Planar Structures by the Least-Squares Boundary Residual Method (Short Papers)

H. Baudrand, M. Boussouis and J.L. Amalric. "Analysis of Some Planar Structures by the Least-Squares Boundary Residual Method (Short Papers)." 1986 Transactions on Microwave Theory and Techniques 34.2 (Feb. 1986 [T-MTT]): 298-301.

A new approach is proposed to analyze a large class of planar transmission lines such as shielded edge or broadside-coupled striplines and microslots with or without a ground plane. Calculations are carried out, in quasi-TEM and hybrid modes, by the application of a new variant of the least-squares boundary residual method (LSBRM), which is the basis change that allows one not only to improve the precision but also to reduce the computer memory occupation so that smaller computers can be used.



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Abstracts

Application of the Boundary-Element Method to Waveguide Discontinuities (Short Papers)

M. Koshiba and M. Suzuki. "Application of the Boundary-Element Method to Waveguide Discontinuities (Short Papers)." 1986 Transactions on Microwave Theory and Techniques 34.2 (Feb. 1986 [T-MTT]): 301-307.

A numerical method for the solution of scattering of the H- and E-plane waveguide junctions is described. The approach is a combination of the boundary-element method and the analytical method. A general computer programs has been developed using the quadratic elements (higher order boundary elements). To show the validity and usefulness of this formulation, computed results are given for a right-angle corner bend, a T-junction, an inductive strip-planar circuit mounted in a waveguide, a waveguide-type dielectric filter, and an inhomogeneous waveguide junction, and a linear taper. Comparison of the present results with the results of the finite-element method shows good agreement.



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A Frequency-Dependent Coupled-Mode Analysis of Multiconductor Microstrip Lines with Application to VLSI Interconnection Problems (Short Papers)

E.G. Farr, C.H. Chan and R. Mittra. "A Frequency-Dependent Coupled-Mode Analysis of Multiconductor Microstrip Lines with Application to VLSI Interconnection Problems (Short Papers)." 1986 Transactions on Microwave Theory and Techniques 34.2 (Feb. 1986 [T-MTT]): 307-310.

The spectral Galerkin procedure is used to calculate the dispersion properties of multiple conductor microstrip lines. The resulting propagation constants are then used in a coupled-mode theory which demonstrates a frequency-dependent coupling of current in a five-conductor system. These results should be useful in the study of crosstalk between parallel microstrip lines used in VLSI interconnections.



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Comparison of Absorption Loss in Metal-Clad Optical Waveguides (Short Papers)

S.J. Al-Bader and H.A. Jamid. "Comparison of Absorption Loss in Metal-Clad Optical Waveguides (Short Papers)." 1986 Transactions on Microwave Theory and Techniques 34.2 (Feb. 1986 [T-MTT]): 310-314.

A comparison of the absorption loss performance of three types of metal-clad slab waveguides is made with the material and waveguide properties standardized. The basic three-layer configuration of the step-index waveguide and two graded-index waveguides is considered the latter two are also considered as two-layer structures. The comparative loss behavior is discussed from the point of view of application in mode and polarization filtering.

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Patent Abstracts (Feb. 1986 [T-MTT])

"Patent Abstracts (Feb. 1986 [T-MTT])." 1986 Transactions on Microwave Theory and Techniques 34.2 (Feb. 1986 [T-MTT]): 315-318.



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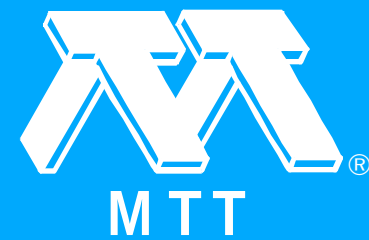
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Call for Papers - GaAs IC Symposium (Feb. 1986 [T-MTT])

"Call for Papers - GaAs IC Symposium (Feb. 1986 [T-MTT])." 1986 Transactions on Microwave Theory and Techniques 34.2 (Feb. 1986 [T-MTT]): 319-319.



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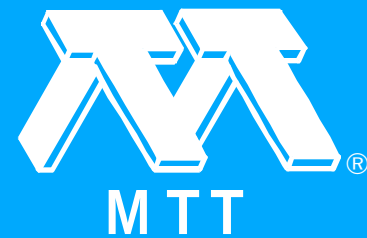
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Call for Papers - Microwave Aspects and Applications of GHz/Gbit Optical Technology (Feb. 1986 [T-MTT])

"Call for Papers - Microwave Aspects and Applications of GHz/Gbit Optical Technology (Feb. 1986 [T-MTT])." 1986 Transactions on Microwave Theory and Techniques 34.2 (Feb. 1986 [T-MTT]): 320-320.



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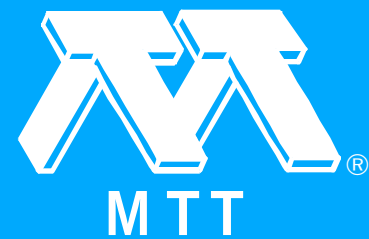
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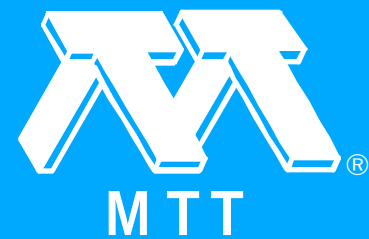
Excitation of Waveguide by Stripline- and Microstrip-Line-Fed Slots

B.N. Das, K.V.S.V.R. Prasad and K.V.S. Rao. "Excitation of Waveguide by Stripline- and Microstrip-Line-Fed Slots." 1986 Transactions on Microwave Theory and Techniques 34.3 (Mar. 1986 [T-MTT]): 321-327.

This paper presents investigations on coupling between stripline/microstrip line and a rectangular waveguide coupled through a slot in the ground plane which is fixed in the cross-sectional plane of the waveguide. A closed-form expression for the impedance loading on stripline/microstrip line is evaluated from knowledge of the complex power flowing down the rectangular waveguide supporting the dominant mode and discontinuity in the modal voltage in stripline/microstrip line. The reactance cancellation is obtained by terminating the stripline/microstrip line exciting the slot in a short-circuited stub. The structure under this condition forms a transition between stripline/microstrip line and a waveguide. The design curves on slot length versus frequency are presented for different values of dielectric constants. The variation of coupling as a function of frequency and also the location of the slot is evaluated. Numerical results for slot coupling useful for the design of waveguide simulators are also presented.

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Calculation of Propagation Constants and Cutoff Frequencies of Radially Inhomogeneous Optical Fibers

C.-C. Su and C.H. Chen. "Calculation of Propagation Constants and Cutoff Frequencies of Radially Inhomogeneous Optical Fibers." 1986 Transactions on Microwave Theory and Techniques 34.3 (Mar. 1986 [T-MTT]): 328-332.

Based on the finite-difference technique, an efficient numerical method that can treat both the propagation constants and cutoff frequencies of optical fibers with arbitrary permittivity profiles is developed in the rigorous vector form. Such a propagation problem is formulated in transverse fields so that the proposed method does not suffer from spurious modes. The associated boundary conditions including those at cutoff are derived in a novel way. Thereafter, numerical results of the cutoff frequency and propagation constant of a fiber with the parabolic profile are presented.

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Theory and Performance of a Power-Combining Multiple-Device Ladder Amplifier

S. Nogi, K. Fukui and S. Tanaka. "Theory and Performance of a Power-Combining Multiple-Device Ladder Amplifier." 1986 Transactions on Microwave Theory and Techniques 34.3 (Mar. 1986 [T-MTT]): 333-341.

This paper presents a detailed discussion on the microwave power amplification using a multiple-device ladder structure which is essentially an array of diode-mount-pairs in a rectangular waveguide cavity. For both transmission and reflection types, the capability of perfect combining of available powers from each component device and available input signal power is analytically described. A power flow distribution along the structure is also described to interpret the power-combining mechanism. Amplifier characteristics are studied through numerical analysis and well confirmed by experiments on X-band amplifiers with up to eight Gunn diodes.

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Interfacial Stress and Excess Noise in Schottky-Barrier Mixer Diodes

G.K. Sherrill, R.J. Mattauch and T.W. Crowe. "Interfacial Stress and Excess Noise in Schottky-Barrier Mixer Diodes." 1986 Transactions on Microwave Theory and Techniques 34.3 (Mar. 1986 [T-MTT]): 342-345.

This paper presents evidence linking excess noise in submillimeter-wave Schottky-barrier mixer diodes to stress at the devices' GaAs-SiO/sub 2/ interface. At the periphery of the Schottky anodes, the SiO/sub 2/ film is discontinuous and the stress surpasses the GaAs yield stress, resulting in damage to the surrounding material. By modifying the device structure in three independent manners, the stress and damage at the diode periphery were either increased or decreased; in each case, the noise temperature increased or decreased accordingly.

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Broad-Band Analysis of a Coaxial Discontinuity Used for Dielectric Measurements

N.-E. Belhadj-Tahar and A. Fourier-Lamer. "Broad-Band Analysis of a Coaxial Discontinuity Used for Dielectric Measurements." 1986 Transactions on Microwave Theory and Techniques 34.3 (Mar. 1986 [T-MTT]): 346-350.

A coaxial line terminated by a gap is considered, the gap being filled with an unknown material. This cell enables measurements of complex permittivity of dielectric materials to be made. The relationship linking the measured admittance to the dielectric properties is obtained from a theoretical analysis of the electromagnetic field in the line. The equivalent-circuit parameters of a coaxial line terminated by a gap are obtained all higher order waves excited at the discontinuity are taken into account. The measurements show good agreement between measured and calculated data from dc to 12.4 GHz.

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Small-Signal Second-Harmonic Generation by a Nonlinear Transmission Line (Short Papers)

K.S. Champlin and D.R. Singh. "Small-Signal Second-Harmonic Generation by a Nonlinear Transmission Line (Short Papers)." 1986 Transactions on Microwave Theory and Techniques 34.3 (Mar. 1986 [T-MTT]): 351-353.

Second-harmonic generation (SHG) by a relatively low-loss transmission line having a capacitive nonlinearity is treated with an extended small-signal analysis. This simple theory brings out the relevance of "phase matching" the fundamental- and second-harmonic waves and of reducing losses in order to optimize SHG. It is shown that maximum SHG will occur when the line is short compared with its "coherence length" and has radian electrical length equal to twice its "transmission Q" at the second-harmonic frequency. The product of a line's "transmission Q" and its "nonlinearity factor" should be maximized to obtain maximum efficiency and is, therefore, believed to be a useful figure of merit for comparing the SHG potential of different transmission-line implementations.

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Transient Analysis of a Directional Coupler Using a Coupled Microstrip Slot Line in Three-Dimensional Space (Short Papers)

S. Koike, N. Yoshida and I. Fukai. "Transient Analysis of a Directional Coupler Using a Coupled Microstrip Slot Line in Three-Dimensional Space (Short Papers)." 1986 Transactions on Microwave Theory and Techniques 34.3 (Mar. 1986 [T-MTT]): 353-357.

In recent MIC techniques, double-sided MIC has been studied because its advantages in propagation characteristics are greater than that conventional MIC's. A coupled microstrip slotline is one of them. Its application to various circuit elements has often been discussed. But the coupled microstrip slotline is essentially three-dimensional structure, so the analysis demands a rigorous three-dimensional treatment. Also, the recent high-speed pulse technique demands analysis in the time domain. The present paper treats a directional coupler using the coupled microstrip slotline in three-dimensional space and time. The results of the directional coupler analysis is presented with the complicated time variation of the three-dimensional electromagnetic field. So, the mechanism of the directional coupling phenomena that is produced by the propagation characteristics of the even and odd modes is presented in the time domain. In particular, the instantaneous diagram of the Poynting vector details the energy flow in the transient process. For the analysis of the characteristics of the complex microwave device, these results present the utilities of the various field distributions that are obtained by the three-dimensional vector analysis in the time domain.



Focused Heating in Cylindrical Targets-Part II (Short Papers)

J.R. Wait and M. Lumori. "Focused Heating in Cylindrical Targets-Part II (Short Papers)." 1986 Transactions on Microwave Theory and Techniques 34.3 (Mar. 1986 [T-MTT]): 357-359.

We implement the analytical formulation for the local power dissipated in a conductive target of cylindrical form that was described in Part I. The scheme employs a number N of horn apertures arranged around the periphery of the target. We show sample results for the radial and the azimuthal variations of the normalized local power. The cases where the array is focused at both the center of the target and where it is focused at an eccentric point are considered for $N = 4, 8$, and 16 . It is shown that the unwanted secondary "hot spots" can be eliminated if the number N of horn apertures is increased sufficiently. The results are relevant to microwave thermic heating in cancer therapy.



Abstracts

Numerical Analysis of Various Configurations of Slab Lines (Short Papers)

G.B. Stracca, G. Macchiarella and M. Politi. "Numerical Analysis of Various Configurations of Slab Lines (Short Papers)." 1986 Transactions on Microwave Theory and Techniques 34.3 (Mar. 1986 [T-MTT]): 359-363.

Numerical solutions are presented for the characteristic impedance of various line structures derived from the slab line, which allow the calculation also of the even and odd impedance of coupled slab lines. Some approximated formulas are also derived, which match the numerical results with good precision for a large range of geometrical dimensions of the structures. The results presented here are compared with some formulas and numerical results available from previous technical papers.



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Shunt-Connected Microstrip Radial Stubs (Short Papers)

F. Giannini, M. Ruggieri and J. Vrba. "Shunt-Connected Microstrip Radial Stubs (Short Papers)." 1986 Transactions on Microwave Theory and Techniques 34.3 (Mar. 1986 [T-MTT]): 363-366.

Radial-line stubs provide an interesting alternative to low-impedance conventional straight stubs. They are useful as filter elements in both series and shunt configurations. In this short paper, the planar circuit analysis previously performed for a series-connected radial stub is extended to the shunt configuration. Theoretical and experimental results are presented to verify the equivalent model for the shunt-connected radial stub.

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



Abstracts

The Effects of Attenuation on the Born Reconstruction Procedure for Microwave Diffraction Tomography (Short Papers)

F.J. Paoloni. "The Effects of Attenuation on the Born Reconstruction Procedure for Microwave Diffraction Tomography (Short Papers)." 1986 Transactions on Microwave Theory and Techniques 34.3 (Mar. 1986 [T-MTT]): 366-368.

The effects of attenuation on the Born inversion process for diffraction tomography are investigated. The exact forward scattered fields for a lossy dielectric cylinder in a lossy medium are calculated and are then used to reconstruct an image of the scattering object. As accurate image is produced only when the cylinder acts as a small perturbation on the dielectric constant of the external medium. Results indicate that even small losses have a significant effect on the resolution of the image. It is possible, however, to eliminate image distortion by matching the loss tangent of the outside medium to that within the cylinder.



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Spectral Domain Analysis of an Elliptical Microstrip Ring Resonator (Comments)

W.C. Chew. "Spectral Domain Analysis of an Elliptical Microstrip Ring Resonator (Comments)." 1986 Transactions on Microwave Theory and Techniques 34.3 (Mar. 1986 [T-MTT]): 369-369.

Along with the above paper several other papers have been published recently by Sharma and his co-workers [2]-[3] on the analysis of the resonant frequencies of a microstrip disk using the quasi-static approach. The quasi-static approach has been proven to be incorrect in [4] and [5]. The quasi-static argument on the correction to the resonant frequencies of a microstrip disk is based on some intuitive arguments that are not rigorous. The only thing it predicts correctly is that the resonant frequencies of a microstrip disk should decrease compared to that of a magnetic-wall model. The author may argue that since the correction to the magnetic-wall model is small, any approximate method is viable. However, we have found that the quasi-static correction could be as much as 50 percent in error. Even when this correction is small, if we bother to calculate it, I think we should calculate it correctly. The author's quasi-static correction has a new twist compared to earlier authors, but when $\epsilon_r = 1$, it does not differ from the quasi-static correction of earlier work.

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The Hybrid-Mode Analysis of Coupled Microstrip-Slot Resonators (Comments)

P. Pribetich and P. Kennis. "The Hybrid-Mode Analysis of Coupled Microstrip-Slot Resonators (Comments)." 1986 Transactions on Microwave Theory and Techniques 34.3 (Mar. 1986 [T-MTT]): 369-371.

We were interested to read the above paper, but it calls for a remark concerning the extension of the hybrid-mode analysis to coupled microstrip-slot resonator. In fact, when the coupled strips are very close to each other, the basis functions used in the above paper does not allow one to obtain a satisfactory resonant frequency. To do so, we must necessary increase the number of basis function by using symmetric and antisymmetric basis functions with respect to the axis of a strip. In this case, we must be sure that the criterion of relative convergence is satisfied. Furthermore, the mathematical developments of this hybrid-mode analysis have been already published by the same author. So it would have been better to focus the purpose of the above paper on the problem more specific to the coupling of the two strips.

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



Abstracts

Magnetostatic Surface-Wave Propagation in Ferrite Thin Films with Arbitrary Variations of the Magnetization through the Film Thickness (Correction)

N.E. Buris and D.D. Stancil. "Magnetostatic Surface-Wave Propagation in Ferrite Thin Films with Arbitrary Variations of the Magnetization through the Film Thickness (Correction)." 1986 Transactions on Microwave Theory and Techniques 34.3 (Mar. 1986 [T-MTT]): 371-371.

Equation of the above paper should read as follows.



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Patent Abstracts (Mar. 1986 [T-MTT])

"Patent Abstracts (Mar. 1986 [T-MTT])." 1986 Transactions on Microwave Theory and Techniques 34.3 (Mar. 1986 [T-MTT]): 372-375.



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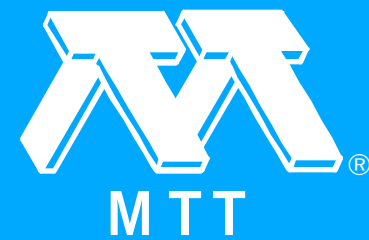
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Abstracts

IEEE Dictionaries (Advertisement) (Mar. 1986 [T-MTT])

"IEEE Dictionaries (Advertisement) (Mar. 1986 [T-MTT])." 1986 Transactions on Microwave Theory and Techniques 34.3 (Mar. 1986 [T-MTT]): 376-376.



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Abstracts

Editorial (Apr. 1986 [T-MTT])

T. Itoh. "Editorial (Apr. 1986 [T-MTT])." 1986 Transactions on Microwave Theory and Techniques 34.4 (Apr. 1986 [T-MTT]): 377-378.

As of January 1, 1986, my editorship of this Transactions was turned over to Dr. Ralph Levy. Actual day-to-day operations as the Editor had not been transferred until February 1. Now, all the operations are in the hands of Dr. Levy. He has been active in a number of MTT-related activities and has published extensively. I am sure that he will handle this important assignment in an expert manner.



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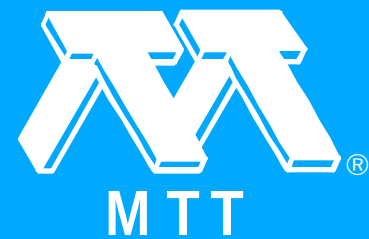
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Comparison of Quasi-Static and Exact Electromagnetic Fields from a Horizontal Electric Dipole Above a Lossy Dielectric Backed by an Imperfect Ground Plane

J.R. Mosig and T.K. Sarkar. "Comparison of Quasi-Static and Exact Electromagnetic Fields from a Horizontal Electric Dipole Above a Lossy Dielectric Backed by an Imperfect Ground Plane." 1986 Transactions on Microwave Theory and Techniques 34.4 (Apr. 1986 [T-MTT]): 379-387.

In most microstrip transmission lines, analysis is made assuming that a quasi-TEM mode exists and propagates down the line. The primary objective of this paper is to obtain the region of validity of this assumption. The second objective of this paper is to derive the expressions for the fields for a horizontal electric dipole over a lossy dielectric medium backed by an imperfect ground plane. It is shown that, to a first approximation, fields at the air-dielectric interface are independent of the ground plane conductivity. Since we are interested in coupling between lines, our interest is in the computation of the fields primarily at the air-dielectric interface. Finally, numerical results are presented to show where the quasi-static approximations deviate from the exact solution for a given microstrip geometry as the frequency of operation or the observation point is changed.





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General Analysis of a Parallel-Plate Waveguide Inhomogeneously Filled with Gyromagnetic Media

M. Mrozowski and J. Mazur. "General Analysis of a Parallel-Plate Waveguide Inhomogeneously Filled with Gyromagnetic Media." 1986 Transactions on Microwave Theory and Techniques 34.4 (Apr. 1986 [T-MTT]): 388-395.

The boundary value problem for a parallel-plate waveguide filled with inhomogeneous gyromagnetic medium is expressed and thoroughly examined in terms of a linear operator equation. A suitable vector definition of transverse mode functions is given and their completeness and orthogonality are proved. Applying a new set of continuity conditions for field components normal to the cross-sectional interface, the transfer matrix for the multilayered parallel-plate waveguiding structure is determined and used to formulate a characteristic equation. The analysis is illustrated by the numerical investigation of eigenfunctions and eigenvalues of a two layer ferrite-air guide.

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Analysis of a Longitudinal Gyroelectric Discontinuity Inside a Fiber Waveguide

P.G. Cottis and N.K. Uzunoglu. "Analysis of a Longitudinal Gyroelectric Discontinuity Inside a Fiber Waveguide." 1986 Transactions on Microwave Theory and Techniques 34.4 (Apr. 1986 [T-MTT]): 396-404.

The scattering of guided electromagnetic waves from a finite-length longitudinal gyroelectric discontinuity inside a fiber waveguide is treated analytically. An integral equation approach is employed to formulate the corresponding boundary-value problem. The induced field inside the gyroelectric discontinuity region is expanded into a Fourier-type series in terms of the well-known cylindrical waves M and N plus a purely longitudinal wave Q. Then the method of moments is applied to decouple the basic integral equation. The resulting infinite coupled system of equations is truncated and solved numerically. After determining the field inside the discontinuity, the scattered far field inside the dielectric-rod waveguide is computed by employing a steepest descent integration technique. Numerical results for the scattering coefficients of an incident HE/sub 11/ dominant mode are obtained. Finally, design principles are discussed for practical components based on the treated longitudinal gyroelectric discontinuity.

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Bragg Reflection Characteristics of Millimeter Waves in a Periodically Plasma-Induced Semiconductor Waveguide

M. Matsumoto, M. Tsutsumi and N. Kumagai. "Bragg Reflection Characteristics of Millimeter Waves in a Periodically Plasma-Induced Semiconductor Waveguide." 1986 Transactions on Microwave Theory and Techniques 34.4 (Apr. 1986 [T-MTT]): 406-411.

Theoretical analysis on the Bragg reflection characteristics of millimeter waves in a periodically plasma-induced semiconductor waveguide is presented. The plasma is assumed to be generated by light illumination. Numerical examples are given which show the dependence of the Bragg reflection characteristics on the length of the plasma-induced section and on the plasma density. Since the period can be changed by altering the illumination pattern, this type of periodic structure may be developed to tunable filters or tunable DBR oscillators for millimeter-wave region.

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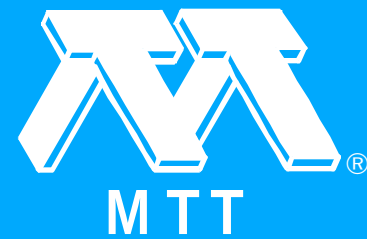


Abstracts

Ka-Band Front End with Monolithic, Hybrid, and Lumped-Element IC's

P.J. Meier, J.A. Calviello, A.J. Cappello, R.J. Pomian, L.D. Cohen and P.R. Bie. "Ka-Band Front End with Monolithic, Hybrid, and Lumped-Element IC's." 1986 Transactions on Microwave Theory and Techniques 34.4 (Apr. 1986 [T-MTT]): 412-419.

A Ku-band front end has been developed which integrates a low-loss wide-band monolithic mixer, a two-stage hybrid IF amplifier, and a lumped-element Gunn local oscillator (LO). Small size (0.5 cubic in), high performance, and potentially low production cost have been demonstrated through the application of highly compatible IC construction techniques.



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Abstracts

A Completely Theoretical Design Method of Dielectric Image Guide Gratings in the Bragg Reflection Region

H. Shigesawa and M. Tsuji. "A Completely Theoretical Design Method of Dielectric Image Guide Gratings in the Bragg Reflection Region." 1986 Transactions on Microwave Theory and Techniques 34.4 (Apr. 1986 [T-MTT]): 420-426.

This paper presents a new and completely theoretical accurate method for the design of dielectric image guide gratings. Our method is based on a network approach that can easily analyze, with satisfactory approximations, the interaction of dielectric step discontinuities. These are the fundamental constituents of our gratings. Measurements on a filter modeled at X-band show excellent agreement with the design characteristics.



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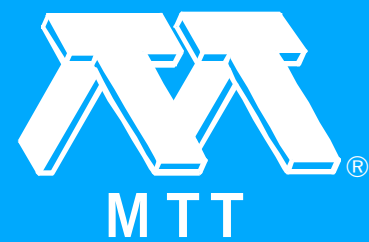
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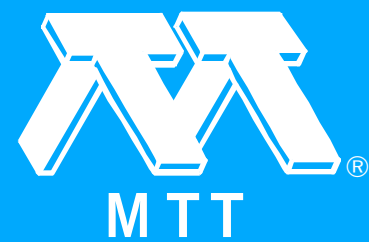
The Declining Drain Line Lengths Circuit--A Computer Derived Design Concept Applied to a 2-26.5-GHz Distributed Amplifier

K.B. Niclas, R.D. Remba, R.R. Pereira and B.D. Cantos. "The Declining Drain Line Lengths Circuit--A Computer Derived Design Concept Applied to a 2-26.5-GHz Distributed Amplifier." 1986 Transactions on Microwave Theory and Techniques 34.4 (Apr. 1986 [T-MTT]): 427-435.

The principle of the "declining drain line lengths" has emerged as a successful concept in the pursuit of improved gain flatness and bandwidth. The optimized performance parameters of an "identical links" gain module are compared to those of a "declining drain line lengths" gain module, and the advantages of one design principle over the other are discussed. In addition, the paper studies the RF voltages and currents of the circuits' GaAs MESFETs and draws some qualitative conclusions as to the causes of gain limiting when approaching nonlinear operation. Finally, experimental results of a power module based on the "declining drain line lengths" principle are reported. The hybrid amplifier which incorporates five active devices with 0.25- μm gates achieves a small signal gain of $G = 6.1 \pm 0.6$ dB from 2-27 GHz. Measurements of its output power, reflection coefficients and noise figure are also discussed.

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Novel Design Approach for X-Band GaAs Monolithic Analog 1/4 Frequency Divider

K. Honjo and M. Madihian. "Novel Design Approach for X-Band GaAs Monolithic Analog 1/4 Frequency Divider." 1986 Transactions on Microwave Theory and Techniques 34.4 (Apr. 1986 [T-MTT]): 436-441.

A novel analog frequency divider which can generate a 1/4 frequency component is proposed. The frequency divider consists of a dual-gate FET and a two-stage capacitor-resistor coupled amplifier. This circuit configuration also enables achieving a small-size GaAs MMIC analog frequency divider. In this analog frequency divider, the input signal f_{in} is mixed with signal component f_{in}/x caused by noise or transients in a feedback loop. Then, a $(1 - 1/x)f_{in}$ IF component is induced and is again mixed with the input signal. This process delivers the f_{in}/x component regeneratively. Resultant continuous signal components f_{in}/x and $(1 - 1/x)f_{in}$ have a harmonic relation when the system reaches a steady state. The f_{in}/x component can be mainly obtained at an output port of the frequency divider. The operation band was simulated using a SPICE II computer program. The designed bandwidth and conversion gain for the 1/4 frequency divider are 8.5-10.6 GHz and -3 dB, respectively. Based on the simulation, a GaAs monolithic analog 1/4 frequency divider was made and tested. The developed 1/4 frequency divider provides a 8.5-10.2-GHz operation bandwidth and -5 ± 1 -dB conversion gain. The designed and experimental values are in good agreement. The frequency division band can be shifted to higher frequency (10.65-11.2 GHz) by adopting the external matching circuit at the GaAs chip output port. The proposed analog frequency divider circuit can be applied not only for 1/4 frequency division, but also for 1/n frequency division (integer $n > 2$).

Click on title for a complete paper.



Abstracts

Improved X-Band FM Discriminator (Short Papers)

T.P. Chattopadhyay and B.N. Biswas. "Improved X-Band FM Discriminator (Short Papers)." 1986 Transactions on Microwave Theory and Techniques 34.4 (Apr. 1986 [T-MTT]): 442-446.

The technique of coherent carrier-addition, using injection synchronization of a narrow-band Gunn oscillator, for improving the performance of an X-band frequency discriminator has been examined in detail. The discriminator is implemented from a single magic tee, two adjustable AM detectors, two sliding shorts, a circulator, an isolator, and a difference amplifier of gain unity. Experimental results are presented in partial support of the conclusions of the analysis. Normal operation of the discriminator in absence of the coherent carrier is also described as a special case of the above analysis.



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Abstracts

New Concepts in Traveling-Wave Amplifiers (Short Papers)

M. Friedgut. "New Concepts in Traveling-Wave Amplifiers (Short Papers)." 1986 Transactions on Microwave Theory and Techniques 34.4 (Apr. 1986 [T-MTT]): 446-451.

Two new networks with the potential for good port VSWR over very broad bandwidths are proposed for use in both low-power balanced amplifiers, and high-power combining systems. These new structures which are called Low-Sidelobe and Squintless Traveling-Wave Amplifiers (LSTWA and SQTWA, respectively) have been derived from conventional Traveling-Wave Amplifiers (TWA) by utilizing Phased Array Antenna concepts and design techniques. Using Monte-Carlo simulations the relative performance of the three structures is compared. Finite loss and mismatch effects are also considered.



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Abstracts

On the Noise Parameters of Isolator and Receiver with Isolator at the Input (Short Papers)

M.W. Pospieszalski. "On the Noise Parameters of Isolator and Receiver with Isolator at the Input (Short Papers)." 1986 Transactions on Microwave Theory and Techniques 34.4 (Apr. 1986 [T-MTT]): 451-453.

Noise parameters of an isolator and those of a receiver with an isolator at the input are reviewed. Some comments on recently published results are offered.



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Abstracts

Two Core Radii for Minimum Total Dispersion in Single-Mode Step-Index Optical Fibers (Short Papers)

P.S. Da Motta Pires, A.J. Giarola and R.F. Souza. "Two Core Radii for Minimum Total Dispersion in Single-Mode Step-Index Optical Fibers (Short Papers)." 1986 Transactions on Microwave Theory and Techniques 34.4 (Apr. 1986 [T-MTT]): 453-456.

Starting from the operating wavelength and the chemical composition of the materials that integrate the core and cladding of an optical fiber, a method was developed for the calculation of the values of the core radii; it allows fiber operation in a monomode region with minimum total dispersion. The study is restricted to step-index fibers and the selected theoretical model is based on the weakly-guiding characteristic equation. From these considerations it is possible to obtain two different values of core radii for a given source operating wavelength. The theory described allows the characterization of an optical fiber for use with a given light source and extends a previously described theory.



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Abstracts

On the Measurement of Noise Parameters of Microwave Two-Ports (Short Papers)

M.W. Pospieszalski. "On the Measurement of Noise Parameters of Microwave Two-Ports (Short Papers)." 1986 Transactions on Microwave Theory and Techniques 34.4 (Apr. 1986 [T-MTT]): 456-458.

A novel procedure for determining the noise parameters of microwave two-ports is introduced. In this procedure, the computations necessary to find the noise parameters from the set of measurements of noise temperature (noise figure) are greatly simplified. The assessment of accuracy with which the noise parameters can be determined from a given set of measurement data is straightforward.



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The Near Field of an Insulated Dipole in a Dissipative Dielectric Medium (Short Papers)

J.P. Casey and R. Bansal. "The Near Field of an Insulated Dipole in a Dissipative Dielectric Medium (Short Papers)." 1986 Transactions on Microwave Theory and Techniques 34.4 (Apr. 1986 [T-MTT]): 459-463.

The near field of uninsulated dipole antenna in a dissipative dielectric medium is important in microwave hyperthermia and geophysical applications. In this paper, the electric field near an insulated dipole has been calculated by the direct numerical evaluation of a surface integral over the insulation. The computed results are compared with those previously obtained by an approximate numerical calculation.

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Measurement Techniques for Planar High-Frequency Circuits (Short Papers)

S.E. Schwarz and C.W. Turner. "Measurement Techniques for Planar High-Frequency Circuits (Short Papers)." 1986 Transactions on Microwave Theory and Techniques 34.4 (Apr. 1986 [T-MTT]): 463-467.

Planar bismuth bolometers can be used as measuring elements in planar millimeter-wave circuits. These devices are easy to fabricate and calibrate; moreover, their responsivity is thought to be nearly independent of frequency throughout the millimeter-wave regime. Furthermore, they are inherently linear detectors over as much as seven orders of magnitude. Noise-equivalent powers of 2×10^{-10} W/Hz^{1/2} can be attained. The high sensitivity of these devices makes them suitable for use in probes. Techniques for measurement of current and reflection coefficient are proposed. Trial measurements, using simulation at 1 GHz, are described.

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Abstracts

Analysis of Square-Spiral Inductors for Use in MMIC's (Short Papers)

P.R. Shepherd. "Analysis of Square-Spiral Inductors for Use in MMIC's (Short Papers)." 1986 Transactions on Microwave Theory and Techniques 34.4 (Apr. 1986 [T-MTT]): 467-472.

A method analysis of square spiral inductors for use in monolithic microwave integrated circuits (MMIC's) is presented. The method is based on the coupled microstrip-line theory and incorporates a novel solution to the multicoupled-line problem. The analysis includes the effect of the discontinuities at the right-angled bends in the lines, and also the feedback effect where the lead-out bridge crosses the lines. The method can be used to analyze components with an arbitrary number of spiral turns. Theoretical results are compared with the measured S-parameters of a 3 1/2-turn component over the range 2-12 GHz, and reasonable agreement between the two is found.



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Abstracts

Characteristic Impedance of Transmission Lines with Arbitrary Dielectrics Under the TEM Approximation (Short Papers)

Y. Naiheng and R.F. Harrington. "Characteristic Impedance of Transmission Lines with Arbitrary Dielectrics Under the TEM Approximation (Short Papers)." 1986 Transactions on Microwave Theory and Techniques 34.4 (Apr. 1986 [T-MTT]): 472-475.

This paper gives a procedure for computing the characteristic impedances of TEM or quasi-TEM transmission lines with arbitrary cross sections and arbitrary dielectrics. Special consideration is given to conductors of finite cross-sectional extent. The solution is obtained by the method of moments using pulse functions for the expansion of charge density and point matching for testing. Numerical examples are given and compared with solutions obtained by other methods.



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Theoretical Considerations on the Use of Circularly Symmetric TE Modes for Digital Ferrite Phase Shifters (Correction)

D.M. Bolle and N. Mohsenian. "Theoretical Considerations on the Use of Circularly Symmetric TE Modes for Digital Ferrite Phase Shifters (Correction)." 1986 Transactions on Microwave Theory and Techniques 34.4 (Apr. 1986 [T-MTT]): 475-475.

Recently, we have become aware of increased publication activity by authors who refer to the above early paper. We felt that it is particularly timely, therefore, to inform those concerned that in the above paper a few formulas, unfortunately, are in error.

Click on title for a complete paper.



Abstracts

Patent Abstracts (Apr. 1986 [T-MTT])

"Patent Abstracts (Apr. 1986 [T-MTT])." 1986 Transactions on Microwave Theory and Techniques 34.4 (Apr. 1986 [T-MTT]): 476-479.



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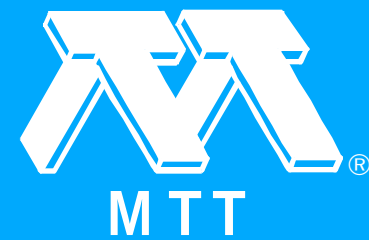
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IEEE Finding Your Way (Advertisement) (Apr. 1986 [T-MTT])

"IEEE Finding Your Way (Advertisement) (Apr. 1986 [T-MTT])." 1986 Transactions on Microwave Theory and Techniques 34.4 (Apr. 1986 [T-MTT]): 480-480.



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Front Cover (May 1986 [T-MTT])

"Front Cover (May 1986 [T-MTT])." 1986 Transactions on Microwave Theory and Techniques 34.5 (May 1986 [T-MTT] (Special Issue on Phased Arrays for Hyperthermia Treatment of Cancer)): f1-f2.



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Abstracts

Foreword (May 1986 [T-MTT])

J.C. Lin. "Foreword (May 1986 [T-MTT])." 1986 Transactions on Microwave Theory and Techniques 34.5 (May 1986 [T-MTT] (Special Issue on Phased Arrays for Hyperthermia Treatment of Cancer)): 481-483.

Hyperthermia cancer therapy is a treatment procedure in which tumor temperatures are elevated to the range of 43-50°C. Experiments performed on cell cultures, tumor-bearing animals, and human patients have clearly shown that hyperthermia affords preferential killing of malignant cells. It is noteworthy that while tumor cells exhibit inherent hyperthermic sensitivity, the response may also depend on such conditions as nutritional deprivation, low pH, and chronic hypoxia that often characterize the interior of many tumors. Moreover, it has been shown that the cytotoxic effects of many anticancer drugs are enhanced and the cell-killing ability of ionizing irradiation is potentiated by hyperthermia.



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Absorbed Power Distributions from Coherent Microwave Arrays for Localized Hyperthermia

J.W. Hand, J.L. Cheetham and A.J. Hind. "Absorbed Power Distributions from Coherent Microwave Arrays for Localized Hyperthermia." 1986 Transactions on Microwave Theory and Techniques 34.5 (May 1986 [T-MTT] (Special Issue on Phased Arrays for Hyperthermia Treatment of Cancer)): 484-489.

Absorbed power distributions in a homogeneous muscle-like tissue due to a planar coherent array consisting of 16 small direct contact applicators at 434 and 915 MHz are calculated, assuming various relative phases and amplitudes are compared with that of a single aperture source at the same frequency with the same overall dimensions. The array applicator may offer improvement in field size or, when focused, a small improvement in penetration, but in practice the performance is very dependent upon bolus thickness. An additional advantage of the array applicator is the ability to modify absorbed power distributions during use by changing the amplitudes of individual applicators.

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Abstracts

Experimental Investigation of a Retro-Focusing Microwave Hyperthermia Applicator: Conjugate-Field Matching Scheme

J. Loane, H. Ling, B.F. Wang and S.W. Lee. "Experimental Investigation of a Retro-Focusing Microwave Hyperthermia Applicator: Conjugate-Field Matching Scheme." 1986 Transactions on Microwave Theory and Techniques 34.5 (May 1986 [T-MTT] (Special Issue on Phased Arrays for Hyperthermia Treatment of Cancer)): 490-494.

A seven-element array of dielectric-loaded open-ended waveguides totally immersed in a water tank is tested as a possible hyperthermia applicator. Experimental results show a substantial increase in focusing ability of the array if a conjugate matching scheme is used to adjust the phase of each element excitation. This scheme could offer a practical procedure for operating a focused hyperthermia applicator in a living patient.



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Discussion of Capabilities of Microwave Phased Arrays for Hyperthermia Treatment of Neck Tumors

F. Jouvie, J.-C. Bolomey and G. Gaboriaud. "Discussion of Capabilities of Microwave Phased Arrays for Hyperthermia Treatment of Neck Tumors." 1986 Transactions on Microwave Theory and Techniques 34.5 (May 1986 [T-MTT] (Special Issue on Phased Arrays for Hyperthermia Treatment of Cancer)): 495-501.

The power deposition capabilities of phased arrays are investigated by means of numerical modeling. Integral formulation and gradient conjugate techniques have been used to calculate the power deposited by complete or limited annular arrays in cylindrical neck cross sections. Comparisons with the power deposition patterns obtained by means of other heating modalities (RF capacitive electrodes, single microwave applicator or nonphased arrays) show that, even with a moderate number of elements, phased arrays are expected to provide better uniformity and larger penetration depths although improvements offered by phased arrays largely depend on the possibility to conveniently check the initial amplitude/phase adjustment of the array elements. Some existing and potential control procedures are addressed.



915-MHz Phased-Array System for Treating Tumors in Cylindrical Structures

A.W. Guy, C.-K. Chou and K.H. Luk. "915-MHz Phased-Array System for Treating Tumors in Cylindrical Structures." 1986 Transactions on Microwave Theory and Techniques 34.5 (May 1986 [T-MTT] (Special Issue on Phased Arrays for Hyperthermia Treatment of Cancer)): 502-507.

A phased-array 915-MHz microwave system consisting of four 13x13 cm square applicators was constructed and tested for its design in heating both deep and superficial tumors in cylindrical structures such as the upper and lower extremities or neck. Since each applicator produced SAR patterns in cylindrical phantoms in a plane through the array similar to those produced by a plane wave, a theoretical analysis of the SAR patterns due to the superposition of four plane waves incident on a cylindrical tissue was done. By altering the orientation of the E-field (either parallel or perpendicular to the axis of the cylinder), as well as the phase and amplitude of the incident waves, various distinct SAR patterns were predicted. Thermograms used to experimentally verify the SAR patterns produced by the four applicators showed similar results with those predicted by the plane-wave analysis. A patient with recurrent melanomas on a lower leg was subjected to a clinical trial of hyperthermia in which high tissue temperatures were produced by utilizing two sets of the phased-array system in series. A therapeutic temperature of 43°C in tumor tissues was confirmed by invasive thermometry with high-resistance thermistors.





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Mini-Annular Phased Array for Limb Hyperthermia

P.F. Turner. "Mini-Annular Phased Array for Limb Hyperthermia." 1986 Transactions on Microwave Theory and Techniques 34.5 (May 1986 [T-MTT] (Special Issue on Phased Arrays for Hyperthermia Treatment of Cancer)): 508-513.

The design concepts of a thin-shell cylindrical or annular phased-array of conformal strip radiators is shown to be suitable for deep heating of phantoms simulating the limbs of the human body. The Mini-Annular Phased Array (MAPA) is presently under clinical investigation for treatment of cancer of the limbs at a limited number of institutions. The effect of frequency and tissue conductivity is shown under simulated conditions for a few sample power-density patterns illustrating the deep focusing of the radiated EM fields. These are compared to a numerical model pattern which can be used to estimate the patterns in varying diameter limbs. The effect of offsetting the limb within the array to steer pattern of heat deposition has also been shown to produce desirable asymmetrical patterns.

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Theoretical Analysis and Clinical Demonstration of the Effect of Power Pattern Control Using the Annular Phased-Array Hyperthermia System

V. Sathiaselan, M.F. Iskander, G.C.W. Howard and N.M. Bleeen. "Theoretical Analysis and Clinical Demonstration of the Effect of Power Pattern Control Using the Annular Phased-Array Hyperthermia System." 1986 Transactions on Microwave Theory and Techniques 34.5 (May 1986 [T-MTT] (Special Issue on Phased Arrays for Hyperthermia Treatment of Cancer)): 514-519.

The phase and amplitude control of power deposition patterns for the BSD Annular Phased Array (APA) has been theoretically analyzed at a frequency of 60 MHz. Absorbed power patterns in simple circular cross-sectional cylindrical dielectric structures were studied first to compare with published experimental results. Models based on computerized tomography (CT) scans from the pelvic region have been used for predicting the specific absorption rate (SAR) patterns in patients. Significant changes were observed with phase changes of 30° and relative amplitude changes of 20 percent. The theoretical predictions qualitatively agree with the experimental results reported for simple phantoms. It is also shown that these techniques result in a better control of the SAR patterns and thus more effective heating of tumors situated eccentrically within the pelvis, which we have confirmed in clinical treatments.



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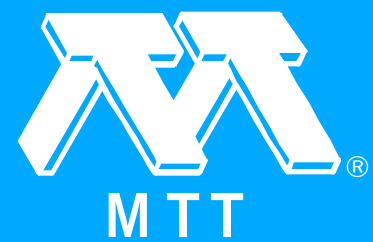
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Phase-Controlled Circular Array Heating Equipment for Deep-Seated Tumors: Preliminary Experiments

G. Sato, C. Shibata, S. Sekimukai, H. Wakabayashi, K. Mitsuka and K. Giga. "Phase-Controlled Circular Array Heating Equipment for Deep-Seated Tumors: Preliminary Experiments." 1986 Transactions on Microwave Theory and Techniques 34.5 (May 1986 [T-MTT] (Special Issue on Phased Arrays for Hyperthermia Treatment of Cancer)): 520-525.

This paper presents some preliminary results on the development of a circular phased-array equipment for heating deep-seated tumors. It is shown that radiators having sharp directivity are needed to realize excellent focusing of SAR. Moreover, moment method calculations indicate that linearly polarized helical radiators inversely wound with double wires possess the desired directivity and the near field pattern. Field patterns were measured in phantom (plastic cylinders containing saline water) with a circular array formed by four pairs of azimuthally positioned radiators. Excellent focusing of SAR was observed. The ratio of valley to peak value was 0.74. Steering of SAR maximum by phase control was observed and the distance of movement coincided with that estimated from phase variation.

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Phased-Array Design Considerations for Deep Hyperthermia through Layered Tissue

P.A. Cudd, A.P. Anderson, M.S. Hawley and J. Conway. "Phased-Array Design Considerations for Deep Hyperthermia through Layered Tissue." 1986 Transactions on Microwave Theory and Techniques 34.5 (May 1986 [T-MTT] (Special Issue on Phased Arrays for Hyperthermia Treatment of Cancer)): 526-531.

Results are presented which demonstrate localized heating at depth, by a phased array in a homogeneous thorax phantom and the problems caused by a more realistic case of a layered tissue equivalent phantom. A phased array of contacting radiators is proposed for overcoming the difficulty of selective heating within the body cavity caused primarily by the muscle layer. The field from one aperture radiator in contact with layered tissue is predicted by a planar spectral diffraction algorithm incorporating transmission and reflection operations on the plane wave spectrum. This prediction process is validated by experimental results. The algorithm enables the prediction of a minimum number of phased contacting radiators required for selective heating within lung tissue through fat and muscle layers at 2.45 GHz, and provides a guide for the design requirements of a multiapplicator system.

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An Optimal Excitation Method in Multi-Applicator Systems for Forming a Hot Zone Inside the Human Body

N. Morita, T. Hamasaki and N. Kumagai. "An Optimal Excitation Method in Multi-Applicator Systems for Forming a Hot Zone Inside the Human Body." 1986 Transactions on Microwave Theory and Techniques 34.5 (May 1986 [T-MTT] (Special Issue on Phased Arrays for Hyperthermia Treatment of Cancer)): 532-538.

A method is proposed for determining the excitation amplitude and phase of each applicator in electromagnetic multi-applicator systems for forming a narrow high temperature zone inside the human body. The principal advantage of this method for determining the optimal amplitudes and phases is its simplicity and reasonableness. The general principle is explained by using the example of an elliptical body region, heated by several line current sources placed outside the body. Numerical examples are presented for the case where a human abdominal region composed of muscular and spinal layers surrounded by a cooling water layer is excited by several line sources at 40.68 MHz.

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Abstracts

Analysis of the Radiation Leakage for a Four-Aperture Phased-Array Applicator in Hyperthermia Therapy

J.R. Wait. "Analysis of the Radiation Leakage for a Four-Aperture Phased-Array Applicator in Hyperthermia Therapy." 1986 Transactions on Microwave Theory and Techniques 34.5 (May 1986 [T-MTT] (Special Issue on Phased Arrays for Hyperthermia Treatment of Cancer)): 539-541.

We develop a criterion for the justified neglect of the field leaking from the regions between the horn apertures in a phased-array applicator. The condition is $(b/\delta)\psi \ll 1$, where δ is the skin depth of the conductive material, b is the radius of the torso or limb, and ψ is the wedge angle between the horn apertures.



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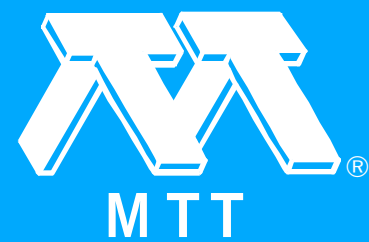
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Concentric-Ring and Sector-Vortex Phased-Array Applicators for Ultrasound Hyperthermia

C.A. Cain and S.-I. Umemura. "Concentric-Ring and Sector-Vortex Phased-Array Applicators for Ultrasound Hyperthermia." 1986 Transactions on Microwave Theory and Techniques 34.5 (May 1986 [T-MTT] (Special Issue on Phased Arrays for Hyperthermia Treatment of Cancer)): 542-551.

Concentric-ring phased arrays subdivided into sectors (radial slices) can, with appropriate phasing, produce power absorption patterns useful for hyperthermia cancer therapy. The ability of a concentric-ring array to move a focal region along the central axis of the transducer is well known. Less well known is the ability of such an array to produce variable diameter annular (or ring) focal regions. Such focal rings can be effective in heating some tumors if directed around the tumor periphery. These focal rings have been produced in the past by fixed annular focus lenses, or effectively by mechanical scanning of "point" focus ultrasonic transducers. Production of these focal rings by a concentric-ring phased array has the advantage of allowing the focal ring diameter and focal length to be easily changed and scanned by phasing providing much greater heating flexibility. However, under some conditions such arrays produce very large secondary focus effects along the central axis of the array. Concentric-ring arrays can also provide only patterns of circular symmetry. These problems can be partially solved by dividing the disk of the array into sectors. By appropriate phasing of the sectors, the intensity along the central axis can be greatly reduced. Moreover, appropriate phasing of the rings and sectors can produce patterns that are circularly asymmetric. By controlling these asymmetries, nonspherical tumors can be heated more optimally. Power absorption patterns in lossy media for this class of applicators are analyzed numerically allowing a quantitative evaluation of both advantages and limitations of this approach. A thermal model based on the bioheat equation is also used to predict temperature distributions in volumes where important thermal parameters, particularly blood flow, are varied.

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Abstracts

The Effect of Scanning Speed on Temperature and Equivalent Thermal Exposure Distributions During Ultrasound Hyperthermia in Vivo

K. Hynynen, R. Roemer, E. Moros, C. Johnson and D. Anhalt. "The Effect of Scanning Speed on Temperature and Equivalent Thermal Exposure Distributions During Ultrasound Hyperthermia in Vivo." 1986 Transactions on Microwave Theory and Techniques 34.5 (May 1986 [T-MTT] (Special Issue on Phased Arrays for Hyperthermia Treatment of Cancer)): 552-559.

Experiments on eight dogs using scanned, focused ultrasound to heat thighs in vivo were performed using extensive thermometry (56 thermocouples) to measure the temperature fields produced. The effects of scanning speed, blood perfusion, and applied power level are investigated. The results show that the temperature fluctuations present at low scanning speeds can significantly enhance the equivalent thermal exposure of the tissue. A theoretical analysis substantiates the major experimental results.



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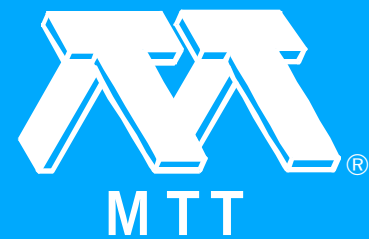
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SAR Patterns from an Interstitial Microwave Antenna-Array Hyperthermia System

T.Z. Wong, J.W. Strohbehn, K.M. Jones, J.A. Mechling and B.S. Trembly. "SAR Patterns from an Interstitial Microwave Antenna-Array Hyperthermia System." 1986 Transactions on Microwave Theory and Techniques 34.5 (May 1986 [T-MTT] (Special Issue on Phased Arrays for Hyperthermia Treatment of Cancer)): 560-567.

In recent years, a number of groups have been investigating the use of interstitial microwave antenna-array hyperthermia (IMAAH) systems for the treatment of superficial and deep-seated tumors. A critical parameter in any hyperthermia system is the SAR (specific absorption rate) pattern, which gives information about the energy absorption in the tumor and surrounding tissue. In this paper, we compare the theoretical and measured values of the SAR distribution for an array of four 915-MHz antennas implanted on the corners of a 2-cm square array. The overall length of the antennas was assumed to be 7 cm theoretically and was either 6 or 7 cm for the measurements. In general, there was good agreement between the theoretical predictions and the experimental results. In particular, both theory and experiment demonstrated that the maximum SAR occurred in the junction plane of the antenna array and at the center of the square array. Similarly, both showed that the longitudinal extent of the heating pattern is about 5 cm for a single antenna, but closer to 3 cm for an array where the longitudinal extent is defined by the length in the longitudinal direction where the SAR is greater than 50 percent of the maximum. The experiments showed that the SAR patterns were quite reproducible, and that the use of double stub tuners to minimize the reflected power for each antenna resulted in poorer SAR patterns due to phase variations created by the tuners. However, the use of an attenuator with each antenna to equalize the maximum SAR from each antenna did improve the SAR distributions slightly.





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Control of the SAR Pattern within an Interstitial Microwave Array through Variation of Antenna Driving Phase

B.S. Trembly, A.H. Wilson, M.J. Sullivan, A.D. Stein, T.Z. Wong and J.W. Strohbehn. "Control of the SAR Pattern within an Interstitial Microwave Array through Variation of Antenna Driving Phase." 1986 Transactions on Microwave Theory and Techniques 34.5 (May 1986 [T-MTT] (Special Issue on Phased Arrays for Hyperthermia Treatment of Cancer)): 568-571.

The interstitial microwave antenna-array hyperthermia (IMAAH) system produces a pattern of specific absorption rate (SAR) that is nonuniform within a 2-cm square array driven in phase at 915 MHz. Theory and experiment show that the point of phase coherence (maximum SAR) can be shifted to a point where the SAR is small by changing the antenna driving phases. Rapid shifting makes the time-average SAR more uniform in the direction perpendicular to the antennas. In 95 percent of the antenna junction plane, the time-average SAR is constant within 10 percent.

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Interstitial Equal-Phased Arrays for EM Hyperthermia

P.F. Turner. "Interstitial Equal-Phased Arrays for EM Hyperthermia." 1986 Transactions on Microwave Theory and Techniques 34.5 (May 1986 [T-MTT] (Special Issue on Phased Arrays for Hyperthermia Treatment of Cancer)): 572-578.

Microwave radiating antenna arrays frequently have been inserted directly into cancerous tumors to heat directly and destroy the tumor cells. Example heating patterns are shown with a simple antenna design. An improved design is also described and power absorption patterns are calculated by a three-dimensional numerical model. This model is used to show effects of frequency and applicator design on the power pattern. The numerical model is also applied to show an improved power pattern with a synchronous (equal-phase) compared to a nonsynchronous array. The model shows that an increase in tip capacitance increases the heating at the tip.

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Synthetic Array for Radiometric Retrieval of Thermal Fields in Tissues

F. Bardati, M. Mongiardo and D. Solimini. "Synthetic Array for Radiometric Retrieval of Thermal Fields in Tissues." 1986 Transactions on Microwave Theory and Techniques 34.5 (May 1986 [T-MTT] (Special Issue on Phased Arrays for Hyperthermia Treatment of Cancer)): 579-583.

The feasibility of reconstructing the thermal field in biological tissues from brightness data measured by an array of microwave antennas is investigated through a numerical simulation. The array does not make use of phase information and is synthesized through the Kalman filter algorithm. The obtained results indicate that, by a multispectral technique, such a synthetic array might be able to achieve spatial resolution not only in a transverse direction, but also in depth.



Abstracts

Effect of Skin in Microwave Detection of Breast Cancer

E. Alanen and I.V. Lindell. "Effect of Skin in Microwave Detection of Breast Cancer." 1986 Transactions on Microwave Theory and Techniques 34.5 (May 1986 [T-MTT] (Special Issue on Phased Arrays for Hyperthermia Treatment of Cancer)): 584-588.

A calculation method is introduced and subsequent numerical results are shown for the effect of skin in radiometric detection of breast cancer using a horn antenna in direct contact with the skin. The electromagnetic problem in layered medium is solved applying the exact image theory, which enables the field calculation also in the near-field range. A proposal to optimize the aperture function for better resolution is given.



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Optimization of Simulated Two-Dimensional Temperature Distributions Induced by Multiple Electromagnetic Applicators

C. De Wagter. "Optimization of Simulated Two-Dimensional Temperature Distributions Induced by Multiple Electromagnetic Applicators." 1986 Transactions on Microwave Theory and Techniques 34.5 (May 1986 [T-MTT] (Special Issue on Phased Arrays for Hyperthermia Treatment of Cancer)): 589-596.

A computer simulation to calculate transient temperature distributions in realistic cross sections of the human body is described. In the simulation, the therapeutic effect of hyperthermia administration is maximized by optimum use of the electromagnetic applicators. The time-dependent mathematical optimum for the levels of energy going to the applicators as well as for the waterbolus separating the applicators from the patients is computed. Among other applications, this modeling is useful for predicting limitations to certain types of hyperthermia systems, and has the potential for realistic computer-aided therapy planning. As an example, the treatment planning for a tumor in the lower limb is given in the case of incoherent sources.



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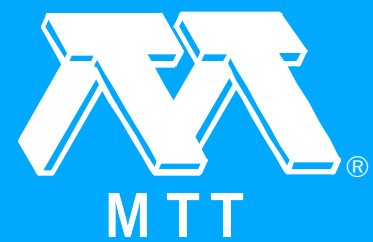
Optimal Temperature Control with Phased Array Hyperthermia System

M. Knudsen and U. Hartmann. "Optimal Temperature Control with Phased Array Hyperthermia System." 1986 Transactions on Microwave Theory and Techniques 34.5 (May 1986 [T-MTT] (Special Issue on Phased Arrays for Hyperthermia Treatment of Cancer)): 597-603.

A strategy for controlling the temperature distribution in tissue, irradiated by a phased array of RF applicators, described. Using the amplitudes and relative phases from the individual applicators as control inputs, feedback control is established from a corresponding number of measured tissue temperatures. Optimal control theory based on a state-space model of the thermal process is used for designing the multi-variable self-toning controller. Simulations of the two-dimensional temperature distribution in cylindrical homogeneous muscle tissue indicate that it is possible to place a temperature maximum near a given point and to maintain therapeutic temperatures in a specified tumor area while the temperatures in the surrounding tissue are lower.

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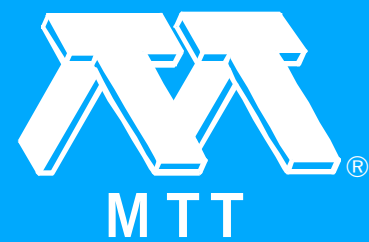
A Predictive-Adaptive, Multipoint Feedback Controller for Local Heat Therapy of Solid Tumors

C.F. Babbs, V.A. Vaguine and J.T. Jones. "A Predictive-Adaptive, Multipoint Feedback Controller for Local Heat Therapy of Solid Tumors." 1986 Transactions on Microwave Theory and Techniques 34.5 (May 1986 [T-MTT] (Special Issue on Phased Arrays for Hyperthermia Treatment of Cancer)): 604-611.

Uniform heating of tumor tissue to therapeutic temperatures without damaging surrounding normal tissue is required for optimal local heat therapy of cancer. This paper describes an algorithm for on-line computer control that will allow the therapist to minimize the standard deviation of measured intratumoral temperatures. The method is applicable to systems incorporating multiple surface and/or interstitial applicators delivering microwave, radiofrequency, or ultrasonic power and operating under control of a small computer. The essential element is a novel predictive-adaptive control algorithm that infers relevant thermal parameters from the responses of multiple temperature sensors as each of the power applicators is briefly turned off. Applied power and effective perfusion are estimated from transient slope changes of the temperature-time curves for each sensor. By substituting these values into a system of linear equations derived from the bio-heat transfer equation, the small computer can calculate the optimal allocation of power among the various applicators ("knob settings") to generate most uniform intratumoral temperature distribution with the desired mean, or minimum, tumor temperature.

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Low-Frequency RF Twin-Dipole Applicator for Intermediate Depth Hyperthermia

C. Franconi, C.A. Tiberio, L. Raganella and L. Begnozzi. "Low-Frequency RF Twin-Dipole Applicator for Intermediate Depth Hyperthermia." 1986 Transactions on Microwave Theory and Techniques 34.5 (May 1986 [T-MTT] (Special Issue on Phased Arrays for Hyperthermia Treatment of Cancer)): 612-619.

In studies on heating deep-seated tumors, various attempts have been made to develop radiofrequency applicators and to confine the controlled volumes into limited sizes at variable useful depths. Results of the present investigation show that the conduction-current mechanism dominates the heating with magnetic dipoles working at frequencies as low as 27 MHz, and that two single-magnetic dipoles forming a loosely coupled pair (twin-dipole applicator) fed by low-frequency, in-phase currents, give a better performance than a single dipole of the same size, due to the phase coherence of the superimposing fields. A number of single-dipole and twin-dipole applicator working at 27 MHz have been developed and given the fundamental tests on phantoms simulating muscle and fat tissues. The results obtained show the feasibility of the proposed applicator to produce a penetration depth up to 7 cm and a power deposition pattern showing a well-defined maximum, which may undergo a controlled shift of a few centimeters in depth. Moreover, the surface overheating may be easily controlled. A circuit design is described that improves the matching and the uniformity of the power deposition pattern. A preliminary calculation in the quasi-static-fields approximation of the electric field induced by the twin-dipole applicator in air is also described.





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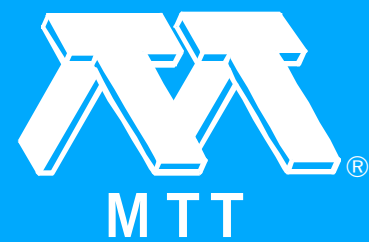
Manipulation of Central Axis Heating Patterns with a Prototype, Three-Electrode Capacitive Device for Deep-Tumor Hyperthermia

G.H. Nussbaum, J. Sidi, N. Rouhanizadeh, P. Morel, C. Jasmin, G. Convert, J.P. Mabire and G. Azam. "Manipulation of Central Axis Heating Patterns with a Prototype, Three-Electrode Capacitive Device for Deep-Tumor Hyperthermia." 1986 Transactions on Microwave Theory and Techniques 34.5 (May 1986 [T-MTT] (Special Issue on Phased Arrays for Hyperthermia Treatment of Cancer)): 620-625.

Measurements of initial temperature elevations produced by a prototype, three-electrode capacitive heating device operating at 13.56 MHz were made at selected points along vertical and horizontal axes in beef phantoms. Adjustment of the net power supplied by the three generators driving the upper and lower two electrodes of the device permitted significant manipulation of the distribution of initial temperature elevations along the vertical "central" axis of the beef phantoms. For example, in a 17 cm thick phantom, the ratio of initial temperature elevations at central axis depths of 1 and 8 cm below the upper surface was reduced from 3.2 to 0.5, through appropriate redistribution of power to the three electrodes.

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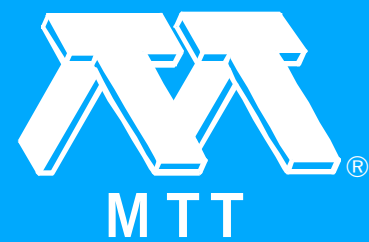
A Direct-Contact Microwave Lens Applicator with a Microcomputer-Controlled Heating System for Local Hyperthermia

Y. Nikawa, H. Watanabe, M. Kikuchi and S. Mori. "A Direct-Contact Microwave Lens Applicator with a Microcomputer-Controlled Heating System for Local Hyperthermia." 1986 Transactions on Microwave Theory and Techniques 34.5 (May 1986 [T-MTT] (Special Issue on Phased Arrays for Hyperthermia Treatment of Cancer)): 626-630.

A direct-contact lens applicator for local microwave hyperthermia is proposed and developed with a computer-controlled microwave heating system. The applicator is a practical one that can converge the radiated electromagnetic field to deposit its energy deep in human tissues. The experimental results, which agree well with the theoretical ones, show that the applicator which operated at 2450 MHz could heat at twice the depth at which a simple and conventional waveguide applicator could heat. The experimental results using a developed computer system that supplies microwave energy and circulated cooling water to the developed applicator show that the fluctuations of temperature at the heating location in the human tissue model were maintained within $\pm 0.3^{\circ}\text{C}$ of the set temperature. The results of the phantom model and the animal experiment using the system with the applicator show that the maximum depth of noninvasive heating was more than 30 mm below the surface. These results are available for the clinical hyperthermia treatment of cancer.

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An Electric Field Converging Applicator with Heating Pattern Controller for Microwave Hyperthermia

Y. Nikawa, T. Katsumata, M. Kikuchi and S. Mori. "An Electric Field Converging Applicator with Heating Pattern Controller for Microwave Hyperthermia." 1986 Transactions on Microwave Theory and Techniques 34.5 (May 1986 [T-MTT] (Special Issue on Phased Arrays for Hyperthermia Treatment of Cancer)): 631-635.

A new type of applicator for microwave hyperthermia at 430 MHz has been developed. The applicator, which consists of an integrated waveguide array, has a convergent effect of the radiated electromagnetic (EM) field in lossy dielectric media, and it can change the heating pattern in the medium with ease. The electric field distributions from the aperture of the applicator were measured in a saline solution having a concentration of 0.2--0.6 percent which served as the model of simulated human tissues. The results show that when using the above applicator, the location of maximum intensity of the electric field could be generated inside of the dissipative medium. The calculations of temperature distribution were performed in the model by using the experimental results of the electric field distribution. The applicator could change the transverse electric field distribution inside the medium, and then could control the depth of tissues located to the hyperthermic range. The heating range available for hyperthermia rising our single applicator is maximum 60 mm in depth theoretically.



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Localized Hyperthermia with Electromagnetic Arrays and the Leaky-Wave Troughguide Applicator

C.M. Rappaport and F.R. Morgenthaler. "Localized Hyperthermia with Electromagnetic Arrays and the Leaky-Wave Troughguide Applicator." 1986 Transactions on Microwave Theory and Techniques 34.5 (May 1986 [T-MTT] (Special Issue on Phased Arrays for Hyperthermia Treatment of Cancer)): 636-643.

Noninvasive microwave hyperthermia is an attractive cancer treatment modality. Understanding the advantages and limitations of focusing are vital for the practical implementations of electromagnetic heating of deep tumors. These, as well as the important issues of tissue coupling and proper choices of polarization and frequency are herein examined. An optimal theoretical source distribution and an applicator design that approximates this distribution are discussed.



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A Large Waveguide Applicator for Deep Regional Hyperthermia

S. Mizushina, Y. Xiang and T. Sugiura. "A Large Waveguide Applicator for Deep Regional Hyperthermia." 1986 Transactions on Microwave Theory and Techniques 34.5 (May 1986 [T-MTT] (Special Issue on Phased Arrays for Hyperthermia Treatment of Cancer)): 644-648.

A large waveguide applicator is proposed for deep regional hyperthermia, where a part of a patient's body is exposed to the TE/sub 10/ -mode waves in the rectangular waveguide through the holes made to fit the body cross section in the broad walls. The electric field and the specific absorption rate distribution produced by the applicator in a realistic model of a human body cross section calculated by a two-dimensional (2-D) numerical method are given.

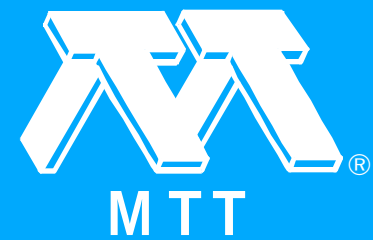
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"Patent Abstracts (May 1986 [T-MTT])." 1986 Transactions on Microwave Theory and Techniques 34.5 (May 1986 [T-MTT] (Special Issue on Phased Arrays for Hyperthermia Treatment of Cancer)): 649-652.



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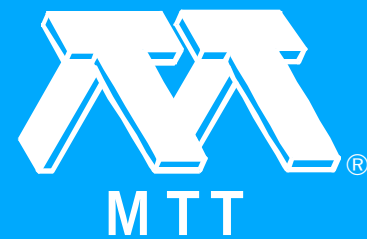
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Abstracts

Call for Papers - Microwave Aspects and Applications of GHz/Gbit Optical Technology (May 1986 [T-MTT])

"Call for Papers - Microwave Aspects and Applications of GHz/Gbit Optical Technology (May 1986 [T-MTT])." 1986 Transactions on Microwave Theory and Techniques 34.5 (May 1986 [T-MTT]) (Special Issue on Phased Arrays for Hyperthermia Treatment of Cancer): 653-653.



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Membership Application (May 1986 [T-MTT])

"Membership Application (May 1986 [T-MTT])." 1986 Transactions on Microwave Theory and Techniques 34.5 (May 1986 [T-MTT] (Special Issue on Phased Arrays for Hyperthermia Treatment of Cancer)): 654-654.



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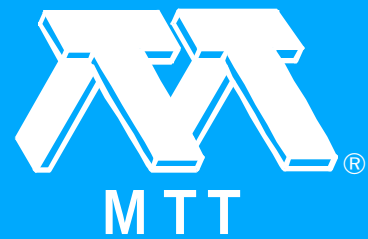
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Abstracts

IEEE Press Books (Advertisement) (May 1986 [T-MTT])

"IEEE Press Books (Advertisement) (May 1986 [T-MTT])." 1986 Transactions on Microwave Theory and Techniques 34.5 (May 1986 [T-MTT] (Special Issue on Phased Arrays for Hyperthermia Treatment of Cancer)): 655-655.



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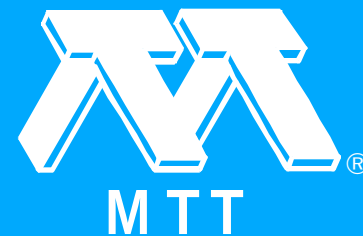
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Abstracts

IEEE Finding Your Way (Advertisement) (May 1986 [T-MTT])

"IEEE Finding Your Way (Advertisement) (May 1986 [T-MTT])." 1986 Transactions on Microwave Theory and Techniques 34.5 (May 1986 [T-MTT] (Special Issue on Phased Arrays for Hyperthermia Treatment of Cancer)): 656-656.



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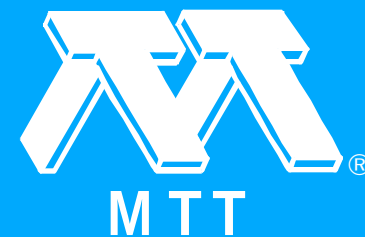
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Abstracts

Back Cover (May 1986 [T-MTT])

"Back Cover (May 1986 [T-MTT])." 1986 Transactions on Microwave Theory and Techniques 34.5 (May 1986 [T-MTT] (Special Issue on Phased Arrays for Hyperthermia Treatment of Cancer)): b1-b2.



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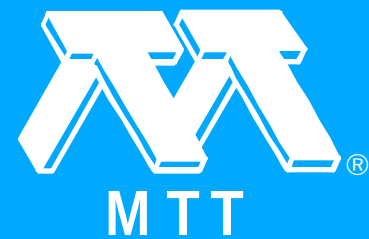
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Accuracy of Block Models for Evaluation of the Deposition of Energy by Electromagnetic Fields

M.J. Hagmann and R.L. Levin. "Accuracy of Block Models for Evaluation of the Deposition of Energy by Electromagnetic Fields." 1986 Transactions on Microwave Theory and Techniques 34.6 (Jun. 1986 [T-MTT]): 653-659.

Numerical solutions were made for block models using as many as 3048 cubes to approximate a prolate spheroidal model of man at 100 and 225 MHz. A high-frequency modification of Hohmann's formulation (HFH) gave values of mean absorption within five to seven percent of those with the Iterative Extended Boundary Condition Method (IEBCM). Arrangement of the cells for a best-fit approximation of the spheroid is essential for such high accuracy. Numerical quadratures using the cubical shape of the cells verified the high accuracy of the closed-form expressions used for HFH matrix elements. Quadrature over spheres having the same volume as the cells gave inaccurate values for the matrix elements. Values of average absorption calculated with 296, 560, 1376, and 1944 cell models of the prolate spheroidal model of man differed from each other by no more than 17 percent at frequencies of 10 to 400 MHz, and by 5.0 percent at the resonant frequency of 75 MHz.

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Analysis of Lossy Transmission Lines with Arbitrary Nonlinear Terminal Networks

A.R. Djordjevic, T.K. Sarkar and R.F. Harrington. "Analysis of Lossy Transmission Lines with Arbitrary Nonlinear Terminal Networks." 1986 Transactions on Microwave Theory and Techniques 34.6 (Jun. 1986 [T-MTT]): 660-666.

A novel method for transient analysis of lossy transmission lines with arbitrary nonlinear terminal networks is presented. The uniqueness of this approach is that we develop time-domain Green's functions for the multiport transmission-line systems by terminating the ports in quasi-matched loads. This ensures Green's functions of a short duration. Hence, the amount of frequency-domain data necessary to obtain time-domain Green's functions is modest. These Green's functions are then convolved with the line port voltages. With this technique one can analyze responses of multiconductor transmission lines with arbitrary nonlinear loads (even with memory) as we have at any instant of time Thévenin's equivalent of the linear portion of the system. An example is presented to illustrate the application of this technique to multiconductor nonlinearly loaded transmission lines.

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Electromagnetic Instability of a Rotating Electron Layer in a Sheath Helix

V.K. Jain and V.K. Tripathi. "Electromagnetic Instability of a Rotating Electron Layer in a Sheath Helix." 1986 Transactions on Microwave Theory and Techniques 34.6 (Jun. 1986 [T-MTT]): 667-670.

A sheath helix supports slow electromagnetic modes with phase velocity considerably lower than the velocity of light in a vacuum. In the presence of a rotating electron layer, the modes can be resonantly driven unstable via cyclotron maser interaction. Using the perturbation technique, the growth rate of the instability is obtained in the weak-beam approximation and is seen to decrease with the slowing down of the modes. For lower order modes, the growth rate is comparable to the one with a cocentric cylindrical waveguide. However, for higher order modes, the growth rate decreases rapidly, suggesting that a sheath helix may be used to suppress the higher order modes.

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



Abstracts

Specific Absorption Rates of Energy in Man Models Exposed to Cellular UHF Mobile-Antenna Fields

A.W. Guy and C.-K. Chou. "Specific Absorption Rates of Energy in Man Models Exposed to Cellular UHF Mobile-Antenna Fields." 1986 Transactions on Microwave Theory and Techniques 34.6 (Jun. 1986 [T-MTT]): 671-680.

Thermography, nonperturbing temperature probes, and E-field sensitive diodes were used to quantify the SAR patterns in human models exposed to UHF mobile-antenna fields. The exposure conditions include man, woman, and child models in the standing position close to roof- and trunk-mounted antenna; man sitting in the back seat near a trunk-mounted antenna; child kneeling in the back seat and looking through the rear window. Incident power densities near the antennas were also measured. Based on the current ANSI radio-frequency protection guide, the exemption of 7-W input power will violate the ANSI primary exposure criterion, but satisfies the 8-W/kg exclusion clauses. A maximum power of 3.5 W would satisfy all of the ANSI guides.



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Design of Dielectric Waveguide Bandpass Filters Using Parallel-Coupled Gratings

P.K. Ikalainen and G.L. Matthaei. "Design of Dielectric Waveguide Bandpass Filters Using Parallel-Coupled Gratings." 1986 Transactions on Microwave Theory and Techniques 34.6 (Jun. 1986 [T-MTT]): 681-689.

Techniques for the design of narrow-band (of the order of a percent or so), bandpass filters using dielectric waveguide gratings are presented. These filters use both single, uncoupled gratings and parallel-coupled configurations of gratings to form multiresonator bandpass filter structures. Transmission-line equivalent circuits are used to model the dielectric waveguide gratings. Using this model, it is then shown how direct-coupled-resonator theory can be applied to such filter structures to synthesize a prescribed passband having Chebyshev or maximally flat characteristic. On the other hand, the parallel-coupled gratings give these filters broad and strong, absorptive stopbands, as is explained. Experimental results are presented which show good agreement between theoretical and measured results.

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



Abstracts

Simulation of Electrostatic Noise Amplification in Gyrotrons

K.R. Chu and L.-H. Lyu. "Simulation of Electrostatic Noise Amplification in Gyrotrons." 1986 Transactions on Microwave Theory and Techniques 34.6 (Jun. 1986 [T-MTT]): 690-695.

Electrostatic noise generated by the electrostatic cyclotron instability is simulated in slab geometry with dc space charge effects neglected. The noise is found to be characterized by a broad spectrum, low saturation levels, and a strong disturbing effect on the electron energy distribution.



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Analysis of Multiple-Strip Discontinuity in a Rectangular Waveguide

S.N. Sinha. "Analysis of Multiple-Strip Discontinuity in a Rectangular Waveguide." 1986 Transactions on Microwave Theory and Techniques 34.6 (Jun. 1986 [T-MTT]): 696-700.

The paper considers the problem of an arbitrary number of thin, transverse, and metallic strips located in the cross section of a rectangular waveguide. The strips can either be inductive or capacitive and are arbitrarily located. Equivalence theorem is utilized, in conjunction with appropriate boundary conditions, to set up an integral equation which is then solved using the method of moments. The method is applied to a number of test problems and the numerical results show good agreement with the available data.

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Analysis of Cylindrical Stripline with Multilayer Dielectrics

C.J. Reddy and M.D. Deshpande. "Analysis of Cylindrical Stripline with Multilayer Dielectrics." 1986 Transactions on Microwave Theory and Techniques 34.6 (Jun. 1986 [T-MTT]): 701-706.

An inhomogeneous, multielectric-layered cylindrical stripline using TEM-model approximation is analyzed. A simple, closed-form expression for the characteristic impedance of an inhomogeneous cylindrical stripline is derived. Numerical results on the characteristic impedance are compared with the results obtained by Wang, and also with the results obtained by the conformal transformation. Extensive data on the impedances of inhomogeneous cylindrical stripline are also presented.

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GaAs-Monolithic IC's for an X-Band PLL-Stabilized Local Source

M. Madihian and K. Honjo. "GaAs-Monolithic IC's for an X-Band PLL-Stabilized Local Source." 1986 Transactions on Microwave Theory and Techniques 34.6 (Jun. 1986 [T-MTT]): 707-713.

X-band GaAs-monolithic voltage controlled-oscillator (VCO), divide-by-four analog frequency divider, and Wilkinson power splitter have been developed for frequency stabilization of an X-band local source in a phase-locked loop (PLL) system. The VCO has a series feedback configuration and utilizes an optimized design procedure to yield the highest dc-RF efficiency ever reported for a GaAs-monolithic FET oscillator. The frequency divider has a novel structure which applies a dual-gate FET mixer and two RC-coupled FET amplifier stages to establish a closed loop for generating a 1/4 subharmonic component of an input frequency. The Wilkinson power splitter consists of an isolation resistor and two quarter-wavelength lines, which have been realized in both meander and spiral forms. A VCO-driven frequency divider system incorporating these IC's consumes 380-mW total power to provide the 1/4 subharmonic component of the VCO frequency with more than 3-dBm output power over a 10.86--11.01-GHz range.

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The Discrete Variational Conformal Technique for the Calculation of Strip Transmission-Line Parameters

R.E. Diaz. "The Discrete Variational Conformal Technique for the Calculation of Strip Transmission-Line Parameters." 1986 Transactions on Microwave Theory and Techniques 34.6 (Jun. 1986 [T-MTT]): 714-722.

This paper describes a new method of obtaining the transmission line properties of strip transmission lines whose geometrical configurations would make them difficult to analyze with other available techniques. The Discrete Variational Conformal (DVC) technique relies on conformal transformations to obtain the simplest possible representation of the Green function for the configuration of interest. This Green function is then used with an assumed charge distribution in the plane of the original configuration, and in a novel variational expression for the modal capacitance. The resulting equation is particularly well suited for numerical evaluation. Sample configurations are used to compare DVC to other techniques: Exact conformal mapping, Method of Moments, Full Wave solutions, and a Transverse Transmission Line Method. Two examples of application of DVC to asymmetric configurations are given.

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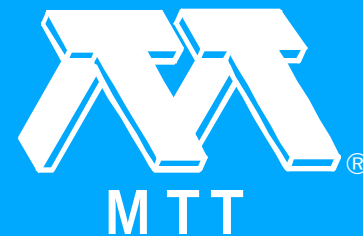


Abstracts

Electromagnetic Analysis of Spherical Dielectric Shielded Resonators (Short Papers)

A. Julien and P. Guillon. "Electromagnetic Analysis of Spherical Dielectric Shielded Resonators (Short Papers)." 1986 Transactions on Microwave Theory and Techniques 34.6 (Jun. 1986 [T-MTT]): 723-729.

We present in this paper, the electromagnetic parameters of free and shielded dielectric spherical resonators for their utilization in the millimeter-wave frequency band.



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Abstracts

Accurate Approach for Computing Quasi-Static Parameters of Symmetrical Broadside-Coupled Microstrips in Multilayered Anisotropic Dielectrics (Short Papers)

M. Horno and F. Medina. "Accurate Approach for Computing Quasi-Static Parameters of Symmetrical Broadside-Coupled Microstrips in Multilayered Anisotropic Dielectrics (Short Papers)." 1986 Transactions on Microwave Theory and Techniques 34.6 (Jun. 1986 [T-MTT]): 729-733.

In this paper, we present a method for calculating the propagation parameters of shielded broadside- end broadside edge-coupled microstrip transmission lines. Conductor strips are assumed to be embedded in a multilayered isotropic and/or anisotropic medium. This method provides accurate expressions for computing upper and lower bounds for the true values of mode capacitances, The effects of side wall-shielding and anisotropy of the material are investigated. Some particular multilayered structures are analyzed, which could be applied to the design of directional couplers and filters.



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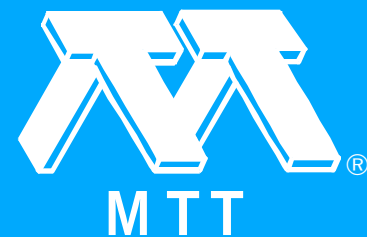


Abstracts

Faster Computation of Z-Matrices for Rectangular Segments in Planar Microstrip Circuits (Short Papers)

A. Benalla and K.C. Gupta. "Faster Computation of Z-Matrices for Rectangular Segments in Planar Microstrip Circuits (Short Papers)." 1986 Transactions on Microwave Theory and Techniques 34.6 (Jun. 1986 [T-MTT]): 733-736.

Currently available formulation of Z-matrices for rectangular segments in planar microstrip circuits involves numerical summation of the doubly infinite series in the corresponding Green's function. These computations can be accelerated considerably by using the formulation proposed here which is based on an analytical treatment of one of the summations involved.



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Abstracts

On Gain-Bandwidth Product for Distributed Amplifiers (Short Papers)

R.C. Becker and J.B. Beyer. "On Gain-Bandwidth Product for Distributed Amplifiers (Short Papers)." 1986 Transactions on Microwave Theory and Techniques 34.6 (Jun. 1986 [T-MTT]): 736-738.

Contours of constant gain-bandwidth product as a function of the gate and drain attenuation factors are presented. Design tradeoffs are established. It is shown that only one design achieves maximum gain-bandwidth, although many possible choices approach this maximum. The curves also lead to the specification of active device parameters when circuit requirements are known.



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Dispersion of Picosecond Pulses in Coplanar Transmission Lines (Short Papers)

G. Hasnain, A. Dienes and J.R. Whinnery. "Dispersion of Picosecond Pulses in Coplanar Transmission Lines (Short Papers)." 1986 Transactions on Microwave Theory and Techniques 34.6 (Jun. 1986 [T-MTT]): 738-741.

The dispersion of coplanar-type transmission lines has been extended to the terahertz regime to examine the distortion of picosecond electrical pulses. Dispersion of coplanar waveguides is compared to equivalent microstrip lines. Agreement with available experimental data is demonstrated for coplanar strips. An approximate dispersion formula for coplanar waveguides is also reported for CAD applications.

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Abstracts

Birefringence Analysis of Anisotropic Optical Fibers Using Variational Reaction Theory (Short Papers)

R.-B. Wu and C.H. Chen. "Birefringence Analysis of Anisotropic Optical Fibers Using Variational Reaction Theory (Short Papers)." 1986 Transactions on Microwave Theory and Techniques 34.6 (Jun. 1986 [T-MTT]): 741-745.

The variational reaction theory is applied to achieve a variational equation for the study of the single-mode optical fibers with anisotropic core media. Emphasized in this paper are the numerical results for the birefringence of the two principal modes in discussing the effects due to differences in refractive indices, anisotropy parameters, and index profiles.



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Abstracts

On the Noise Parameters of Isolator and Receiver with Isolator at the Input (Correction)

M.W. Pospieszalski. "On the Noise Parameters of Isolator and Receiver with Isolator at the Input (Correction)." 1986 Transactions on Microwave Theory and Techniques 34.6 (Jun. 1986 [T-MTT]): 746-746.

Due to a typographical error in the above paper, equation (5) on p. 452 should have appeared as follows.



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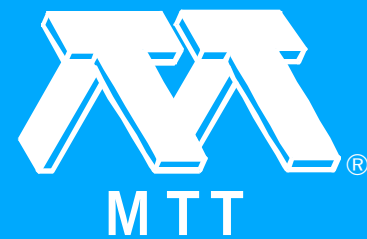
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Abstracts

A New Recurrence Method for Determining the Green's Function of Planar Structures with Arbitrary Anisotropic Layers (Correction)

R. Marques, M. Horno and F. Medina. "A New Recurrence Method for Determining the Green's Function of Planar Structures with Arbitrary Anisotropic Layers (Correction)." 1986 Transactions on Microwave Theory and Techniques 34.6 (Jun. 1986 [T-MTT]): 746-746.
In the above paper, there is a typographical error. Equation (25) should read as follows.



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Abstracts

Propagation of Quasi-Static Modes in Anisotropic Transmission Lines Application to MIC Lines (Corrections)

R. Marques and M. Horno. "Propagation of Quasi-Static Modes in Anisotropic Transmission Lines Application to MIC Lines (Corrections)." 1986 Transactions on Microwave Theory and Techniques 34.6 (Jun. 1986 [T-MTT]): 746-746.

In the above paper, there are some typographical errors. On p. 928, right column, "... $\bar{L}$ and $\bar{C}$ must be diagonalizable with the same set of eigenvalues,..." should read "... $\bar{L} \cdot \bar{C}$ and $\bar{C} \cdot \bar{L}$ must be diagonalizable with the same set of eigenvalues,...".



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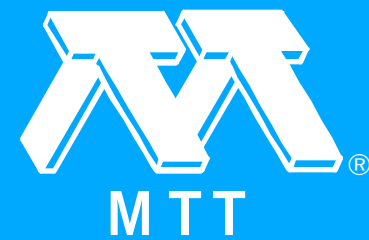
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Individual Learning Packages (Advertisement) (Jun. 1986 [T-MTT])

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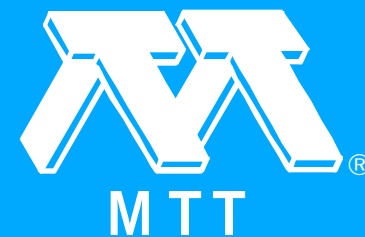
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Conversion Loss in GaAs Schottky-Barrier Mixer Diodes

T.W. Crowe and R.J. Mattauch. "Conversion Loss in GaAs Schottky-Barrier Mixer Diodes." 1986 Transactions on Microwave Theory and Techniques 34.7 (Jul. 1986 [T-MTT]): 753-760.

In this paper, the intrinsic conversion loss of GaAs Schottky-barrier mixer diodes is analyzed in light of a more accurate diode model. This analysis resolves the discrepancy between the predictions of an earlier intrinsic conversion loss model and experimental results. In particular, it is shown that a) cryogenic cooling should not degrade the conversion loss, and b) the diode diameter can be smaller than previously predicted before conversion-loss degradation begins to occur. Evidence is also presented which indicates that mixer diodes must be pumped beyond flat-band if the minimum, possible conversion loss is to be obtained. A more complete model of the conversion loss, which includes the parasitic circuit elements, is discussed and found to be in agreement with the qualitative results of the intrinsic conversion-loss model.

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An Absorber-Wall Parallel-Plate Waveguide

C.M. Knop, Y.B. Cheng and E.L. Ostertag. "An Absorber-Wall Parallel-Plate Waveguide." 1986 Transactions on Microwave Theory and Techniques 34.7 (Jul. 1986 [T-MTT]): 761-766.

The electromagnetic fields that can propagate through a parallel-plate waveguide having absorber walls are investigated, and it is shown that dominant TM_{10} and TE_{10} modes can propagate independently with both having a highly-tapered (cosine-type) transverse distribution, a phase velocity slightly exceeding the speed of light, and very low axial attenuation, especially for a wall-spacing large as compared to a free-space wavelength. In other words, such an absorber-guide acts like a corrugated waveguide having " $\lambda/4$ " teeth (balanced-hybrid mode) but it does so over virtually an unlimited bandwidth and with little sensitivity to the absorber's characteristics.

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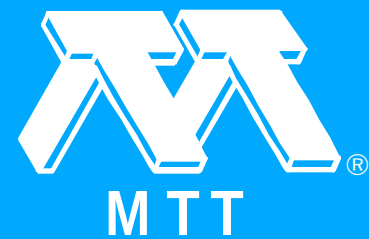
Asymmetrical Three-Line with Anisotropic Coupled Striplines Substrates

T. Kitazawa and Y. Hayashi. "Asymmetrical Three-Line with Anisotropic Coupled Striplines Substrates." 1986 Transactions on Microwave Theory and Techniques 34.7 (Jul. 1986 [T-MTT]): 767-772.

Analytical methods are presented for the general structure of three-line coupled striplines with anisotropic media for the first time. Two approaches are included one gives variational expressions for the quasistatic parameters of the cases with the uniaxially anisotropic substrates cut with their planar surface at an arbitrary angle to the optical axis, the other gives the rigorous hybrid-mode formulation for the cases with the uniaxially anisotropic substrates cut with their surface perpendicular to the optical axis. Accurate numerical results are presented for the propagation constants as well as the characteristic impedances of various types of three-line coupled striplines with anisotropic media.

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Normal Modes in an Overmoded Circular Waveguide Coated with Lossy Material

C.S. Lee, S.-W. Lee and S.-L. Chuang. "Normal Modes in an Overmoded Circular Waveguide Coated with Lossy Material." 1986 Transactions on Microwave Theory and Techniques 34.7 (Jul. 1986 [T-MTT]): 773-785.

The normal modes in an overmoded waveguide coated with a lossy material are analyzed, particularly for their attenuation properties as a function of coating material, layer thickness, and frequency. When the coating material is not too lossy, the low-order modes are highly attenuated even with a thin layer of coating. This coated guide serves as a mode suppressor of the low-order modes, which can be particularly useful for reducing the radar cross section (RCS) of a cavity structure such as a jet engine inlet. When the coating material is very lossy, low-order modes fall into two distinct groups highly and lowly attenuated modes. However, as a/λ (a = radius of the cylinder; λ = the free-space wavelength) increases, the separation between these two groups becomes less distinctive. The attenuation constants of most of the low-order modes become small and decrease as a function of λ^2/a^3 .

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Ultra-High-Speed GaAs Monolithic Prescaler and Phase Frequency Comparator IC

K. Osafune and K. Ohwada. "Ultra-High-Speed GaAs Monolithic Prescaler and Phase Frequency Comparator IC." 1986 Transactions on Microwave Theory and Techniques 34.7 (Jul. 1986 [T-MTT]): 786-790.

A high-speed, low-power prescaler and phase frequency comparator (PFC) IC for a phase-lock stable oscillator was designed and fabricated on a single chip using GaAs MESFET BFL circuitry. The gate width of the master-slave T-type flip-flops used in designing the 1/32 frequency divider prescaler was determined by circuit simulations. The fabricated 1/32 prescaler operated up to 8.0 GHz while the fabricated monolithic prescaler and PFC IC performed stable division, and phase and frequency comparison at input frequencies up to 4.8 GHz with a chip power dissipation of only 715 mW.

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Field Theory Design of Rectangular Waveguide Multiple-Slot Narrow-Wall Couplers

H. Schmiedel and F. Arndt. "Field Theory Design of Rectangular Waveguide Multiple-Slot Narrow-Wall Couplers." 1986 Transactions on Microwave Theory and Techniques 34.7 (Jul. 1986 [T-MTT]): 791-798.

A compact narrow-wall multiple-slot coupler suitable for inexpensive and very accurate metal-etching manufacturing techniques is proposed and optimized. A computer-aided design theory based on the method of field expansion of eigenmodes considers the effects of finite insert thickness and higher order mode interaction, step discontinuities, and changes in width. Computer-optimized design data for --20-, --8.34-, and --3-dB couplers in the R140-waveguide band (12.4--18 GHz) are given. These data are transferable into other common waveguide bands, e.g., R620 band (50-75 GHz), by suitable frequency scaling calculations. A metal-etched 12-slot coupler prototype for a midband frequency of about 15 GHz achieves a ± 1 -dB bandwidth of the --3-dB coupling of about 3.2 GHz together with a measured isolation of typically 35-40 dB (minimum 25 dB at the band limits). The measurements show good agreement with theory.

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Design and Performance of a 45-GHz HEMT Mixer

S.A. Maas. "Design and Performance of a 45-GHz HEMT Mixer." 1986 Transactions on Microwave Theory and Techniques 34.7 (Jul. 1986 [T-MTT]): 799-803.

A 45-GHz single-ended HEMT mixer has been developed with unity gain and 7-8-dB SSB noise figure over a 2-GHz bandwidth, including an IF amplifier, and 2-dBm output intermodulation intercept. This paper describes its design, structure, and performance. High performance has been achieved by careful attention to the design of the input and output embedding networks. This is the first reported HEMT mixer and the first active mixer above 30 GHz.

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Millimetric Nonreciprocal Coupled-Slot Finline Components

L.E. Davis and D.B. Sillars. "Millimetric Nonreciprocal Coupled-Slot Finline Components." 1986 Transactions on Microwave Theory and Techniques 34.7 (Jul. 1986 [T-MTT]): 804-808.

Promising preliminary results are presented for isolators and a four-port circulator in novel finline structures in the frequency range 26.5-40.0 GHz. The basic configuration is a ferrite-loaded coupled-slot finline with the ferrite magnetized parallel with the direction of propagation. The nonreciprocal effects of the odd mode propagating alone and of the odd and even modes propagating are described. All structures exhibit a 20-dB isolation bandwidth greater than 3.6 GHz. It is suggested that such structures would also be suitable for higher frequencies.

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Abstracts

Convergence of Numerical Solutions of Open-Ended Waveguide by Modal Analysis and Hybrid Modal-Spectral Techniques (Jul. 1986 [T-MTT])

J.A. Encinar and J.M. Rebollar. "Convergence of Numerical Solutions of Open-Ended Waveguide by Modal Analysis and Hybrid Modal-Spectral Techniques (Jul. 1986 [T-MTT])." 1986 Transactions on Microwave Theory and Techniques 34.7 (Jul. 1986 [T-MTT]): 809-814.

Two different methods are considered to deal with open-ended waveguides with an infinite metallic flange. The first one, modal analysis, is valid only when the aperture is radiating into a lossy medium. The second one is based on a hybrid modal-spectral technique, and it is valid for any medium, with or without losses. The rectangular aperture problem is solved by both methods, and the influence of different parameters on the convergence of numerical solutions is studied for each method. Finally, a comparison between both methods is presented for lossy and low-loss media.



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Abstracts

New Results in Dielectric-Loaded Resonators

K.A. Zaki and C. Chen. "New Results in Dielectric-Loaded Resonators." 1986 Transactions on Microwave Theory and Techniques 34.7 (Jul. 1986 [T-MTT]): 815-824.

Analysis of cylindrical dielectric-loaded resonators is reviewed. The fields within the dielectric-loaded region are postulated as the superposition of hybrid, TE, or TM modes of the infinite dielectric-loaded waveguide, while the fields in the end regions of the resonators are described by the superposition of the normal modes of a homogeneously filled waveguide. Numerical results are presented which reveal that accurate representation of the fields in the resonant structure generally require several modes. Hence, the resonant modes cannot be correlated directly with single waveguide modes. A new method for mode identification is proposed. For a wide range of parameters, the resonant frequencies, mode charts, field expansion coefficients, field intensity, and distributions are presented. Excellent agreement of the mode charts with resonant frequency measurement results are obtained.



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Abstracts

Experimental Simulation of Plasma Using Strip Medium (Short Papers)

D Kalluri, R. Prasad and S. Sataindra. "Experimental Simulation of Plasma Using Strip Medium (Short Papers)." 1986 Transactions on Microwave Theory and Techniques 34.7 (Jul. 1986 [T-MTT]): 825-828.

A technique for the plasma simulation using a two-dimensional strip medium is developed. The experimental results for, X-band rectangular waveguide and cavity filled with the strip simulated plasma are in good agreement with the theoretical results and thus validate the simulation.



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Abstracts

Microwave Radiation from a Magnetic Dipole in an Azimuthally Magnetized Ferrite Cylinder (Short Papers)

R.S. Mueller. "Microwave Radiation from a Magnetic Dipole in an Azimuthally Magnetized Ferrite Cylinder (Short Papers)." 1986 Transactions on Microwave Theory and Techniques 34.7 (Jul. 1986 [T-MTT]): 828-831.

The electromagnetic radiation pattern from a ferrite coated dipole antenna is a torus with a point center. By deriving an expression for the far-field electric field and defining a form factor $F(\Theta)$, the dilations and contractions of the radiation pattern were evaluated and demonstrated graphically.



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Abstracts

Electromagnetic Standard Fields: Generation and Accuracy Levels from 100 KHz to 990 MHz (Short Papers)

S. Tofani, L. Anglesio, G. Agnesod and P. Ossola. "Electromagnetic Standard Fields: Generation and Accuracy Levels from 100 KHz to 990 MHz (Short Papers)." 1986 Transactions on Microwave Theory and Techniques 34.7 (Jul. 1986 [T-MTT]): 832-835.

The interest for problems concerning health protection against RF and MW electromagnetic fields is increasing more and more. This requires uniformity in performances supplied by the measurement instruments employed. It follows the importance of accurately evaluating the procedures of field generation and the overall indetermination on the obtainable field strength levels as well as the need of an intercomparison, carried out by means of a traveling standard too, between the laboratories operating in different countries. In this way, the need for standardizing the exposures techniques in the ever increasing number of experiments addressed to the study of biological effects is satisfied, too. For this purpose, an instrumental chain is described. This chain allows the generation of standard electromagnetic fields, in the context of the Italian National Health Service, with frequencies ranging from 100 KHz to 990 MHz and with field strength levels superior to the limits reported in recent international guidelines. Finally, the overall indetermination of the reached field strength levels is evaluated and discussed.



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Abstracts

Electromagnetic Waves in Conical Waveguides with Elliptic Cross Section (Short Papers)

S. Blume and B. Grafmuller. "Electromagnetic Waves in Conical Waveguides with Elliptic Cross Section (Short Papers)." 1986 Transactions on Microwave Theory and Techniques 34.7 (Jul. 1986 [T-MTT]): 835-838.

The electromagnetic field in a conical waveguide with an elliptical cross section is calculated with the aid of two scalar potentials which satisfy the Helmholtz equation, the Dirichlet, and the Neumann boundary condition, respectively. The transverse parts of the solutions of the Helmholtz equation in the sphero-conal coordinate system are products of periodic and nonperiodic Lamé functions. These functions allow a mode definition similar to that for conventional waveguides. Some transverse modal field distributions, together with the corresponding Lamé functions, are graphically represented for a special elliptic conical waveguide.



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Dependence of the Multiple-Device Oscillator Injection-Locking Range on the Number of Constituent Devices (Short Papers)

S. Sarkar and O.S. Gupta. "Dependence of the Multiple-Device Oscillator Injection-Locking Range on the Number of Constituent Devices (Short Papers)." 1986 Transactions on Microwave Theory and Techniques 34.7 (Jul. 1986 [T-MTT]): 839-840.

An analysis of the behavior of an injection-locked multiple. device oscillator is presented. It is shown that the external Q of the oscillator circuit decreases towards a limiting value as the number of devices is increased. This limiting value is determined by the Q of an individual device. It is also shown that improvement of the locking range with an increase in the number of devices is rapid when the locking gain is very low and independent of the increase of the number of devices.



Abstracts

Invariant Definitions of the Unloaded Q Factor (Short Papers)

D. Kajfez and W.P. Wheless, Jr.. "Invariant Definitions of the Unloaded Q Factor (Short Papers)." 1986 Transactions on Microwave Theory and Techniques 34.7 (Jul. 1986 [T-MTT]): 840-841.

Equations are presented for computing the unloaded Q factor of a microwave resonator embedded in an impedance-transforming lossless, reciprocal two-port. Knowledge of the transformation properties of the two-port is not required.



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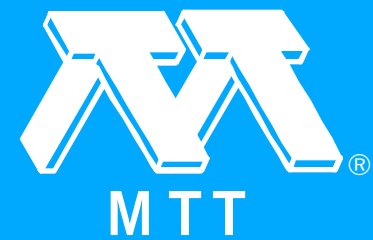
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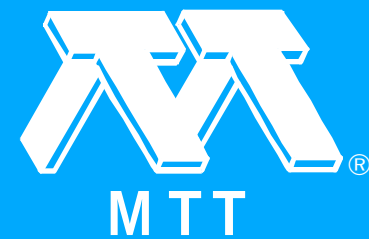
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Field Solution, Polarization, and Eigenmodes of Shielded Microstrip Transmission Line

E.E. Hassan. "Field Solution, Polarization, and Eigenmodes of Shielded Microstrip Transmission Line." 1986 Transactions on Microwave Theory and Techniques 34.8 (Aug. 1986 [T-MTT]): 845-852.

Application of the reciprocity theorem leads to a variational expression for the propagation constant of the fields inside shielded microstrip-like transmission lines. The resulting equation involves both the propagation constant and the tangential fields at the air-dielectric interface. Using the Rayleigh-Ritz optimization technique, both the propagation constant and the fields are completely determined. The calculated results of the propagation constant compare well with other available data. Moreover, the field solution obtained is presented in the form of a polarization ratio relating the axial to the transverse electric field. Results cover both low and high frequencies, and the technique proves valid at both frequency ranges. The method may be extended to other configurations of planar striplines by proper adjustment of the integration limits.

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On a Class of Electromagnetic Wave Functions for Propagation Along the Circular Gyrotropic Waveguide

K.P. Ivanov and G.N. Georgiev. "On a Class of Electromagnetic Wave Functions for Propagation Along the Circular Gyrotropic Waveguide." 1986 Transactions on Microwave Theory and Techniques 34.8 (Aug. 1986 [T-MTT]): 853-862.

The properties of confluent hypergeometric functions as exact electromagnetic wave functions for propagation in a circular waveguide containing azimuthally magnetized remanent ferrite are investigated. Two different forms of solutions of the propagation problem for angular symmetric transverse electric modes are constructed—one in terms of Kummer and Tricomi confluent hypergeometric functions of complex parameter and variable and a second in terms of Whittaker functions. An evaluation of this class of wave functions is performed to sufficient extent, followed by tabulation of their imaginary zeros, providing computation of eigenvalue spectrum and phase characteristics of the gyrotropic guide.

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Short-Step-Stub Chebyshev Transformers Impedance

P.W. Van der Walt. "Short-Step-Stub Chebyshev Transformers Impedance." 1986 Transactions on Microwave Theory and Techniques 34.8 (Aug. 1986 [T-MTT]): 863-868.

A transfer function for short-step impedance transforming filters consisting of short cascaded TEM transmission-line sections and at least one commensurate length open-circuit stub is described. Element values are given for a particular family of octave-bandwidth short-step transformers that are much more compact than existing short-step transformers.

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Generalized Coupled Dielectric Waveguide and its Variants for Millimeter-Wave Applications

A.K. Tiwari, B. Bhat and R.P. Singh. "Generalized Coupled Dielectric Waveguide and its Variants for Millimeter-Wave Applications." 1986 Transactions on Microwave Theory and Techniques 34.8 (Aug. 1986 [T-MTT]): 869-875.

The characteristic equations of hybrid TM and TE modes for a generalized coupled dielectric waveguide are derived using the mode-matching technique. From the characteristic equations of the generalized coupled dielectric waveguide, the phase constant, wave impedance, and field distribution can be evaluated. A variety of single and coupled dielectric waveguides can be obtained by assigning proper parameter values to the generalized coupled dielectric waveguide.

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Analysis and Measurements of Nonradiative Dielectric Waveguide Bends (Aug.1986 [T-MTT])

T. Yoneyama, H. Tamaki and S. Nishida. "Analysis and Measurements of Nonradiative Dielectric Waveguide Bends (Aug.1986 [T-MTT])." 1986 Transactions on Microwave Theory and Techniques 34.8 (Aug. 1986 [T-MTT]): 876-882.

The coupling theory is applied to analyze loss characteristics of the NRD-guide bends. Besides the operating LSM/sub 01/ mode, the parasitic LSE/sub 01/ mode is generated at bends as a result of the mode conversion. A rigorous expression for the coupling coefficient between these two modes is derived and then employed in the two-mode coupling equations to be solved for the bending loss analysis. Design diagrams, which are useful for optimizing the strip width against a given curvature radius to build a lossless bend, are constructed for 90 and 180° NRD-guide bends. It is shown that the field profile at a bend always shifts inwards. This confirms the previous experimental prediction. It is found that the periodic spikes on the loss versus frequency curve of a bend, which have been observed before, can be interpreted as being caused by resonances of the parasitic mode between the transition horns fixed at both ends of the bend, and that the true bending loss itself is normally restricted within a reasonable level. As an application of the present theory, a lossless 180° bend with a curvature radius of 5 mm was fabricated with polystyrene and tested at 50 GHz. The measured bending loss was less than 0.3 dB.



Multiple Dielectric Posts in a Rectangular Waveguide

C.G. Hsu and H.A. Auda. "Multiple Dielectric Posts in a Rectangular Waveguide." 1986 Transactions on Microwave Theory and Techniques 34.8 (Aug. 1986 [T-MTT]): 883-891.

This paper presents a complete analysis for a system of linear, homogeneous, and isotropic dielectric posts in a rectangular waveguide. These posts are assumed uniform along the narrow side of the waveguide, but are otherwise of arbitrary cross section and thickness. The scattering and impedance matrices describing the effect of the posts on the dominant waveguide mode are derived. The latter is then realized as a two-port T-network. A moment procedure is devised and applied to a set of test problems with a wide variety of post configurations to compute the scattering parameters and equivalent network elements. The accuracy and convergence aspects of the numerical solution are also investigated. The branch and network resonances are determined for some post configurations.





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Theory and Design of Broad-Band Nongrounded Matched Loads for Planar Circuits (Short Papers)

L.J.P. Linner and H.B. Lunden. "Theory and Design of Broad-Band Nongrounded Matched Loads for Planar Circuits (Short Papers)." 1986 Transactions on Microwave Theory and Techniques 34.8 (Aug. 1986 [T-MTT]): 892-896.

A filter theory approach is used for the synthesis of very broad-band resistive terminations with no direct grounding. The immediate use is in microwave integrated circuits (MIC's) where no holes or wraparound straps are desirable. Bandwidths achieved amount to 100 and 160 percent for networks of order 2 and 6, respectively. The total circuit lengths are λ and $3\lambda/2$ in these cases. This performance is superior to older designs where only 30-40 percent is obtained.

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Abstracts

A Wide-Band 12-GHz 12-Way Planar Power Divider/Combiner (Short Papers)

V.F. Hanna and J. Jumeau. "A Wide-Band 12-GHz 12-Way Planar Power Divider/Combiner (Short Papers)." 1986 Transactions on Microwave Theory and Techniques 34.8 (Aug. 1986 [T-MTT]): 896-897.

A 12-way, low-loss, wide-band planar electrically symmetric hybrid power divider/combiner for the X-band is described. It is a two-stage fork, 12-way hybrid realized completely in microstrip. A circuit design is given to maximize the match and isolation at band center. Over a frequency band of 10-13 GHz, this divider/combiner has an insertion loss of less than 1 dB and an isolation between output ports of better than 17 dB.



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Analysis and Experiment Concerning the Cutoff Frequencies of Rectangular Striplines (Short Papers)

R. Lampe, P. Klock, D. Tanner and P. Mayes. "Analysis and Experiment Concerning the Cutoff Frequencies of Rectangular Striplines (Short Papers)." 1986 Transactions on Microwave Theory and Techniques 34.8 (Aug. 1986 [T-MTT]): 898-899.

The cutoff frequency of the first higher order mode in a rectangular stripline is determined by two disparate techniques and compared to published results. Results from a novel experiment verify the cutoff frequency predictions. Furthermore, a nomenclature scheme for uniquely identifying rectangular stripline modes is offered.



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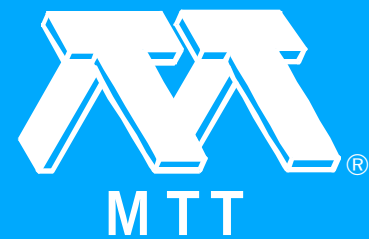
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Characteristic Impedance of a Wide Slotline on Low-Permittivity Substrates (Short Papers)

R. Janaswamy and D.H. Schaubert. "Characteristic Impedance of a Wide Slotline on Low-Permittivity Substrates (Short Papers)." 1986 Transactions on Microwave Theory and Techniques 34.8 (Aug. 1986 [T-MTT]): 900-902.

Computed results on the characteristic impedance of wide slots etched on an electrically thin substrate of low dielectric constant ϵ_r are presented. These results combined with those in [1] provide design data for these slotlines. Curves are presented for $\epsilon_r = 2.22, 3.0, 3.8, \text{ and } 9.8$. Comparison is shown for the characteristic impedance between the present calculations and those available in the literature for high- ϵ_r substrates. Empirical formulas, based on least-square curve fitting, are presented for the normalized slot wavelength λ/λ_0 and the characteristic impedance Z_0 over the range $0.0015 \leq W/\lambda_0 \leq 1.0$, $0.006 \leq d/\lambda_0 \leq 0.06$, $2.22 \leq \epsilon_r \leq 9.8$.

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Abstracts

A Broad-Band Homodyne Network Analyzer with Binary Phase Modulation (Short Papers)

U. Gartner and B. Schiek. "A Broad-Band Homodyne Network Analyzer with Binary Phase Modulation (Short Papers)." 1986 Transactions on Microwave Theory and Techniques 34.8 (Aug. 1986 [T-MTT]): 902-906.

An automatic homodyne network analyzer system using cascaded binary phase shifters is described which operates over the full X-band with a high dynamic range due to an auxiliary modulation and linear detection technique. A general analytic solution of the complex nonlinear system equations is given which allows the use of a coupled modulator/phase shifter structure. Measurement results are reported.



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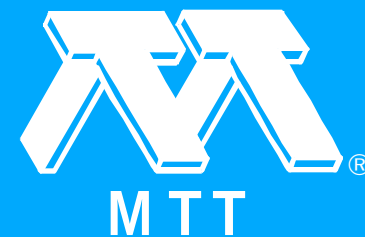
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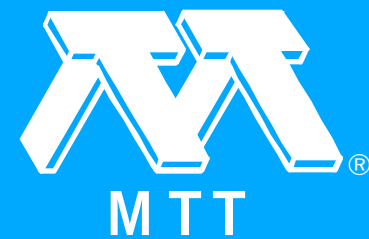
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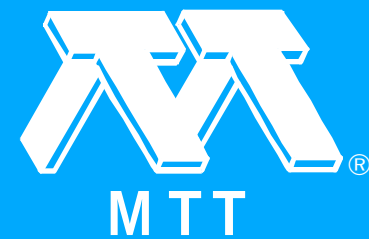
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Temperature-Variable Characteristics and Noise in Metal--Semiconductor Junctions

E.L. Kollberg, H. Zirath and A. Jelenski. "Temperature-Variable Characteristics and Noise in Metal--Semiconductor Junctions." 1986 Transactions on Microwave Theory and Techniques 34.9 (Sep. 1986 [T-MTT]): 913-922.

Although metal-semiconductor junctions were first explored a hundred years ago, some important aspects of the transport mechanism of electrons across the metal-semiconductor barrier have not yet been fully explained. In this paper, we report on a new model and supporting experimental results which explain deviations observed from the ideal exponential current-voltage characteristic. The model and results are applicable to the optimization of microwave and millimeter-wave front ends.

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Abstracts

A New Method for Measuring Dielectric Constant Using the Resonant Frequency of a Patch Antenna

D. Shimin. "A New Method for Measuring Dielectric Constant Using the Resonant Frequency of a Patch Antenna." 1986 Transactions on Microwave Theory and Techniques 34.9 (Sep. 1986 [T-MTT]): 923-931.

An analytical expression is given for the resonant frequency of a rectangular patch antenna. It shows explicitly the dependence of the resonant frequency on the characteristic parameters of a patch antenna. Based on this result, a new method is developed for the measurement of the dielectric constant of a thin slab substrate. Basically, the test equipment consists of a rectangular microstrip antenna the patch of which is fed either by a microstrip line or coaxial line. From the measured resonance parameters of the rectangular patch antenna, the dielectric constant can be easily obtained. The measured values of the present method are in agreement with the precision standard cavity resonator method. Accuracy of the dielectric constant so obtained is satisfactory.



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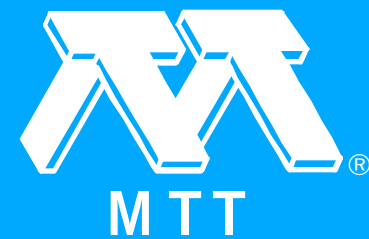


Abstracts

Complex Dielectric Constants for Selected Near-Millimeter-Wave Materials at 245 GHz

J.M. Dutta, C.R. Jones and H. Dave. "Complex Dielectric Constants for Selected Near-Millimeter-Wave Materials at 245 GHz." 1986 Transactions on Microwave Theory and Techniques 34.9 (Sep. 1986 [T-MTT]): 932-936.

A double-beam instrument developed in this laboratory has been used to measure the complex dielectric constant of selected materials at 245 GHz. We report here the results for crystalline quartz, fused silica (Spectrosil WF and Dynasil 4000), beryllia (iso-pressed), boron nitride (hot-pressed), and a nickel ferrite (Trans-Tech 2-111). Results are compared with the data obtained by other researchers.



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Modeling of a Coaxial-Waveguide Power-Combining Structure

M.E. Bialkowski. "Modeling of a Coaxial-Waveguide Power-Combining Structure." 1986 Transactions on Microwave Theory and Techniques 34.9 (Sep. 1986 [T-MTT]): 937-942.

The modeling of the Kurokawa-Magalhaes power-combiner mounting structure is presented. The combiner is regarded as a four-port network with the ports created at the coaxial-waveguide apertures. By using a radial-modal wave approach, the admittance matrix for this network is determined. The theory is verified through an alternative approach based on the equivalence between a coaxial-waveguide junction and a dual-gap post structure.



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Mode Analytical Study of Cylindrical Cavity Power Combiners

K. Fukui and S. Nogi. "Mode Analytical Study of Cylindrical Cavity Power Combiners." 1986 Transactions on Microwave Theory and Techniques 34.9 (Sep. 1986 [T-MTT]): 943-951.

A mode analytical treatment of cylindrical cavity power combiners is presented to discuss power-combining capability and the method for attaining stable desired mode operation. Both the conventional coaxial-probe output type and the window output type are treated, based on a circuit model which can support TM/sub 010/, TM/sub 020/, and TM/sub m10/ modes ($1 \leq m \leq N$, N being the number of active devices employed). It is shown that adoption of the window output largely facilitates undesired mode suppression and also enables power combining in some azimuthal modes.

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Transient Analysis of Single and Coupled Lines with Capacitively-Loaded Junctions

Q. Gu and J.A. Kong. "Transient Analysis of Single and Coupled Lines with Capacitively-Loaded Junctions." 1986 Transactions on Microwave Theory and Techniques 34.9 (Sep. 1986 [T-MTT]): 952-964.

Transient processes are studied for a single line or a pair of coupled lines consisting of line sections with different characteristic admittances and with capacitances loaded at the junctions of line sections. Equations for the Laplace transform of the reflection and transmission coefficients of single and coupled lines are derived for the general case. When the capacitances are loaded at regular intervals, the corresponding expressions of the transient response waveforms at different terminal ports of these lines for both a step and a ramp input are developed. Based on the theoretical analysis, we illustrate the transient responses to ramp signals on some simplified computer signal lines, such as parallel-plate lines with transverse ridges, and parallel striplines with perpendicular crossing strips sandwiched between common upper and lower ground planes. The numerical results suggest that signals with a rise time of $t_r < 50$ ps will cause too much distortion, and should not be used when the length of the line is longer than 2 cm.

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



Abstracts

Traveling-Wave IMPATT Amplifiers and Oscillators

R.K. Mains and G.I. Haddad. "Traveling-Wave IMPATT Amplifiers and Oscillators." 1986 Transactions on Microwave Theory and Techniques 34.9 (Sep. 1986 [T-MTT]): 965-971.

Traveling-wave IMPATT oscillators and amplifiers are analyzed using a large-signal transmission-line model. A specific case for a GaAs structure at 33.7 GHz is examined in detail. General equations relating to the design and expected power output from these devices are also developed. It is concluded that more RF power can be generated by traveling-wave structures than is obtainable from discrete IMPATT devices.



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Abstracts

A Direct-Coupled Lambda/4-Coaxial Resonator Bandpass Filter for Land Mobile Communications

K. Hano, H. Kohriyama and K.-I. Sawamoto. "A Direct-Coupled Lambda/4-Coaxial Resonator Bandpass Filter for Land Mobile Communications." 1986 Transactions on Microwave Theory and Techniques 34.9 (Sep. 1986 [T-MTT]): 972-976.

A bandpass filter operating at 870 MHz was constructed using lambda/4-coaxial resonators. The resonators were made of metallized high- Q dielectric ceramic ($Q \geq 10\,000$, $\epsilon_r = 37$), and were directly coupled to each other through apertures which were formed on the outer side surface of the resonators. In order to couple the input and output resonators to the external circuit, a rectangular metal film was deposited on the open-circuit end. The resonant frequency of each resonator, coupling coefficients between adjacent resonators, and external Q's at both ends were adjusted before assembly. The resonators were then assembled in a housing with no further adjustment. The measured response was in excellent agreement with the theory.



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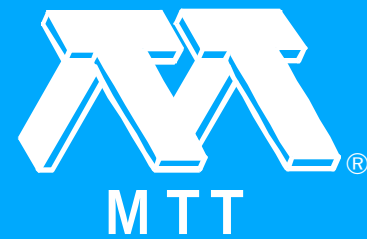


Abstracts

The Effect of Fringing Fields on the Resistance of a Conducting Film

S.M. Schwarzbek and S.T. Ruggiero. "The Effect of Fringing Fields on the Resistance of a Conducting Film." 1986 Transactions on Microwave Theory and Techniques 34.9 (Sep. 1986 [T-MTT]): 977-981.

We have calculated the effect of fringing fields on the measured resistance of a conducting film between two circular disks, using two complementary approaches, for a wide range of disk separations. The problem is cast as the numerical solution of a dual integral equation and a straightforward relaxation procedure for the isomorphic problem of the fringing effects on the capacitance of a circular disk between two grounded planes. These results also represent the solution for the capacitance in the high dielectric limit for two disks separated by a dielectric medium.



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Abstracts

Characteristic Impedance of Integrated Circuit Bond Wires (Short Papers)

R.H. Caverly. "Characteristic Impedance of Integrated Circuit Bond Wires (Short Papers)." 1986 Transactions on Microwave Theory and Techniques 34.9 (Sep. 1986 [T-MTT]): 982-984.

In microwave circuit analysis, bond wires are frequently modeled as lumped elements or sections of microstrip. These models are insufficient since part of the wire is suspended above the substrate. This paper shows numerical results that provide the line impedance and effective dielectric constant for a round wire above a grounded dielectric substrate.



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Field Theory Design of Rectangular Waveguide Broad-Wall Metal-Insert Slot Couplers for Millimeter-Wave Applications (Correction)

F. Arndt, B. Koch, H.-J. Orlok and N. Schroder. "Field Theory Design of Rectangular Waveguide Broad-Wall Metal-Insert Slot Couplers for Millimeter-Wave Applications (Correction)." 1986 Transactions on Microwave Theory and Techniques 34.9 (Sep. 1986 [T-MTT]): 985-985.

In the above paper, the designation of the columns "Slot Lengths (mm)" of Tables I-IV should have read "Half Slot Lengths (mm)," as is indicated correctly in Fig. 1 of the paper, by $z = l/\text{sub } 1/$, $z = 2l/\text{sub } 1/$, respectively, for the first slot. $S/\text{sub } 1/$, $S/\text{sub } 2/$, $\dots$, in the figure of Table I, therefore, should have read $2S/\text{sub } 1/$, $2S/\text{sub } 2/$, $\dots$, as shown above.

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Abstracts

Patent Abstracts (Sep. 1986 [T-MTT])

"Patent Abstracts (Sep. 1986 [T-MTT])." 1986 Transactions on Microwave Theory and Techniques 34.9 (Sep. 1986 [T-MTT]): 986-989.



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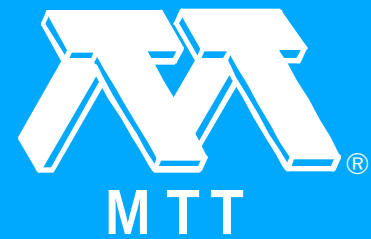
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Abstracts

The Calculus Tutoring Book (Advertisement) (Sep. 1986 [T-MTT])

"The Calculus Tutoring Book (Advertisement) (Sep. 1986 [T-MTT])." 1986 Transactions on Microwave Theory and Techniques 34.9 (Sep. 1986 [T-MTT]): 990-990.



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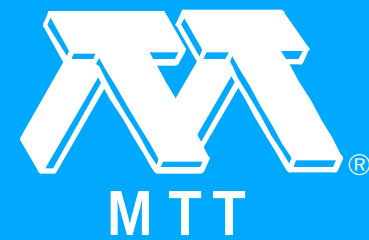
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Abstracts

Getting the Picture (Advertisement) (Sep. 1986 [T-MTT])

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Membership Application (Sep. 1986 [T-MTT])

"Membership Application (Sep. 1986 [T-MTT])." 1986 Transactions on Microwave Theory and Techniques 34.9 (Sep. 1986 [T-MTT]): 992-992.



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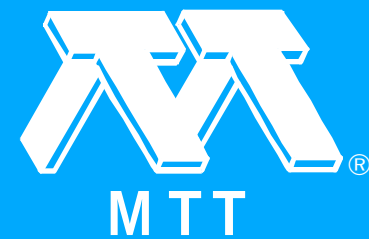
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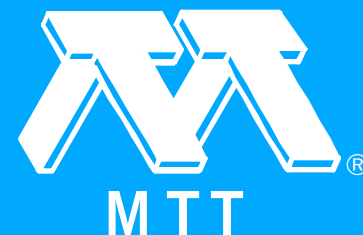


Abstracts

Foreword (Oct. 1986 [T-MTT])

J.B. Horton. "Foreword (Oct. 1986 [T-MTT])." 1986 Transactions on Microwave Theory and Techniques 34.10 (Oct. 1986 [T-MTT] (Special Issue on New and Future Applications of Microwave Systems)): 993-993.

The purpose of this special issue is to bring together some of the recent technology advances that will have a significant effect on future microwave systems. To some extent, this issue is an extension of the panel discussion on Advances in Millimeter-Wave Subsystems held at the 1985 International Microwave Symposium, in St. Louis. We are currently experiencing a rapid growth in the number of traditional microwave functions included in a subsystem. Subsystem designers must include signal processing, synthesizer functions, antenna control, and other related functions within the overall subsystem package. Examples of these technologies are included in the first four papers of this issue.



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Abstracts

Advances in Gallium Arsenide Monolithic Microwave Integrated-Circuit Technology for Space Communications Systems

K.B. Bhasin and D.J. Connolly. "Advances in Gallium Arsenide Monolithic Microwave Integrated-Circuit Technology for Space Communications Systems." 1986 Transactions on Microwave Theory and Techniques 34.10 (Oct. 1986 [T-MTT] (Special Issue on New and Future Applications of Microwave Systems)): 994-1001.

Future communications satellites are likely to use gallium arsenide (GaAs) monolithic microwave integrated-circuit (MMIC) technology in most, if not all, communications payload subsystems. Multiple- scanning beam antenna systems are expected to use GaAs MMIC's to increase functional capability, to reduce volume, weight, and cost, and to greatly improve system reliability. RF and IF matrix switch technology based on GaAs MMIC's is also being developed for these reasons. MMIC technology, including gigabit-rate GaAs digital integrated circuits, offers substantial advantages in power consumption and weight over silicon technologies for high-throughput, on-board baseband processor systems. In this paper, current developments in GaAs MMIC technology are described, and the status and prospects of the technology are assessed.



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Abstracts

Advances in Microwave Acoustic Frequency Sources

E.A. Gerber, T. Lukaszek and A. Ballato. "Advances in Microwave Acoustic Frequency Sources." 1986 Transactions on Microwave Theory and Techniques 34.10 (Oct. 1986 [T-MTT] (Special Issue on New and Future Applications of Microwave Systems)): 1002-1016.

This paper reviews the principal advances with microwave frequency sources that use mechanical vibrations and waves in their frequency-controlling elements. Specifically, the review discusses the direction microwave acoustic technology has taken in the utilization of bulk acoustic-wave (BAW), surface acoustic-wave (SAW), shallow bulk acoustic wave (SBAW), thin-film membrane, and composite structures to generate stable microwave frequency sources in the range from 100 MHz to 1 GHz and above.



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Abstracts

Inter-Injection-Locked Oscillators for Power Combining and Phased Arrays

K.D. Stephan. "Inter-Injection-Locked Oscillators for Power Combining and Phased Arrays." 1986 Transactions on Microwave Theory and Techniques 34.10 (Oct. 1986 [T-MTT] (Special Issue on New and Future Applications of Microwave Systems)): 1017-1025.

This paper presents a novel approach to synchronizing the phases of several oscillators for coherent power combining either in a conventional power-combining circuit or in free space as each oscillator drives an antenna element in a phased array. A set of nonlinear differential equations is derived to predict the system's behavior. These equations are used in the computer-aided design and construction of a demonstration three-oscillator inter-injection-locked system at VHF. Good qualitative agreement between initial experimental results and theoretical predictions is observed, and applications of the inter-injection-locking concept to systems are discussed.



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Millimeter-Wave Imaging Sensor (Oct. 1986 [T-MTT])

W.J. Wilson, R.J. Howard, A. Ibbott, G.S. Parks and W.B. Ricketts. "Millimeter-Wave Imaging Sensor (Oct. 1986 [T-MTT])." 1986 Transactions on Microwave Theory and Techniques 34.10 (Oct. 1986 [T-MTT] (Special Issue on New and Future Applications of Microwave Systems)): 1026-1035.

A scanning 3-mm radiometer system has been built and used on a helicopter to produce moderate-resolution (0.5°) images of the ground. This millimeter-wave sensor can be used for a variety of remote-sensing applications and produces images through clouds, smoke, and dust when visual and IR sensors are not usable. The system is described and imaging results are presented.



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Abstracts

Binary Peak Power Multiplier and its Application to Linear Accelerator Design

Z.D. Farkas. "Binary Peak Power Multiplier and its Application to Linear Accelerator Design." 1986 Transactions on Microwave Theory and Techniques 34.10 (Oct. 1986 [T-MTT] (Special Issue on New and Future Applications of Microwave Systems)): 1036-1043.

This paper describes a new method of pulse compression, the binary power multiplier (BPM), a device which multiplies RF power in binary steps. It comprises one or more stages, each of which doubles the input power and halves the input pulse length. Practical designs are described and expressions for their compression efficiency are derived. The usefulness of pulse compression for accelerator design is illustrated and compared with the pulse compression system currently in use at the Stanford Linear Accelerator Center.



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Theory of Gyrotron Traveling-Wave Amplifiers

Q.F. Li, S.Y. Park and J.L. Hirshfield. "Theory of Gyrotron Traveling-Wave Amplifiers." 1986 Transactions on Microwave Theory and Techniques 34.10 (Oct. 1986 [T-MTT] (Special Issue on New and Future Applications of Microwave Systems)): 1044-1058.

A unified single-mode theory is developed for the gyrotron traveling-wave amplifier (gyro-TWA) at harmonics of electron gyro frequency, both in linear and nonlinear regimes. The theory is applicable to a wide class of waveguide cross sections and waveguide modes; it can also be useful for arbitrary harmonic numbers and with the generalized electron beam model. The waveguide fields are expanded into series of multipoles about the electron guiding centers. A general dispersion equation is derived. Some numerical examples of the gain-frequency curves of gyro-TWA's with out-ridged, magnetron-type, rectangular and circular waveguides are computed by employing the results of kinetic theory.

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Abstracts

New Design Approach for Wide-Band FET Voltage-Controlled Oscillators

W. El-Kamali, J.-P. Grimm, R. Meierer and C. Tsironis. "New Design Approach for Wide-Band FET Voltage-Controlled Oscillators." 1986 Transactions on Microwave Theory and Techniques 34.10 (Oct. 1986 [T-MTT] (Special Issue on New and Future Applications of Microwave Systems)): 1059-1063.

A new, computer-assisted method, based on small-signal "S" parameters, is described for the systematic design of wide-band VCO's. The method has been applied to design 6-12-GHz and 12-18-GHz GaAs FET VCO's, and it has shown an excellent capability to predict the maximum obtainable tuning bandwidth. The tuning linearity of the VCO's has also been optimized $\Delta f/f \leq \pm 0.4$ percent over a 3-GHz bandwidth.



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Electromagnetic Modeling for Microwave Imaging of Cylindrical Buried Inhomogeneities

L. Chommeloux, C. Pichot and J.-C. Bolomey. "Electromagnetic Modeling for Microwave Imaging of Cylindrical Buried Inhomogeneities." 1986 Transactions on Microwave Theory and Techniques 34.10 (Oct. 1986 [T-MTT] (Special Issue on New and Future Applications of Microwave Systems)): 1064-1076.

Many diagnostic techniques in geophysics and civil engineering are based on the interaction of electromagnetic waves with objects buried in homogeneous or stratified media. Most of the investigations are concerned with the detection of buried objects, but a few papers have dealt with the problem of identifying the objects. The proposed method is based on the integral representation for a plane wave incident on a lossy half-space containing a cylindrical object of arbitrary cross section and electrical properties. The induced current distribution in the object is obtained from the backscattered field measurement in amplitude and phase. In order to improve the spatial resolution of the image, the scattered field is measured for different plane wave incidence and frequencies. Results of numerical simulations concerning the shape and size of the object for different values of soil electromagnetic parameters are presented in this paper.

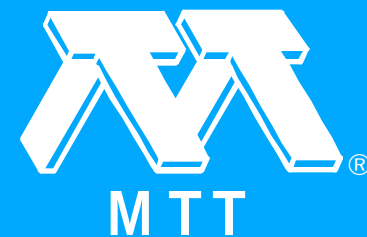
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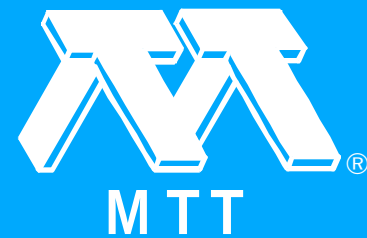
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Next-Generation Computers (Advertisement) (Oct. 1986 [T-MTT])

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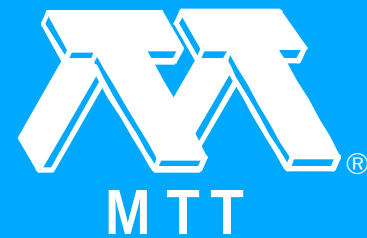
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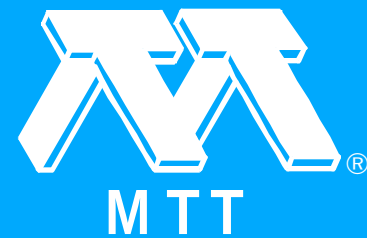
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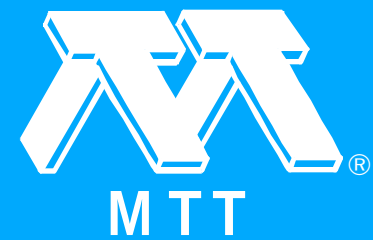
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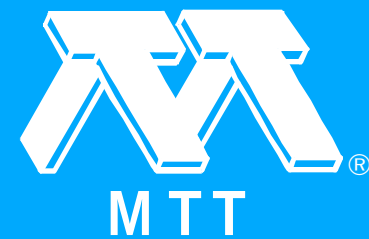
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Scattering at Circular-to-Rectangular Waveguide Junctions

J.D. Wade and R.H. MacPhie. "Scattering at Circular-to-Rectangular Waveguide Junctions." 1986 Transactions on Microwave Theory and Techniques 34.11 (Nov. 1986 [T-MTT]): 1085-1091.

A formally exact solution is given for the problem of scattering at a circular-to-rectangular waveguide junction and at a thick diaphragm, with a centered circular aperture, in a rectangular waveguide. The method uses normal TE and TM mode expansions of the waveguide fields and traditional mode matching of the transverse electric and magnetic fields at the junction boundary. Exact closed-form expressions are obtained for the electric field mode-matching coefficients which couple the TE(TM) modes in the rectangular guide to the TE(TM) and TM(TE) modes in the circular guide. Numerical results are presented for the case of TE/sub 10/ mode propagation in the larger rectangular guide with all other modes cutoff. Convergent numerical results for the equivalent shunt susceptances of such junctions are obtained when about 12 modes (eight TE and four TM) are retained in the circular waveguide or in the circular aperture of the diaphragm. The results are graphically compared with formulas and curves due to the quasi-static theory of Bethe and the variational theory given in the Waveguide Handbook.

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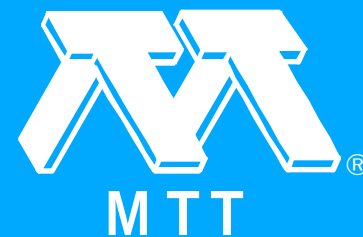


Abstracts

Green's Function Treatment of Edge Singularities in the Quasi-TEM Analysis of Microstrip

V. Postoyalko. "Green's Function Treatment of Edge Singularities in the Quasi-TEM Analysis of Microstrip." 1986 Transactions on Microwave Theory and Techniques 34.11 (Nov. 1986 [T-MTT]): 1092-1096.

A new Green's function approach to the quasi-TEM analysis of microstrip is presented. By expressing the charge density on the strip conductor as the sum of a singular term, derived from the consideration of a Motz expansion, and a continuous term, the integral equation defining this charge density is transformed into an integral equation for the continuous term. An accurate numerical solution to this new integral equation can be obtained by approximating the continuous term by a low-order unit-pulse expansion. It is seen that the numerical scheme developed in this work is both easy to implement and rapidly convergent, thus making it an excellent choice for use in microwave CAD packages.



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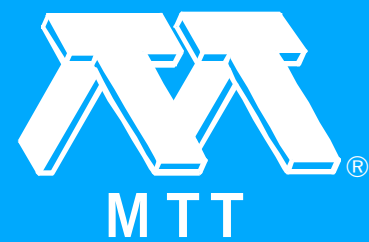
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Quasi-TEM Analysis of Microwave Transmission Lines by the Finite-Element Method

Z. Pantic and R. Mittra. "Quasi-TEM Analysis of Microwave Transmission Lines by the Finite-Element Method." 1986 Transactions on Microwave Theory and Techniques 34.11 (Nov. 1986 [T-MTT]): 1096-1103.

This paper describes a finite-element approach to the quasi-TEM analysis of several different types of isolated and coupled microwave transmission lines. Both the first- and higher order ordinary elements, as well as singular and infinite elements, are used to solve for the potential and field distributions in the cross section of the line. Next, the cross-sectional field distribution is inserted in a variational expression to compute the capacitance per unit length of the line, and the effective permittivity and characteristic impedance of the line are obtained from the capacitance value. A perturbational approach is developed for estimating the losses due to conductor and dielectric dissipation and computing the attenuation constant. Both the upper and lower bounds for the capacitance and the characteristic impedance are found by solving the original and the corresponding dual problem. Lines treatable by this method may contain an arbitrary number of arbitrarily shaped conductors, including a system of conductors placed either above a single ground plane or between two parallel ground planes, and inhomogeneous dielectric regions that can be approximated locally by a number of homogeneous subregions. The results obtained using the finite-element procedure have been compared for various types of microwave transmission lines and have been found to agree well with available theoretical and measured data.

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Finite-Difference Analysis of Rectangular Dielectric Waveguide Structures

K. Bierwirth, N. Schulz and F. Arndt. "Finite-Difference Analysis of Rectangular Dielectric Waveguide Structures." 1986 Transactions on Microwave Theory and Techniques 34.11 (Nov. 1986 [T-MTT]): 1104-1114.

A class of dielectric waveguide structures using a rectangular dielectric strip in conjunction with one or more layered dielectrics is analyzed with a finite-difference method formulated directly in terms of the wave equation for the transverse components of the magnetic field. This leads to an eigenvalue problem where the nonphysical, spurious modes do not appear. Moreover, the analysis includes hybrid-mode conversion effects, such as complex waves, at frequencies where the modes are not yet completely bound to the core of the highest dielectric constant, as well as at frequencies below cutoff. Dispersion characteristic examples are calculated for structures suitable for millimeter-wave and optical integrated circuits, such as dielectric image lines, shielded dielectric waveguides, insulated image guides, ridge guides, and inverted strip, channel, strip-slab, and indiffused inverted ridge guides. The numerical examples are verified by results available from other methods.

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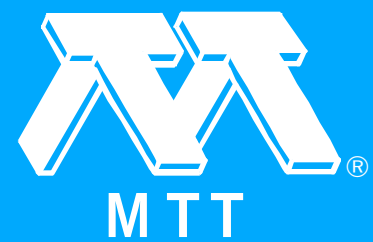
A SPICE Model for Enhancement-and Depletion-Mode GaAs FET's

S.E. Sussman-Fort, J.C. Hantgan and F.L. Huang. "A SPICE Model for Enhancement-and Depletion-Mode GaAs FET's." 1986 Transactions on Microwave Theory and Techniques 34.11 (Nov. 1986 [T-MTT]): 1115-1119.

An improved model for the GaAs MESFET has been implemented in the source code of the circuit-simulation program SPICE. New features include 1) an accurate model for the Schottky barrier, which allows simulation of both enhancement- and depletion-mode devices; 2) detailed modeling of the nonlinear gate-source and gate-drain capacitance; and 3) a user-specifiable value for the exponent in the expression for the dependence of the dc drain current upon the gate-source voltage. Also discussed are some important points concerning the charge-voltage equations that must accompany the new model's capacitance-voltage equations within SPICE. The new GaAs FET SPICE model is believed to be the most comprehensive one available to date in the public domain.

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Vectorial Finite-Element Method Without Any Spurious Solutions for Dielectric Waveguiding Problems Using Transverse Magnetic-Field Component

K. Hayata, M. Koshiba, M. Eguchi and M. Suzuki. "Vectorial Finite-Element Method Without Any Spurious Solutions for Dielectric Waveguiding Problems Using Transverse Magnetic-Field Component." 1986 Transactions on Microwave Theory and Techniques 34.11 (Nov. 1986 [T-MTT]): 1120-1124.

An improved finite-element method for the analysis of dielectric waveguiding problems is formulated rising the transverse magnetic-field component. In this approach, the divergence relation $\nabla \cdot \mathbf{H} = 0$ is satisfied and the spurious, nonphysical solutions which have been necessarily included in the solutions of earlier vectorial finite-element methods are completely eliminated in the whole region of a propagation diagram. To verify the accuracy of the present method, numerical results for a rectangular metallic waveguide half filled with dielectric are presented and compared with exact and earlier finite-element solutions. Dielectric rectangular waveguides are also analyzed for both isotropic and anisotropic cases.



Improved Approximations for the Fringing and Shielded Slab-Line Capacitances

H.J. Riblet. "Improved Approximations for the Fringing and Shielded Slab-Line Capacitances." 1986 Transactions on Microwave Theory and Techniques 34.11 (Nov. 1986 [T-MTT]): 1125-1130.

Given the dimensions $w/(b - t)$ and t/b for the slab-line geometry or the dimensions s/b and t/b for the fringing capacitance geometry, it is shown how the capacitances associated with each geometry can be determined accurately from new explicit expressions rather than by a computerized search. The two expansions for the nome q' , in terms of the dimensions, which are essential for the calculations, are identical except for signs. Finally, comparisons are made with values of the capacitances obtained by a computerized search.

Abstracts

A Procedure for Calculating Fields Inside Arbitrarily Shaped, Inhomogeneous Dielectric Bodies Using Linear Basis Functions with the Moment Method

C.-T. Tsai, H. Massoudi, C.H. Durney and M.F. Iskander. "A Procedure for Calculating Fields Inside Arbitrarily Shaped, Inhomogeneous Dielectric Bodies Using Linear Basis Functions with the Moment Method." 1986 Transactions on Microwave Theory and Techniques 34.11 (Nov. 1986 [T-MTT]): 1131-1139.

A moment method for calculating the internal field distributions of arbitrarily shaped, inhomogeneous dielectric bodies is presented. A free-space Green's function integral equation is used with 3-D linear basis functions to describe the field variation within cells. Polyhedral volume elements are used to model the scatterer's curvature realistically without an excessive number of unknowns. A new testing procedure, called the modified Galerkin's method, is developed and used to obtain the matrix equations with less CPU time but greater accuracy. Calculated internal field distributions of dielectric spheres, spheroids, and a composite model of a rat are compared with other calculations and experimental data. The agreement is generally good.



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Abstracts

A Combined Method for Dielectric Waveguides Using the Finite-Element Technique and the Surface Integral Equations Method

C.-C. Su. "A Combined Method for Dielectric Waveguides Using the Finite-Element Technique and the Surface Integral Equations Method." 1986 Transactions on Microwave Theory and Techniques 34.11 (Nov. 1986 [T-MTT]): 1140-1146.

A combined method employing a finite-element technique in the $H_{x/}$ - $H_{y/}$ formulation and the surface integral equations method is proposed to treat the propagation characteristics of inhomogeneous waveguides with single or multiple claddings. The significant features of this combined method are that it does not suffer from any kind of spurious modes, which have been troublesome in applying the finite-element technique to waveguides and it is also capable of treating the cutoff frequencies of arbitrarily shaped, inhomogeneous dielectric waveguides with a single cladding, which is perhaps original. Furthermore, the proposed method is convenient in treating propagation constants close to cutoff and in handling coupled waveguides. Numerical results of inhomogeneous elliptical waveguides, diffusion waveguides, and the corresponding directional couplers are presented, including the cutoff frequencies of the elliptical waveguides.



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Systematic Characterization of the Spectrum of Unilateral Finline

C.A. Olley and T.E. Rozzi. "Systematic Characterization of the Spectrum of Unilateral Finline." 1986 Transactions on Microwave Theory and Techniques 34.11 (Nov. 1986 [T-MTT]): 1147-1156.

The fundamental mode of finline is well documented. A sufficiently complete knowledge of the higher mode spectrum, however, is necessary for the treatment of discontinuities. This paper is concerned with a rigorous approach to the problem of the spectrum of unilateral finline on the basis of a variational solution in the space domain and transverse equivalent network considerations. We call this method transverse resonance diffraction. Having satisfied the correct edge condition a priori, the analysis produces highly accurate dispersion characteristics calculated at each "spot frequency" for the fundamental and higher order modes with matrices of very low order. By exploiting the quasi-analytical character of the model, it is possible to derive a systematic and complete characterization of the spectrum in terms of "mode families." Moreover, simple-to-use wide-band approximations to the dispersion characteristics are also obtained which are suitable for evaluation by a desktop calculator.

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Printed Circuit Transmission-Line Characteristic Impedance by Transverse Modal Analysis

H.-Y. Yee and K. Wu. "Printed Circuit Transmission-Line Characteristic Impedance by Transverse Modal Analysis." 1986 Transactions on Microwave Theory and Techniques 34.11 (Nov. 1986 [T-MTT]): 1157-1163.

Dispersion characteristics of printed circuit transmission lines such as finlines, shielded microstrips, slotlines, suspended striplines, coupled slotlines, and coupled striplines computed by the transverse modal analysis were reported in a previous paper. Application of the transverse modal analysis to compute the characteristic impedances of these printed circuit transmission lines is illustrated in this paper. Favorable comparison with various published data demonstrates the outstanding accuracy achieved by this technique. Combining the characteristic impedance computation with the dispersion results, the transverse modal analysis can be employed for solving various problems in printed circuit transmission lines.

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Abstracts

Vortex Formation Near an Iris in a Rectangular Waveguide

R.W. Ziolkowski and J.B. Grant. "Vortex Formation Near an Iris in a Rectangular Waveguide." 1986 Transactions on Microwave Theory and Techniques 34.11 (Nov. 1986 [T-MTT]): 1164-1182.

The generalized dual-series approach to the capacitive and inductive iris waveguide problems is presented. Currents on the iris and plots of the fields and power flow in the vicinity of the iris are given for the capacitive iris case. It is found that vortices form in the iris region when higher order scattered modes are present. The formation of these vortices and their properties will be described in this paper.



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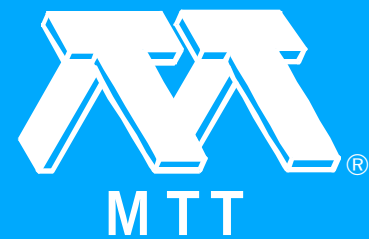


Transit-Time Effects in the Noise of Schottky-Barrier Diodes

M. Trippe, G. Bosman and A. Van der Ziel. "Transit-Time Effects in the Noise of Schottky-Barrier Diodes." 1986 Transactions on Microwave Theory and Techniques 34.11 (Nov. 1986 [T-MTT]): 1183-1192.

Room-temperature noise measurements at 2.2, 12, and 97.5 GHz were performed on commercial silicon Schottky-barrier diodes and are shown to agree with the model presented in this work. This model is an extension of earlier work by van der Ziel on infrared detection in Schottky-barrier diodes. In the theoretical analysis, the electrons participating in the charge-transport process across the barrier are subdivided into four groups based on their initial velocity. The contribution of each group to the device conductance, susceptance, and current spectral intensity was incorporated including the effects of the transit time. By taking each of these effects into account, an accurate model which applies over a wide range of bias and frequency has been developed. Although the emphasis of this model has been on the high-frequency performance, the model also gives the correct results in the low-frequency limit.





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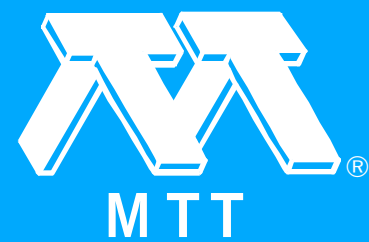
Broad-Band Noise Mechanisms and Noise Measurements of Metal Semiconductor Junctions

A. Jelenski, E.L. Kollberg and H.H.G. Zirath. "Broad-Band Noise Mechanisms and Noise Measurements of Metal Semiconductor Junctions." 1986 Transactions on Microwave Theory and Techniques 34.11 (Nov. 1986 [T-MTT]): 1193-1201.

Classic work on optimized heterodyne receivers has concentrated on the network aspects of mixers with limited emphasis on device properties. We present experimental results of GaAs Schottky-barrier diode noise measurements in the frequency range from 0.1 to 88 GHz and a detailed analysis of noise generation in these diodes which can explain the observed current and frequency dependence.

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Reflecting Rubber Characteristics of Anisotropic Sheets and Measurement of Complex Permittivity Tensor

O. Hashimoto and Y. Shimizu. "Reflecting Rubber Characteristics of Anisotropic Sheets and Measurement of Complex Permittivity Tensor." 1986 Transactions on Microwave Theory and Techniques 34.11 (Nov. 1986 [T-MTT]): 1202-1207.

Complex values of the permittivity tensor of rubber sheets which are manufactured by the rolling process were estimated by the least-squares method using the reflection coefficient measured for normal incidence. First, the frequency characteristics of the reflection coefficients of a rubber sheet backed by thin aluminum were measured from 8.5 to 10.5 GHz by changing the rolling angle relative to the incident electric field. Next, the elements of the permittivity tensor were determined by the least-squares method from many data of measured reflection coefficients of the samples. Five kinds of rubber sheets containing carbon particles or fibers were selected, and circular pieces 30 cm in diameter were measured by this method. The complex permittivity tensors including off-diagonal elements were thus obtained, and the principal directions of the tensor were calculated from the measured permittivity tensor. The following facts were found through this analysis: The permittivity element in the rolling direction is about five times larger and the off-diagonal elements are small compared with the diagonal elements. The principal direction of the real part is different from that of the imaginary part for a certain kind of rubber sheet mixed with carbon particles.



Abstracts

Low-Frequency Characteristic Modes for Aperture Coupling Problems

Y. Leviatan. "Low-Frequency Characteristic Modes for Aperture Coupling Problems." 1986 *Transactions on Microwave Theory and Techniques* 34.11 (Nov. 1986 [T-MTT]): 1208-1213.

In this paper, a recently suggested general procedure which leads to an eigenvalue equation for aperture problems is specialized to the range of frequencies for which the maximum linear dimension of the aperture l is much smaller than the wavelengths, known as the Rayleigh region. As kl asymptotically approaches zero, we arrive at a set of two eigenvalue equations which aided by the edge condition, constitutes an alternative set of equations for a derivation of the quasi-static distributions characterizing the aperture.



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Unloaded Q-Factor of Stepped-Impedance Resonators

G.B. Stracca and A. Panzeri. "Unloaded Q-Factor of Stepped-Impedance Resonators." 1986 Transactions on Microwave Theory and Techniques 34.11 (Nov. 1986 [T-MTT]): 1214-1219.

The paper presents general expressions for the unloaded Q-factor of stepped-impedance resonators partially loaded with high-dielectric constant ceramics to realize miniaturized microwave bandpass filters. Some theoretical calculations for coaxial resonators are also presented in diagrams to show a correct design optimization of coaxial miniaturized filters. The formulas presented in this paper take into account the imaginary component of the characteristic impedance Z of the lines constituting the resonator; the results previously presented by other authors neglected such an imaginary component of Z . The relevant influence that this imaginary component has for the calculation of the correct unloaded Q of the resonator is pointed out by this paper through a comparison between correct calculations and calculations performed by neglecting the imaginary component of Z . Some experimental results are compared with theoretical calculations.

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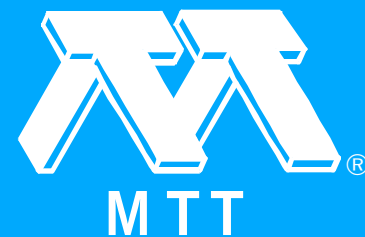


Abstracts

Measurements of Time-Varying Millimeter-Wave Vectors by a Dynamic Bridge Method (Short Papers)

A.M. Yurek, M.G. Li and C.H. Lee. "Measurements of Time-Varying Millimeter-Wave Vectors by a Dynamic Bridge Method (Short Papers)." 1986 Transactions on Microwave Theory and Techniques 34.11 (Nov. 1986 [T-MTT]): 1220-1223.

A dynamic bridge-measurement technique has been developed to characterize the time evolution of millimeter-wave fields in a plasma-controlled semiconductor waveguide. The time resolution of this technique is about 2 ns.



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An X-Band Four-Diode Power Combiner Using Gunn Diodes (Short Papers)

K. Bhattacharyya, S.K. De, G. Ghosh, P.C. Rakshit, P.K. Saha and B.R. Nag. "An X-Band Four-Diode Power Combiner Using Gunn Diodes (Short Papers)." 1986 Transactions on Microwave Theory and Techniques 34.11 (Nov. 1986 [T-MTT]): 1223-1225.

A four-diode X-band Gunn diode combiner is described, and the performance characteristics are presented for combining efficiency, tuning range, pushing fire, frequency drift, external Q, and FM noise.

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Nonuniform Layer Model of a Millimeter-Wave Phase Shifter (Comments)

K. Ogusu and I. Tanaka. "Nonuniform Layer Model of a Millimeter-Wave Phase Shifter (Comments)." 1986 Transactions on Microwave Theory and Techniques 34.11 (Nov. 1986 [T-MTT]): 1226-1227.

In the above paper, Butler et al. have investigated theoretically the propagation characteristics of the dielectric waveguide with plasma layer created by an exponentially absorbed optical beam. They have solved numerically the complex wave equation by using a multipoint boundary-value differential equation solver. On the other hand, we have already treated the same nonuniform layer model by using a multilayer staircase method [2]. In this approach, the actual permittivity profile of the waveguide is approximated by the finite number of steps. The wave equation is solved for each step and the complex propagation constant is determined so as to satisfy the boundary conditions at all interfaces. The mathematical formulation is very simple and an accurate solution can be obtained by increasing the number of steps M . The details of the method can be found in [3] and [4].

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Self-Adjoint Vector Variational Formulation for Lossy Anisotropic Dielectric Waveguide (Comments)

R. Hoffmann. "Self-Adjoint Vector Variational Formulation for Lossy Anisotropic Dielectric Waveguide (Comments)." 1986 Transactions on Microwave Theory and Techniques 34.11 (Nov. 1986 [T-MTT]): 1227-1228.

In the above paper, the authors present a "new variational formula" and its derivation. A careful inspection of the text shows that there are a number of errors and wrong conclusions with the fatal consequence that the final variational formula [1, eq. (37)] is incorrect. The main fallacy of the authors appears to be the derivation of the adjoint solution, and the following discussion will be restricted to this point.

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



Abstracts

Computer-Aided Design Models for Millimeter-Wave Finlines and Suspended-Substrate Microstrip Lines (Comments)

J.K. Piotrowski. "Computer-Aided Design Models for Millimeter-Wave Finlines and Suspended-Substrate Microstrip Lines (Comments)." 1986 Transactions on Microwave Theory and Techniques 34.11 (Nov. 1986 [T-MTT]): 1228-1229.

In the above paper, Pramanick and Bhartia state in Section I that, "In this paper, closed-form equations are developed for dispersion in bilateral and unilateral finlines by using equivalent susceptances of waveguide T-junctions, and for the characteristic impedances by curve fitting to the spectral-domain results."



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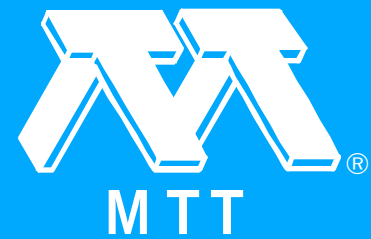


Abstracts

Normal Modes in an Overmoded Circular Waveguide Coated with Lossy Material (Corrections)

C.S. Lee, S.W. Lee and S.L. Chuang. "Normal Modes in an Overmoded Circular Waveguide Coated with Lossy Material (Corrections)." 1986 Transactions on Microwave Theory and Techniques 34.11 (Nov. 1986 [T-MTT]): 1229-1229.

In the above paper, the following corrections need to be made.



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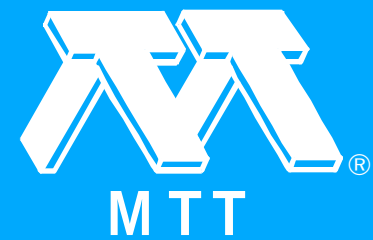
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Patent Abstracts (Nov. 1986 [T-MTT])

"Patent Abstracts (Nov. 1986 [T-MTT])." 1986 Transactions on Microwave Theory and Techniques 34.11 (Nov. 1986 [T-MTT]): 1230-1233.



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Call for Papers - 1987 IEEE MTT-S International Microwave Symposium (Nov. 1986 [T-MTT])

"Call for Papers - 1987 IEEE MTT-S International Microwave Symposium (Nov. 1986 [T-MTT])." 1986 Transactions on Microwave Theory and Techniques 34.11 (Nov. 1986 [T-MTT]): 1234-1234.



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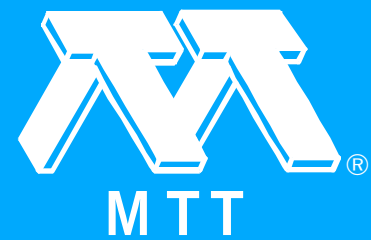
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IEEE on Microfilm (Advertisement) (Nov. 1986 [T-MTT])

"IEEE on Microfilm (Advertisement) (Nov. 1986 [T-MTT])." 1986 Transactions on Microwave Theory and Techniques 34.11 (Nov. 1986 [T-MTT]): 1235-1235.



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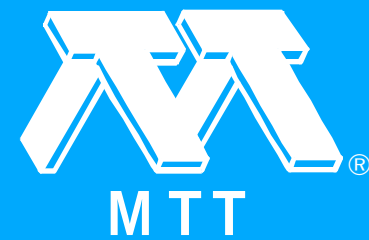
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Individual Learning Packages (Advertisement) (Nov. 1986 [T-MTT])

"Individual Learning Packages (Advertisement) (Nov. 1986 [T-MTT])." 1986 Transactions on Microwave Theory and Techniques 34.11 (Nov. 1986 [T-MTT]): 1236-1236.



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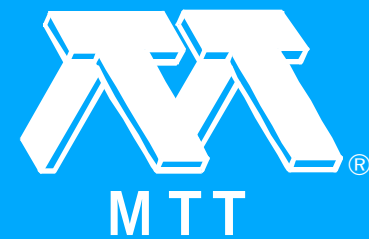
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"Back Cover (Nov. 1986 [T-MTT])." 1986 Transactions on Microwave Theory and Techniques 34.11 (Nov. 1986 [T-MTT]): b1-b2.



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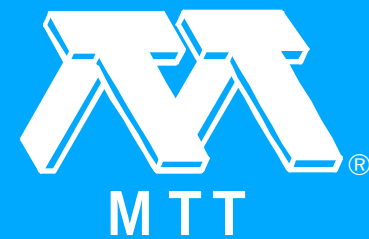
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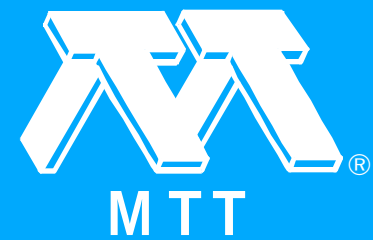
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"Table of Contents (Dec. 1986 [T-MTT])." 1986 Transactions on Microwave Theory and Techniques 34.12 (Dec. 1986 [T-MTT] (1986 Symposium Issue)): 1237-1238.



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Abstracts

Editor's Overview (Dec. 1986 [T-MTT])

W.J. Getsinger. "Editor's Overview (Dec. 1986 [T-MTT])." 1986 Transactions on Microwave Theory and Techniques 34.12 (Dec. 1986 [T-MTT] (1986 Symposium Issue)): 1239-1239.

Baltimore is a historical city with its own special character. It became even more attractive recently with the construction of the hotels, shops, and restaurants of Harbor Place, and its large, bright Convention Center. These advantages were evident to all who attended the 1986 MTT-S International Microwave Symposium and the Microwave and Millimeter-Wave Monolithic Circuits Symposium. Such amenities made for a Symposium of congeniality and enjoyment. But as is expected for MTT-S, the technical papers presented were the very heart of the Symposium.



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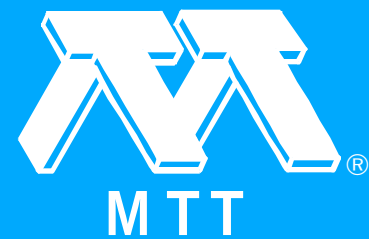


Abstracts

1986 MTT-S International Microwave Symposium (Dec. 1986 [T-MTT])

E.C. Niehenke. "1986 MTT-S International Microwave Symposium (Dec. 1986 [T-MTT])." 1986 Transactions on Microwave Theory and Techniques 34.12 (Dec. 1986 [T-MTT] (1986 Symposium Issue)): 1240-1252.

Baltimore was for the first time the host for the 1986 IEEE MTT-S International Microwave Symposium and Workshops, held jointly with the 1986 IEEE Microwave and Millimeter-Wave Monolithic Circuits Symposium during the week of Monday, June 2, through Friday, June 6, 1986. This Symposium broke all previous records in attendance with many innovations and activities, both technical and social. Baltimore offered the attendees a convenient location at the beautiful Baltimore Inner Harbor complex. The technical activities were held at the new, spacious Baltimore Convention Center, with the majority of hotels located within walking distance of the Center. Many hotels had over-the-street walkways to the Convention Center. The weather was perfect, with the sun shining every day and an average day temperature of 80 degrees F. The many attractions of the Inner Harbor within walking distance of the Convention Center were enjoyed by the attendees at lunchtime and in the evenings.



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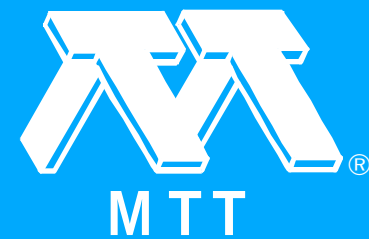
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Awards (Dec. 1986 [T-MTT])

"Awards (Dec. 1986 [T-MTT])." 1986 Transactions on Microwave Theory and Techniques 34.12 (Dec. 1986 [T-MTT] (1986 Symposium Issue)): 1253-1258.



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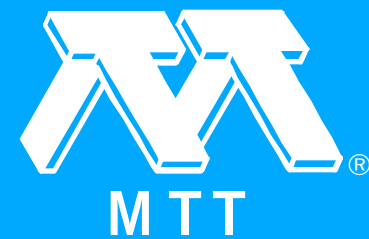
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Presented Paper Awards (Dec. 1986 [T-MTT])

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Abstracts

1986 IEEE MTT-S International Microwave Symposium Keynote Address (Dec. 1986 [T-MTT])

J.V. Charyk. "1986 IEEE MTT-S International Microwave Symposium Keynote Address (Dec. 1986 [T-MTT])." 1986 Transactions on Microwave Theory and Techniques 34.12 (Dec. 1986 [T-MTT] (1986 Symposium Issue)): 1262-1264.

One hundred years ago, Heinrich Hertz's experiments, proving the validity of Maxwell's equations, opened up a new world, whose full dimensions have only in recent years been adequately appreciated. Your theme of Microwaves Linking Nations is most appropriate since through satellites using microwave frequencies the world is today interlinked as never before. The full impact of this global net is yet to be fully felt, but there is no doubt that it is and will be changing in a fundamental way the nature of the world in which we live.



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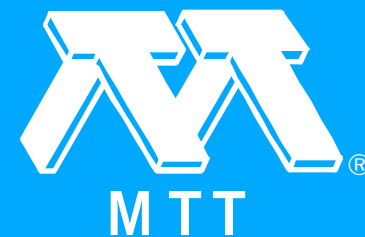
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"Table of Contents, 1986 MTT Symposium Digest (Dec. 1986 [T-MTT])." 1986 Transactions on Microwave Theory and Techniques 34.12 (Dec. 1986 [T-MTT] (1986 Symposium Issue)): 1265-1269.



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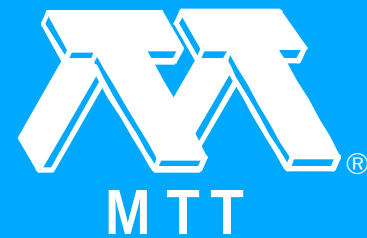
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Table of Contents, 1986 IEEE Microwave and Millimeter-Wave Monolithic Circuits Symposium Digest (Dec. 1986 [T-MTT])

"Table of Contents, 1986 IEEE Microwave and Millimeter-Wave Monolithic Circuits Symposium Digest (Dec. 1986 [T-MTT])." 1986 Transactions on Microwave Theory and Techniques 34.12 (Dec. 1986 [T-MTT] (1986 Symposium Issue)): 1270-1270.



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Abstracts

Microstrip Computer-Aided Design in Europe (Dec. 1986 [T-MTT])

F.E. Gardiol. "Microstrip Computer-Aided Design in Europe (Dec. 1986 [T-MTT])." 1986 Transactions on Microwave Theory and Techniques 34.12 (Dec. 1986 [T-MTT] (1986 Symposium Issue)): 1271-1275.

The purpose of this survey is to provide a general idea on present research activities in microstrip in Europe, emphasizing computer-aided design. Attention is drawn to the particularities of microstrip, which make its design particularly difficult. The survey covers the description of microstrip lines, discontinuities, patch antennas, and computer programs for circuit analysis, synthesis, and layout, followed by a brief description of relevant areas in MMIC and nonlinear CAD.



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Improved Computer-Aided Synthesis Tools for the Design of Matching Networks for Wide-Band Microwave Amplifiers (Dec. 1986 [T-MTT])

D.J. Mellor. "Improved Computer-Aided Synthesis Tools for the Design of Matching Networks for Wide-Band Microwave Amplifiers (Dec. 1986 [T-MTT])." 1986 Transactions on Microwave Theory and Techniques 34.12 (Dec. 1986 [T-MTT] (1986 Symposium Issue)): 1276-1281.

Network synthesis is a powerful design tool when applied to the design of matching networks for wide-band microwave amplifiers. Significant design improvements have been made in the computer-aided synthesis process, which provides a powerful, efficient, and friendly tool for the microwave amplifier designer. Design methodologies are given, computer automation methods are outlined, and a complete amplifier design example is included.



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Abstracts

Microwave Device Modeling Using Efficient l_1 Optimization: A Novel Approach (Dec. 1986 [T-MTT])

J.W. Bandler, S.H. Chen and S. Daijavad. "Microwave Device Modeling Using Efficient l_1 Optimization: A Novel Approach (Dec. 1986 [T-MTT])." 1986 Transactions on Microwave Theory and Techniques 34.12 (Dec. 1986 [T-MTT] (1986 Symposium Issue)): 1282-1293.

A powerful modeling technique which exploits the theoretical properties of the l_1 norm is presented. The concept of multicircuit measurements and its advantages for unique identification of parameters are discussed. Self-consistent models for passive and active devices are achieved by an approach that automatically checks the validity of model parameters obtained from optimization. A set of formulas is presented to evaluate the first-order sensitivities of two-port, S-parameters with respect to circuit elements appearing in an admittance or impedance matrix description of linear network equivalents. These formulas are used for devices with linear network models in conjunction with an efficient gradient based l_1 algorithm. Practical use of the efficient l_1 algorithm in complicated problems for which gradient evaluation may not be feasible is also discussed. Two different optimization problems are formulated which connect the concept of modeling to physical adjustments on the device. Detailed examples in modeling of multicoupled cavity filters and GaAs FET's are presented.



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Nonlinear Circuit Design Using the Modified Harmonic Balance Algorithm

R. Gilmore. "Nonlinear Circuit Design Using the Modified Harmonic Balance Algorithm." 1986 Transactions on Microwave Theory and Techniques 34.12 (Dec. 1986 [T-MTT] (1986 Symposium Issue)): 1294-1307.

A modification to a harmonic balance algorithm allows the nonlinear analysis of circuits driven by two nonharmonically related input frequencies. The algorithm was implemented on an IBM AT Personal Computer. Three examples are presented to illustrate the analysis. The first is a novel wide-band FET frequency doubler that achieves an average conversion loss of 3.5 dB over the 8-16-GHz output band. The second example illustrates a technique used in the design of a C-band power amplifier in which third-order intermodulation distortion was reduced by 8 dB with two tones of 34 dBm each at the output. The final example illustrates the gain suppression of a smaller tone in the presence of a larger one of slightly different frequency in a limiting amplifier. Simulations agree with measurements in which 2.5-dB gain suppression was observed in a 2-GHz FET feedback amplifier driven into saturation.

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Prediction of Wide-Band Power Performance of MESFET Distributed Amplifiers Using the Volterra Series Representation

C.L. Law and C.S. Aitchison. "Prediction of Wide-Band Power Performance of MESFET Distributed Amplifiers Using the Volterra Series Representation." 1986 Transactions on Microwave Theory and Techniques 34.12 (Dec. 1986 [T-MTT] (1986 Symposium Issue)): 1308-1317.

The power performance of a four-section MESFET distributed amplifier is predicted over the frequency range 2-8 GHz. The nonlinear model of the MESFET used has three nonlinear elements: $g_{\text{sub } m/}$, $g_{\text{sub } d/}$, and $C_{\text{sub } gs/}$, which are represented by power series up to the third order. The analysis employs the Volterra series representation up to the third order. Experimental verification is first made on a $0.5 \times 400\text{-}\mu\text{m}$ medium-power MESFET device to confirm the validity of the nonlinear model used in the analysis. The agreement between predicted and measured output power at 1-dB gain compression is within ± 0.5 dBm across the 2-16 GHz band. A four-section distributed amplifier was then built with four $0.5 \times 400\text{-}\mu\text{m}$ MESFET's. The agreement between predicted and measured output power at 1-dB gain compression of this amplifier is within ± 0.7 dBm across the 2-8-GHz band. The measured output power at 1-dB gain compression is (22 ± 1) dBm across the 2-8-GHz band.

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High-Efficiency 1-, 2-, and 4-W Class-B FET Power Amplifiers

J.R. Lane, R.G. Freitag, H.-K. Hahn, J.E. Degenford and M. Cohn. "High-Efficiency 1-, 2-, and 4-W Class-B FET Power Amplifiers." 1986 Transactions on Microwave Theory and Techniques 34.12 (Dec. 1986 [T-MTT] (1986 Symposium Issue)): 1318-1326.

X-band GaAs FET amplifiers utilizing the higher efficiency of class-B operation have been designed and fabricated. This paper describes the design of these amplifiers and includes the results of a computer time-domain simulation of one of the topologies, which gives insight into the harmonic content of the output currents in different branches of the FET and amplifier circuit. The performance is presented of 1-W single-ended, 2-W push-pull, and 4-W dual push-pull amplifiers having state-of-the-art power-added efficiencies of 45 percent, 40 percent, and 35 percent, respectively, in a 1-GHz bandwidth, with associated gains of 5.8 dB, 5.4 dB, and 5.0 dB. Data are given for 15-unit lots of the 1-W and 2-W units to show the consistency of their performance. In addition to output power and efficiency data, this paper includes information on AM-to-PM conversion, second-harmonic generation, and intermodulation products.

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Abstracts

A Compact 4-GHz Linearizer for Space Use (Dec. 1986 [T-MTT])

R. Inada, H. Ogawa, S. Kitazume and P. Desantis. "A Compact 4-GHz Linearizer for Space Use (Dec. 1986 [T-MTT])." 1986 Transactions on Microwave Theory and Techniques 34.12 (Dec. 1986 [T-MTT] (1986 Symposium Issue)): 1327-1332.

A compact and lightweight 4-GHz linearizer for satellite TWTA's has been developed by using MIC packages with chip devices. The linearizer is composed of a preamplifier, a predistortion linearizer, and a limiting amplifier, consisting of two, three, and three 25x12.5-mm packages, respectively. It improves the noise power ratio for an FM system by 3 dB and the required C/N for a TDMA system by 4.5 dB compared with the conventional satellite TWTA. A space environmental test and an aging test were successfully performed on the equipment.



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Abstracts

A Millimeter-Wave Microslab™ Oscillator

H.B. Sequeira, J.A. McClintock, B. Young and T. Itoh. "A Millimeter-Wave Microslab™ Oscillator." 1986 Transactions on Microwave Theory and Techniques 34.12 (Dec. 1986 [T-MTT] (1986 Symposium Issue)): 1333-1336.

Simplified and rigorous mode-matching analyses are applied to find the propagating characteristics of Microslab-a novel, planar waveguiding medium. We also report, for the first time, the coupling of a millimeter-wave GaAs Gunn device directly to Microslab using a monolithic-like structure to produce 0.25 mW of oscillator power at 141 GHz.



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Wave Coupling Between Parallel Single-Mode and Multimode Optical Fibers

H.-C. Chang, H.S. Huang and J. Wu. "Wave Coupling Between Parallel Single-Mode and Multimode Optical Fibers." 1986 Transactions on Microwave Theory and Techniques 34.12 (Dec. 1986 [T-MTT] (1986 Symposium Issue)): 1337-1343.

A directional coupler composed of a single-mode optical fiber and a multimode optical fiber has been considered to be capable of serving as a drop/insert device of a node in optical fiber local area networks. It should couple almost all the local transmitter power into the multimode fiber bus, while removing only a small fraction of the optical power from the bus through the single-mode fiber. In this paper, the underlying fundamental process of the power transfer between two such optical fibers is analyzed utilizing a coupled-mode theory. Numerical calculations show that wave coupling among the guided modes on the fibers is quite complicated and that the wave amplitude variations along the propagation direction are different from the sinusoidal types resulting from two-mode coupling. The theoretical results do support the expected performance of the proposed couplers and provide an important guide for the design of such devices.

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GaAs/GaAlAs Heterojunction Bipolar Phototransistor for Monolithic Photoreceiver Operating at 140 Mbit/s (Dec. 1986 [T-MTT])

H. Wang, C. Bacot, C. Gerard, J.L. Lievin, C. Dubon-Chevallier, D. Ankri and A. Scavennec.
"GaAs/GaAlAs Heterojunction Bipolar Phototransistor for Monolithic Photoreceiver Operating at 140 Mbit/s (Dec. 1986 [T-MTT])." 1986 Transactions on Microwave Theory and Techniques 34.12 (Dec. 1986 [T-MTT] (1986 Symposium Issue)): 1344-1348.

The development of optical transmission calls for sensitive and fast optoelectronic transducers. With the advent of optical local area networks, hybrid transducers may no longer be appropriate, and monolithic emitters and receivers will be preferred. In this paper, we report on the first monolithic photoreceiver implemented with GaAs-GaAlAs bipolar devices. One phototransistor and two transistors are integrated, together with four resistors on a 0.5x0.5-mm² GaAs chip. The transimpedance receiver has a bandwidth of 80 MHz. Signal and noise power measurements indicate that for a digital signal at 140 Mbit/s, the minimum detectable power is 1 μ W (-30 dBm).

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Analysis of Optically Controlled Microwave/Millimeter-Wave Device Structures

R.N. Simons and K.B. Bhasin. "Analysis of Optically Controlled Microwave/Millimeter-Wave Device Structures." 1986 Transactions on Microwave Theory and Techniques 34.12 (Dec. 1986 [T-MTT] (1986 Symposium Issue)): 1349-1355.

Light-induced voltage and the change in the source-to-drain channel current under optical illumination higher than the semiconductor band gap for GaAs MESFET, InP MESFET, Al/sub 0.3/Ga/sub 0.7/As/GaAs high electron mobility transistor (HEMT), and GaAs permeable base transistor (PBT) are analytically obtained. The GaAs PBT and GaAs MESFET have higher sensitivity than the InP MESFET. However, the Al/sub 0.3/Ga/sub 0.7/As/ GaAs HEMT is observed to have the highest sensitivity. Variations in the small-signal parameters, such as channel conductance, gate-to-source capacitance, and transconductance, as well as transient parameters, such as switching time and power-delay product, of GaAs MESFET with illumination are computed. The computed capacitance and transconductance are compared with the experimentally obtained values and are found to be in fair agreement. Based on these results, the design considerations for an optically controlled MESFET switch are discussed. Finally, variation in device parameter due to optical illumination and its effect on the cutoff frequencies f_T and f_{max} are also investigated.





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Internal Microwave Propagation and Distortion Characteristics of Traveling-Wave Amplifiers Studied by Electrooptic Sampling

M.J.W. Rodwell, M. Riazat, K.J. Weingarten, B.A. Auld and D.M. Bloom. "Internal Microwave Propagation and Distortion Characteristics of Traveling-Wave Amplifiers Studied by Electrooptic Sampling." 1986 Transactions on Microwave Theory and Techniques 34.12 (Dec. 1986 [T-MTT] (1986 Symposium Issue)): 1356-1362.

The internal signal propagation and saturation characteristics of two monolithic microwave traveling-wave amplifiers (TWA) are measured by electrooptic sampling. Gate and drain line responses are compared with theory and simulation, leading to revisions in the FET models. Drain voltage frequency dependence and harmonic current propagation together lead to more complex saturation behavior than is discussed in the literature.

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Abstracts

Comparison of Indirect Optical Injection-Locking Techniques of Multiple X-Band Oscillators (Dec. 1986 [T-MTT])

A.S. Daryoush, P.R. Herczfeld, Z. Turski and P.K. Wahi. "Comparison of Indirect Optical Injection-Locking Techniques of Multiple X-Band Oscillators (Dec. 1986 [T-MTT])." 1986 Transactions on Microwave Theory and Techniques 34.12 (Dec. 1986 [T-MTT] (1986 Symposium Issue)): 1363-1370.

Experimental results of indirect optical injection-locking of two X-band FET oscillators are presented. An S-band master source is used to synchronize both oscillators simultaneously, with 18-MHz locking range using the fiber-optic link nonlinearity. The source of the optical link nonlinearity is traced to the laser diode by interferometric measurement. Both the laser diode and the FET oscillator nonlinearities can be exploited to achieve frequency multiplication of the master oscillator signal. The merits of these different methods are evaluated based on the locking range and the FM noise level of the injection-locked oscillator.



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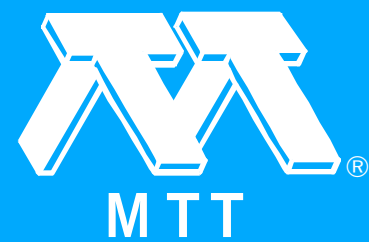
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Indirect Subharmonic Optical Injection Locking of a Millimeter-Wave IMPATT Oscillator (Dec. 1986 [T-MTT])

P.R. Herczfeld, A.S. Daryoush, A. Rosen, A.K. Sharma and V.M. Contarino. "Indirect Subharmonic Optical Injection Locking of a Millimeter-Wave IMPATT Oscillator (Dec. 1986 [T-MTT])." 1986 Transactions on Microwave Theory and Techniques 34.12 (Dec. 1986 [T-MTT] (1986 Symposium Issue)): 1371-1376.

Large aperture phased-array antennas operating at millimeter-wave frequencies are designed for space-based communications and imaging. Array elements are composed of active transmit-receive (T/R) modules that are phase and frequency synchronized to a reference signal at the central processing unit by a fiber-optic (FO) distribution network. The implementation of FO links, synchronizing the millimeter-wave local oscillators (LO's), imposes a great challenge. This paper presents results of indirect optical injection locking of a free-running 38-GHz (Ka-band) IMPATT oscillator over the locking range of 2-132 MHz, depending on the injected power level (amplifier gain). In the experiment, the nonlinearity of both the laser diode and the IMPATT oscillator is exploited to achieve 12th subharmonic injection locking. The overall system FM noise degradation of the reference signal is 16 dB at 500-Hz offset. The FM noise degradation is dominated by the theoretical limit of $20 \log N$, where N is the frequency multiplication factor used in subharmonic injection locking. Methods by which optical injection locking may be extended into 60 and 90 GHz are demonstrated.





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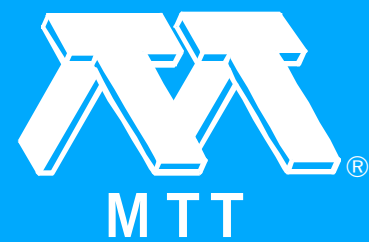
Magnetostatic Wave Propagation in a Finite YIG-Loaded Rectangular Waveguide

M. Radmanesh, C.-M. Chu and G.I. Haddad. "Magnetostatic Wave Propagation in a Finite YIG-Loaded Rectangular Waveguide." 1986 Transactions on Microwave Theory and Techniques 34.12 (Dec. 1986 [T-MTT] (1986 Symposium Issue)): 1377-1382.

The propagation of magnetostatic waves (MSW) in a waveguide partially loaded with a low-loss ferrite slab is investigated theoretically. The most common low-loss ferrite material used for MSW propagation is epitaxial yttrium iron garnet (YIG). A YIG slab is placed inside and along the guide and not in contact with the sidewalls of the waveguide. The dc magnetic field is assumed to be parallel to the YIG slab and perpendicular to the direction of propagation. Using the integral equation method, the dispersion relation is found to be an infinitely large determinant equal to zero. Proper truncation of this determinant and numerical analysis to find its roots are carried out in this work. It is seen that in order to obtain high values of group time delay, the YIG slab must be narrow and placed at the bottom of the guide. On the other hand, to maximize the device bandwidth, a narrow YIG slab positioned at the top inside surface of the waveguide is preferred. It is also noticed that there exists a tradeoff between the time delay and the device bandwidth and that maximization of one property leads to a poor value in the other. Thus, some design compromises should be made. It is also observed that the frequency range of operation of the device can be adjusted by an external magnetic bias field. This property of tuning the device to operate in any frequency range adds an extra dimension of flexibility to the operation and also to the design of these devices.

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Tunable Microwave Resonators Using Magnetostatic Wave in YIG Films

W.S. Ishak and K.-W. Chang. "Tunable Microwave Resonators Using Magnetostatic Wave in YIG Films." 1986 Transactions on Microwave Theory and Techniques 34.12 (Dec. 1986 [T-MTT] (1986 Symposium Issue)): 1383-1393.

The purpose of this paper is to review the status of magnetostatic wave (MSW) resonators and to describe, in detail, the theory of operation of the recently developed straight-edge resonators. These resonators are based on magnetostatic waves propagating in high Q cavities fabricated in thin ferrimagnetic films. The resonance frequency of these resonators can be tuned via a bias magnetic field. The theory of propagation of magnetostatic wave devices in periodic arrays will be briefly described followed by a detailed overview of the different configurations for MSW resonators. Three distinct classes of resonators will be discussed 1) resonators based on array reflectors (deposited metals and etched grooves) will be described in detail; 2) guided-wave ring resonators will be discussed; and 3) the theory of operation and design criteria for the straight-edge resonators will be described. Each class will be evaluated, pointing out the advantages and drawbacks, and whenever applicable, the power handling properties and the phase noise performance will be given.

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Broad-Band Stripline Circulators Based on YIG and Li-Ferrite Single Crystals

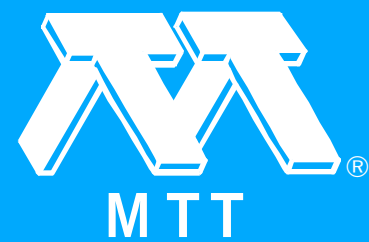
E. Schloemann and R.E. Blight. "Broad-Band Stripline Circulators Based on YIG and Li-Ferrite Single Crystals." 1986 Transactions on Microwave Theory and Techniques 34.12 (Dec. 1986 [T-MTT] (1986 Symposium Issue)): 1394-1400.

The useful operating range of circulators has been extended by avoiding the "low-field loss" problems usually associated with operating at frequencies smaller than the magnetization frequency $f/\text{sub } M/$, through the use of a device configuration that assures a nearly uniform internal magnetic field. Performance data on experimental stripline circulators using single-crystal YIG or Li-ferrite disks and external YIG (or Li-ferrite) domes (for achieving a nearly uniform internal magnetic field) are summarized and compared with theoretical expectations. Reasonably good circulator performance is observed in the frequency range from 2.8 to 10.20 GHz for the circulator based on YIG and in the frequency range from 5.8 GHz to 18 GHz for the circulator based on Li-ferrite. The external ferrite domes improve the performance significantly when the frequency is near the lower edge of the operating band.

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A Printed-Circuit Hybrid-Ring Directional Coupler for Arbitrary Power Divisions

A.K. Agrawal and G.F. Mikucki. "A Printed-Circuit Hybrid-Ring Directional Coupler for Arbitrary Power Divisions." 1986 Transactions on Microwave Theory and Techniques 34.12 (Dec. 1986 [T-MTT] (1986 Symposium Issue)): 1401-1407.

A directional coupler in the form of a hybrid ring particularly suited for printed circuits is described. The maximum power-split ratio between the two output ports of a printed-circuit conventional hybrid-ring coupler is limited by the highest impedance line that can be realized. The hybrid-ring directional coupler described in this paper allows a larger power-split ratio for the same impedance lines, and thereby increases the range of the power-split ratio that can be realized for printed circuits. A theoretical analysis was conducted using the scattering matrix, and experimental verification of the theoretical results was achieved in a stripline configuration at Ku-band.

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A Bandstop Filter Constructed in Coupled Nonradiative Dielectric Waveguide

J.A.G. Malherbe and J.C. Olivier. "A Bandstop Filter Constructed in Coupled Nonradiative Dielectric Waveguide." 1986 Transactions on Microwave Theory and Techniques 34.12 (Dec. 1986 [T-MTT] (1986 Symposium Issue)): 1408-1412.

The design of a bandstop filter in nonradiative dielectric waveguide is described. The filter makes use of side-coupled guides to realize an equivalent of an open-circuited shunt stub and transmission-line section. Theoretical and practical results of the coupled lines as well as the filter performance are presented.

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Abstracts

Coherent RF Error Statistics (Dec. 1986 [T-MTT])

R.B. Dybdal and R.H. Ott. "Coherent RF Error Statistics (Dec. 1986 [T-MTT])." 1986 Transactions on Microwave Theory and Techniques 34.12 (Dec. 1986 [T-MTT] (1986 Symposium Issue)): 1413-1420.

RF error statistics for power, voltage, and phase are derived under the assumptions that the error component is coherently related to the desired signal, that its magnitude is constant, and that its phase is equally likely and uniformly distributed from 0 to 360°. The error statistics which result from these assumptions have nonzero mean values for power and voltage and standard deviations which differ significantly from those projected on the basis of Gaussian statistics that apply to incoherent errors. These statistics will be applied to typical component errors which arise in an overall system error budget.



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Abstracts

Direct Calibration and Measurement of Microstrip Structures on Gallium Arsenide (Dec. 1986 [T-MTT])

P.R. Shepherd and R.D. Pollard. "Direct Calibration and Measurement of Microstrip Structures on Gallium Arsenide (Dec. 1986 [T-MTT])." 1986 Transactions on Microwave Theory and Techniques 34.12 (Dec. 1986 [T-MTT] (1986 Symposium Issue)): 1421-1426.

Measurements on coupled microstrip line structures on gallium arsenide (GaAs) are described which use a direct launch and calibration standards in the same microstrip medium. Novel techniques are adopted to ensure repeatability and overcome problems of fragility of the substrates. Measurements of the S-parameters show good agreement with theoretical analysis. The theoretical derivation of the S-parameters is summarized in an appendix.



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Abstracts

Dispersion of Transient Signals in Microstrip Transmission Lines (Dec. 1986 [T-MTT])

R.L. Veghte and C.A. Balanis. "Dispersion of Transient Signals in Microstrip Transmission Lines (Dec. 1986 [T-MTT])." 1986 Transactions on Microwave Theory and Techniques 34.12 (Dec. 1986 [T-MTT] (1986 Symposium Issue)): 1427-1436.

The distortion of an electrical pulse caused by dispersion as it propagates along a microstrip line is investigated. A model for dispersion of the phase constant is selected to meet the frequency, accuracy, and microstrip parametric requirements. Numerical integration and Taylor series expansion approximation techniques are used to compute the shape of dc dispersed pulses having square and Gaussian envelope shapes. Taylor series expansion methods are more convenient for the analysis of RF pulses.



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Abstracts

A New Model for the Apparent Characteristic Impedance of Finned Waveguide and Finlines

P. Pramanick and P. Bhartia. "A New Model for the Apparent Characteristic Impedance of Finned Waveguide and Finlines." 1986 Transactions on Microwave Theory and Techniques 34.12 (Dec. 1986 [T-MTT] (1986 Symposium Issue)): 1437-1441.

This paper presents a new model for the apparent characteristic impedance of finned waveguide and finlines from the standpoint of per-unit-length capacitance of the fins, obtained by conformal mapping, and of the waveguide, obtained from cutoff wavelengths, without going into the controversy of definition. The model strongly supports the power-voltage definition. Closed-form synthesis equations have also been derived which are within 1.5 percent of the analysis equations. The model will be useful in computer-aided design of millimeter-wave finned waveguide and finlines.



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Multilayer Planar Structures for High-Directivity Directional Coupler Design (Dec. 1986 [T-MTT])

M. Horno and F. Medina. "Multilayer Planar Structures for High-Directivity Directional Coupler Design (Dec. 1986 [T-MTT])." 1986 Transactions on Microwave Theory and Techniques 34.12 (Dec. 1986 [T-MTT] (1986 Symposium Issue)): 1442-1449.

One of the problems that appears in the directional couplers designed with nonhomogeneous coupled transmission lines (CTL's) is their inherently poor directivity, due to the difference between the mode phase velocities. In order to overcome this defect, several multilayer configurations for high-directivity coupler design are proposed and studied in this paper. The analysis has been achieved by means of variational techniques in the spectral domain. A computer program to generate optimum design curves has been written, and several examples for certain dielectric materials are included. On the basis of these curves, various directional coupler designs are presented and discussed.

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Abstracts

Considerations in the Use of Coplanar Waveguide for Millimeter-Wave Integrated Circuits

R.W. Jackson. "Considerations in the Use of Coplanar Waveguide for Millimeter-Wave Integrated Circuits." 1986 Transactions on Microwave Theory and Techniques 34.12 (Dec. 1986 [T-MTT] (1986 Symposium Issue)): 1450-1456.

Using a full-wave analysis, coplanar waveguide (CPW) transmission line is compared to microstrip in terms of conductor loss, dispersion, and radiation into parasitic modes. It is shown that, on a standard 0.1-mm semiconductor at 60 GHz, the dimensions of CPW can be chosen to give better results in terms of conductor loss and dispersion than microstrip. A calculation of parasitic mode generation is presented for CPW on a semiconductor for an open substrate, for a substrate suspended above a ground plane, and for substrates separated from a ground plane by quartz.



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Analysis Method for Generalized Suspended Striplines

E. Yamashita, M. Nakajima and K. Atsuki. "Analysis Method for Generalized Suspended Striplines." 1986 Transactions on Microwave Theory and Techniques 34.12 (Dec. 1986 [T-MTT] (1986 Symposium Issue)): 1457-1463.

This paper describes an effective analysis method suited to generalized suspended striplines, that is, planar transmission lines having multiple conductor sheets on multiple substrates, and multiple supporting grooves or pedestals. Two example striplines structures are analyzed based on this method. Some experimental results are also shown.

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The Finite-Difference - Time-Domain Method and its Application to Eigenvalue Problems

D.H. Choi and W.J.R. Hoefer. "The Finite-Difference - Time-Domain Method and its Application to Eigenvalue Problems." 1986 Transactions on Microwave Theory and Techniques 34.12 (Dec. 1986 [T-MTT] (1986 Symposium Issue)): 1464-1470.

This paper describes the application of the finite-difference method in the time domain to the solution of three-dimensional (3-D) eigenvalue problems. Maxwell's equations are discretized in space and time, and steady-state solutions are then obtained via Fourier transform. While achieving the same accuracy and versatility as the TLM method, the finite-difference-time-domain (FD-TD) method requires less than half the CPU time and memory under identical simulation conditions. Other advantages over the TLM method include the absence of dielectric boundary errors in the treatment of 3-D inhomogeneous planar structures, such as microstrip. Some numerical results, including dispersion curves of a microstrip on anisotropic substrate, are presented.

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Abstracts

Characteristics of Multiconductor, Asymmetric, Slow-Wave Microstrip Transmission Lines (Dec. 1986 [T-MTT])

T.-C. Mu, H. Ogawa and T. Itoh. "Characteristics of Multiconductor, Asymmetric, Slow-Wave Microstrip Transmission Lines (Dec. 1986 [T-MTT])." 1986 Transactions on Microwave Theory and Techniques 34.12 (Dec. 1986 [T-MTT] (1986 Symposium Issue)): 1471-1477.

Spectral-domain technique has been applied to analyze multiconductor, asymmetric, slow-wave microstrip lines. It is observed that 1) the coupled slow-wave microstrip line on a two-layer substrate may have substantially different propagation constants for even and odd modes and 2) the slow-wave factor of an odd mode of coupled microstrip lines on a three-layer substrate may be equal to or larger than that of an even mode under appropriate conditions. This presents the flexibility to realize a large variety of passive components, such as directional couplers, phase shifters, and attenuators.



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Abstracts

Slow-Wave Characteristics of Ferromagnetic Semiconductor Microstrip Line (Dec. 1986 [T-MTT])

H. Ogawa and T. Itoh. "Slow-Wave Characteristics of Ferromagnetic Semiconductor Microstrip Line (Dec. 1986 [T-MTT])." 1986 Transactions on Microwave Theory and Techniques 34.12 (Dec. 1986 [T-MTT] (1986 Symposium Issue)): 1478-1482.

A new slow-wave microstrip line made of a ferromagnetic semiconductor (FMS) substrate is proposed and its characteristics are discussed. Another possibility of a slow-wave microstrip line by a ferromagnetic (FM) substrate is also described in this paper. It is shown that these structures have more desirable and flexible guided wave properties than the conventional metal-insulator-semiconductor (MIS) microstrip line.



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Finite-Element Analysis of Slow-Wave Schottky Contact Printed Lines

C.-K. Tzuang and T. Itoh. "Finite-Element Analysis of Slow-Wave Schottky Contact Printed Lines." 1986 Transactions on Microwave Theory and Techniques 34.12 (Dec. 1986 [T-MTT] (1986 Symposium Issue)): 1483-1489.

Extensive finite-element analyses on MMIC slow-wave structures with both localized and layered models are presented. Good agreement is achieved between the data presented here and other theoretical results and experiments. Higher order elements that improve accuracy are discussed. The comparative studies for Schottky contact microstrip and coplanar waveguide with localized and layered models are presented. Potential applications of the localized models to more general and practical slow-wave circuits are also discussed.



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An Improved Transmission Matrix Formulation of Cascaded Discontinuities and its Application to E-Plane Circuits (Dec. 1986 [T-MTT])

R.R. Mansour and R.H. MacPhie. "An Improved Transmission Matrix Formulation of Cascaded Discontinuities and its Application to E-Plane Circuits (Dec. 1986 [T-MTT])." 1986 Transactions on Microwave Theory and Techniques 34.12 (Dec. 1986 [T-MTT] (1986 Symposium Issue)): 1490-1498.

We study the effect of the relative convergence problem on the transmission matrix formulation of cascaded discontinuities. A numerically efficient modified formulation satisfying the edge condition is presented. Application is in the analysis of waveguiding structures in which a number of conductors are placed on various interfaces. Numerical results are presented for double-ridged waveguides and finlines. Applications to E-plane filters are also discussed.



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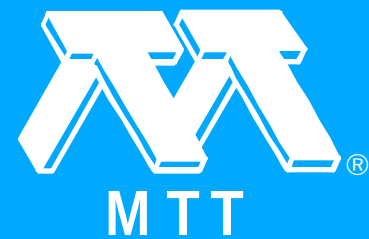
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Discontinuities in Finlines on Semiconductor Substrate (Dec. 1986 [T-MTT])

K. Uhde. "Discontinuities in Finlines on Semiconductor Substrate (Dec. 1986 [T-MTT])." 1986 Transactions on Microwave Theory and Techniques 34.12 (Dec. 1986 [T-MTT] (1986 Symposium Issue)): 1499-1507.

Using the singular integral equation (SIE) technique, two finline structures on an insulator-semiconductor substrate are analyzed. The complex propagation constants of the dominant and the first three higher order modes are presented depending on the conductivity of the semiconductor layer. Then, discontinuities in both slot width and substrate complex dielectric constant are investigated theoretically. The reflection and the transmission coefficients of the dominant mode are calculated showing that a step in the permittivity can almost be compensated for by a step in the slot width.

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The Effect of Complex Modes at Finline Discontinuities

A.S. Omar and K.F. Schunemann. "The Effect of Complex Modes at Finline Discontinuities." *1986 Transactions on Microwave Theory and Techniques* 34.12 (Dec. 1986 [T-MTT] (1986 Symposium Issue)): 1508-1514.

The effect of ignoring complex modes on the solution of finline discontinuity problems is investigated. It is shown that the modal energy distribution at both sides of the discontinuity may be greatly affected by overlooking complex modes, even if they are not strongly excited. It is also shown that disregarding only one mode of a pair of complex modes, while taking the other into account, results in a contradiction to the principle of complex power continuity across the discontinuity plane. Comparison to measured data is also given to justify the validity of the numerical results.

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Abstracts

Foreword (Dec. 1986 [T-MTT])

Y. Ayasli. "Foreword (Dec. 1986 [T-MTT])." 1986 Transactions on Microwave Theory and Techniques 34.12 (Dec. 1986 [T-MTT] (1986 Symposium Issue)): 1515-1515.

The 1986 IEEE Microwave and Millimeter-Wave Monolithic Circuits Symposium was held on June 4-5, 1986, at the Baltimore Convention Center, in conjunction with the IEEE MTT-S International Symposium. With more than 750 attendees, five sessions, and two invited and 21 contributed papers, this fifth Monolithic Symposium continued to enjoy a high level of interest from the scientific community.



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Silicon High-Resistivity-Substrate Millimeter-Wave Technology (Dec. 1986 [T-MTT])

J. Buechler, E. Kasper, P. Russer and K.M. Strohm. "Silicon High-Resistivity-Substrate Millimeter-Wave Technology (Dec. 1986 [T-MTT])." 1986 Transactions on Microwave Theory and Techniques 34.12 (Dec. 1986 [T-MTT] (1986 Symposium Issue)): 1516-1521.

The application of molecular beam epitaxy (MBE) and X-ray lithography for the fabrication of monolithic integrated millimeter-wave devices on high-resistivity silicon has been investigated. Process compatibility and the retention of high-resistivity characteristics were measured using the spreading resistance method and Hall measurements after various process steps. Microstrip resonators of ring and linear geometry were fabricated on 10 000 $\Omega \cdot \text{cm}$ silicon substrates. For linear microstrip resonators, the attenuation was found to be less than 0.6 dB/cm at 90 GHz. A 95-GHz IMPATT oscillator circuit and a planar microstrip antenna array have been fabricated on highly insulating silicon substrates. For the oscillator, a combined monolithic-hybrid integration technique was used to attach the discrete IMPATT diode to the resonator circuit. The oscillator does not require tuning elements. Preliminary experimental results are 8 mW of output power with 0.2 percent efficiency at 95 GHz.

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Low-Noise HEMT Using MOCVD

K. Tanaka, M. Ogawa, K. Togashi, H. Takakuwa, H. Ohke, M. Kanazawa, Y. Kato and S. Watanabe. "Low-Noise HEMT Using MOCVD." 1986 Transactions on Microwave Theory and Techniques 34.12 (Dec. 1986 [T-MTT] (1986 Symposium Issue)): 1522-1527.

Low-noise HEMT AlGaAs/GaAs heterostructure devices have been developed using metal organic chemical vapor deposition (MOCVD). The HEMT's with 0.5- μm -long and 200- μm -wide gates have shown a minimum noise figure of 0.83 dB with an associated gain of 12.5 dB at 12 GHz at room temperature. Measurements have confirmed calculations on the effect of the number of gate bonding pads on the noise figure for different gate widths. Substantial noise figure improvement was observed under low-temperature operation, especially compared to conventional GaAs MESFET's. A two-stage amplifier designed for DBS reception using the HEMT in the first stage has displayed a noise figure under 2.0 dB from 11.7 to 12.2 GHz.

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GaAs Ultra-High-Frequency Dividers with Advanced SAINT FET's (Dec. 1986 [T-MTT])

K. Osafune, T. Enoki, K. Yamasaki and K. Ohwada. "GaAs Ultra-High-Frequency Dividers with Advanced SAINT FET's (Dec. 1986 [T-MTT])." 1986 Transactions on Microwave Theory and Techniques 34.12 (Dec. 1986 [T-MTT] (1986 Symposium Issue)): 1528-1532.

The circuit design, fabrication, and performance of ultra-high-frequency dividers with buffer FET logic (BFL) circuits are described. Using air-bridge technology and a new, self-aligned-gate, GaAs FET process, called advanced SAINT, which avoids excess gate metal overlap on the dielectric film, 10.6-GHz operation at 258 mW is achieved. This performance is made possible by a reduction of gate and interconnection parasitic capacitance. Furthermore, the possibility of operation above 20 GHz for GaAs MESFET frequency dividers is predicted on the basis of circuit optimization and FET improvements including parasitic capacitance reduction and transconductance enhancement.

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Abstracts

Monolithic RC All-Pass Networks with Constant-Phase-Difference Outputs

S.K. Altes, T.-H. Chen and L.J. Ragonese. "Monolithic RC All-Pass Networks with Constant-Phase-Difference Outputs." 1986 Transactions on Microwave Theory and Techniques 34.12 (Dec. 1986 [T-MTT] (1986 Symposium Issue)): 1533-1541.

All-pass network techniques have made it possible to realize very small monolithic lumped active phase shifters with decade bandwidths, high yield, and relative phase stability, even when the device parameters vary ± 20 percent. We have successfully demonstrated fully monolithic first-order networks (at 250 MHz) and second-order networks (at 4 GHz).



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A High-Yield, 3-7-GHz, 0.5-W Push-Pull GaAs MMIC Amplifier

S.B. Moghe and R. Genin. "A High-Yield, 3-7-GHz, 0.5-W Push-Pull GaAs MMIC Amplifier." 1986 Transactions on Microwave Theory and Techniques 34.12 (Dec. 1986 [T-MTT] (1986 Symposium Issue)).

A high-yield, 3-7-GHz, 0.5-W MMIC GaAs amplifier has been successfully designed and tested. The amplifier features small chip size (1.2 mm sq.), high gain (12 ± 1.5 dB), high power-added efficiency (20 percent), good RF yield (57 percent), and high tolerance to process variations. Packaged amplifiers were built with this chip for both the 2-6-GHz and the 5.9-6.4-GHz bands. Saturated output power of 25 dBm was achieved in the 2-6-GHz band, and 27 dBm in the 5.9-6.4-GHz band. Infrared measurements show that the device has low FET channel temperatures when operated at full bias power over the full range of military ambient temperatures.

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Abstracts

A 12-dB High-Gain Monolithic Distributed Amplifier

R.A. LaRue, S.G. Bandy and G.A. Zdasiuk. "A 12-dB High-Gain Monolithic Distributed Amplifier." 1986 Transactions on Microwave Theory and Techniques 34.12 (Dec. 1986 [T-MTT] (1986 Symposium Issue)): 1542-1547.

By reducing gate and drain line loss associated with the active elements of a distributed amplifier, significant gain improvements are possible. Loss reduction is achieved in a novel monolithic distributed amplifier by replacing the common-source FET's of the conventional design with cascode elements having a gate length of one-quarter micron. A record gain of over 10 dB from 2 to 18 GHz and a noise figure of 4 dB at 7 GHz have been achieved on a working amplifier. Details of the design and fabrication process are described.



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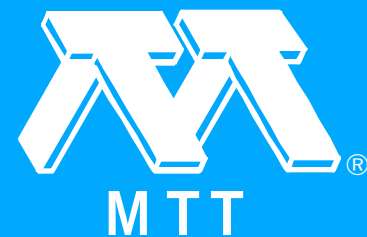


Abstracts

A 30-GHz Monolithic Receiver

L.C.T. Liu, C.S. Liu, J.R. Kessler, S.-K. Wang and C.-D. Chang. "A 30-GHz Monolithic Receiver." 1986 Transactions on Microwave Theory and Techniques 34.12 (Dec. 1986 [T-MTT] (1986 Symposium Issue)): 1548-1552.

Several monolithic integrated circuits have been developed to make a 30-GHz receiver. The receiver components include a low-noise amplifier, an IF amplifier, a mixer, and a phase shifter. The LNA has a 7-dB noise figure with over 17 dB of associated gain. The IF amplifier has a 13-dB gain with a 30-dB control range. The mixer has a conversion loss of 10.5 dB. The phase shifter has a 180° phase shift control and a minimum insertion loss of 1.6 dB.



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Cost-Effective High-Performance Monolithic X-Band Low-Noise Amplifiers (Dec. 1986 [T-MTT])

D.C. Wang, R.G. Pauley, S.-K. Wang and L.C.T. Liu. "Cost-Effective High-Performance Monolithic X-Band Low-Noise Amplifiers (Dec. 1986 [T-MTT])." 1986 Transactions on Microwave Theory and Techniques 34.12 (Dec. 1986 [T-MTT] (1986 Symposium Issue)): 1553-1558.

A low-cost, high-performance X-band amplifier with ion-implanted MESFET technology has been demonstrated. Various design, material, and processing approaches have been evaluated in terms of yield, cost, and device performance. An average noise figure of 2.2 dB and a standard deviation of 0.1 dB, with an associated gain of 22.5 dB and a standard deviation of 0.8 dB at the center frequency band of 9.5 GHz, have been measured.



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A High-Performance 2-18.5-GHz Distributed Amplifier--Theory and Experiment

T. McKay, J. Eisenberg and R.E. Williams. "A High-Performance 2-18.5-GHz Distributed Amplifier--Theory and Experiment." 1986 Transactions on Microwave Theory and Techniques 34.12 (Dec. 1986 [T-MTT] (1986 Symposium Issue)): 1559-1568.

A high-performance 2-18.5-GHz monolithic GaAs MESFET distributed amplifier has been designed and fabricated. The distributed amplifier is analyzed theoretically using a normalized transmission matrix approach and a closed-form gain equation is presented for the MMIC m-derived drain-line case. Theoretical predictions are compared to measured results and more complicated CAD models. The measured small-signal gain is typically 8.0 ± 0.40 dB from 2-18.5 GHz at standard bias. Typical input return loss is greater than 12 dB, and the output return loss is greater than 15 dB. The saturated output power is in excess of 23 dBm over most of the band, and the noise figure is less than 7.5 dB.

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Abstracts

Surface-Mounted GaAs Active Splitter and Attenuator MMIC's Used in a 1-10-GHz Leveling Loop

G.S. Barta, K.E. Jones, G.C. Herrick and E.W. Strid. "Surface-Mounted GaAs Active Splitter and Attenuator MMIC's Used in a 1-10-GHz Leveling Loop." 1986 Transactions on Microwave Theory and Techniques 34.12 (Dec. 1986 [T-MTT] (1986 Symposium Issue)): 1569-1575.

A wide-band monolithic GaAs bridge-T variable attenuator has been used with a monolithic GaAs active power splitter to form a compact 1-10-GHz leveling loop having a minimum 9-dB leveling range with buffered output. The attenuator internally optimizes input and output return loss over a 1-10-GHz bandwidth by the use of an on-chip GaAs op-amp. The active power splitter provides unity gain to each port over a 1-10-GHz bandwidth by the use of distributed amplification. The entire 4.5-cm by 4.2-cm subsystem was realized with surface mount packages on RT-Duroid®, demonstrating new construction techniques for GaAs MMIC assembly.



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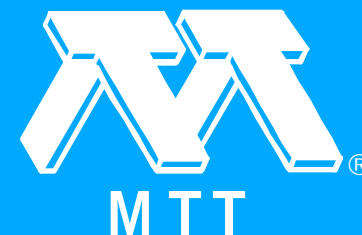
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Index, IEEE [T-MTT] 1986, Volume 34, and MTT-S Sponsored Conferences

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Abstracts

Wave Propagation on MESFET Electrodes and its Influence on Transistor Gain

W. Heinrich and H.L. Hartnagel. "Wave Propagation on MESFET Electrodes and its Influence on Transistor Gain." 1987 Transactions on Microwave Theory and Techniques 35.1 (Jan. 1987 [T-MTT]): 1-8.

A rigorous analysis of wave propagation along MESFET electrodes is presented. Both the losses caused by the channel and those caused by the finite electrode conductivity are included, together with small-signal amplification. Results from this wave analysis are used to determine overall gain. Conclusions concerning traveling-wave FET design, optimal gate width and related criteria are drawn.



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An Ultra-High-Speed GaAs Prescaler Using a Dynamic Frequency Divider

K. Osafune and K. Ohwada. "An Ultra-High-Speed GaAs Prescaler Using a Dynamic Frequency Divider." 1987 Transactions on Microwave Theory and Techniques 35.1 (Jan. 1987 [T-MTT]): 9-13.

A high-speed, low-power-consumption prescaler for a phase lock stable oscillator is designed and fabricated with a GaAs MESFET BFL circuit. The prescaler of a 1/32 frequency divider is composed of a dynamic frequency divider for the prescaler first stage, a newly developed dual-phase signal generator, and master-slave T-type flip-flops for the presealer post stages. The fabricated 1/32 prescaler operated up to 8.5 GHz at only 540 mW. The 1/2 dynamic frequency divider corresponding to the prescaler first stage shows a maximum operation frequency of 13.2 GHz at only 115 mW.

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Abstracts

A Multifilament Method-of-Moments Solution for the Input Impedance of a Probe-Excited Semi-Infinite Waveguide

J.M. Jarem. "A Multifilament Method-of-Moments Solution for the Input Impedance of a Probe-Excited Semi-Infinite Waveguide." 1987 Transactions on Microwave Theory and Techniques 35.1 (Jan. 1987 [T-MTT]): 14-19.

The input impedance and surface currents of a probe-excited, short-circuited semi-infinite waveguide are determined by the method of moments. Expressions are given for the impressed electric field used to excite the probe from the coaxial source input using a semi-infinite-waveguide Green's function, and expressions are given for a free-space approximate impressed electric field which arises from the coaxial source input. The method-of-moments formulation used is based on a multifilament current approximation and solves for the surface currents of the probe as a function of probe angle around the probe. Comparison of theory and experiment is made.



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Abstracts

Polynomial Approximations for the Transverse Magnetic Polarizabilities of Some Small Apertures

N.A. McDonald. "Polynomial Approximations for the Transverse Magnetic Polarizabilities of Some Small Apertures." 1987 Transactions on Microwave Theory and Techniques 35.1 (Jan. 1987 [T-MTT]): 20-23.

Polynomial approximations are given for the magnetic polarizabilities of some small apertures of various shapes, as functions of the aperture width to length ratios, for the case where the applied magnetic field is across the narrower dimension of the aperture. The shapes considered are the rectangle, diamond, rounded end slot, and ellipse, of which only the last has an exact solution.



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Uniaxial and Biaxial Substrate Effects on Finline Characteristics

H.-Y. Yang and N.G. Alexopoulos. "Uniaxial and Biaxial Substrate Effects on Finline Characteristics." 1987 Transactions on Microwave Theory and Techniques 35.1 (Jan. 1987 [T-MTT]): 24-29.

The effect of uniaxial and biaxial substrates on the frequency-dependent properties of a bilateral finline is investigated in this article. The finline characteristics are obtained by using the spectral-domain procedure in conjunction with the Galerkin method. Investigation of uniaxial substrates indicates that there is a particular optical axis direction for which the permittivity component in that direction dominates the finline behavior. In addition, a study has been carried out which determines the error which results when the material layer anisotropy is neglected.





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Characteristic Impedance of Microstrip Lines

J.R. Brews. "Characteristic Impedance of Microstrip Lines." 1987 Transactions on Microwave Theory and Techniques 35.1 (Jan. 1987 [T-MTT]): 30-34.

It is shown that it is feasible to force the complex power P of microstrip line to be given by the usual circuit definition: $P = I^* V/2$ where I and V are the current and voltage of the equivalent transmission line and $*$ denotes complex conjugation. If this requirement is made, then the three common definitions of characteristic impedance (namely, the voltage-current, power-voltage, and power-current definitions) all become equivalent. The remaining arbitrariness in microstrip characteristic impedance stems not from the choice of definition, as sometimes argued, but from the ability to choose one of the magnitudes $|I|$, $|V|$, and $|Z_{0}|$ for convenience, and also to choose the phase of either I or V (but not their relative phase). This clarification should make it easier to simplify equivalent circuits for drivers, loads, and discontinuities.

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On the Numerical Inversion of the Schwarz-Christoffel Conformal Transformation

E. Costamagna. "On the Numerical Inversion of the Schwarz-Christoffel Conformal Transformation." 1987 Transactions on Microwave Theory and Techniques 35.1 (Jan. 1987 [T-MTT]): 35-40.

Considering the numerical optimization approach for the inversion of the Schwarz-Christoffel conformal transformation formula, some improvements in integration procedures and some topics in optimization methods are discussed. Predictor-corrector techniques are introduced in order to map internal lines after the polygonal boundary is transformed these are applied to the dielectric interface in inhomogeneous line cross sections, allowing conformal transformation of quasi-TEM structures by purely numerical methods. Some examples of computations are presented, and some results are compared to known analytical calculations.

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Pulse Dispersion and Shaping in Microstrip Lines

J.F. Whitaker, T.B. Norris, G. Mourou and T.Y. Hsiang. "Pulse Dispersion and Shaping in Microstrip Lines." 1987 Transactions on Microwave Theory and Techniques 35.1 (Jan. 1987 [T-MTT]): 41-46.

A method for determining the modal dispersion of gigahertz-bandwidth pulses on microstrip transmission lines is described. We have investigated the evolution of temporal waveforms propagating on microstrips, with very good agreement noted between experimental pulse shapes and numerical simulations. The resulting pulse distortion contributed to a pulse-shaping application where 100-ps rise times were stretched to the nanosecond durations necessary to control the shape of high-energy optical pulses used in fusion research. The tunability of the shape of the rising edge was investigated through variation of the stripline geometry and the substrate material. Additional effects due to high-frequency attenuation in several dipolar liquid dielectrics were substantiated experimentally, and the relevance of the results has been discussed.



Abstracts

Analysis of Inductive Dielectric Posts in Rectangular Waveguide

Y. Leviatan and G.S. Sheaffer. "Analysis of Inductive Dielectric Posts in Rectangular Waveguide." 1987 Transactions on Microwave Theory and Techniques 35.1 (Jan. 1987 [T-MTT]): 48-59.

A rapidly converging moment solution for the complete analysis of homogeneous dielectric posts of the inductive type in rectangular waveguide is presented. The moment method approach uses filamentary currents to simulate both the field scattered by the post and the field inside the post and in turn point-matches the continuity conditions for the tangential components of the electric and magnetic fields across the post surface. The procedure is simple to execute and is general in that inductive posts of arbitrary smooth shape, size, location, and number, lossless as well as lossy, can be handled effectively. Data are given and compared with the few cases for which approximate results are available. The technique is further applied to other situations where no experimental data or other analytic results are available.



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Abstracts

On the Relationship Between TLM and Finite-Difference Methods for Maxwell's Equations (Short Papers)

P.B. Johns. "On the Relationship Between TLM and Finite-Difference Methods for Maxwell's Equations (Short Papers)." 1987 Transactions on Microwave Theory and Techniques 35.1 (Jan. 1987 [T-MTT]): 60-61.

It is shown that if the expanded node three-dimensional TLM method is operated in a certain way, then it can be numerically equivalent to a finite-difference method. Some comments are made on comparisons between the two approaches.



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Approximate Determination of the Characteristic Impedance of the Coaxial System Consisting of an Irregular Outer Conductor and a Circular Inner Conductor (Short Papers)

S.-G. Pan. "Approximate Determination of the Characteristic Impedance of the Coaxial System Consisting of an Irregular Outer Conductor and a Circular Inner Conductor (Short Papers)." 1987 Transactions on Microwave Theory and Techniques 35.1 (Jan. 1987 [T-MTT]): 61-63.

An elementary formula is presented for the determination of the characteristic impedance of a coaxial transmission line consisting of a circular inner conductor and an irregular outer conductor. In this approach, the irregular outer conductor is replaced by an eccentric circular conductor which has the same "shield factor" as an irregular one at the extreme of a small wire, and the same formula is adapted for outer conductors of different shapes by determining values of eccentricity of the equivalent eccentric coaxial lines. The validity of the formula is confirmed by numerical results.

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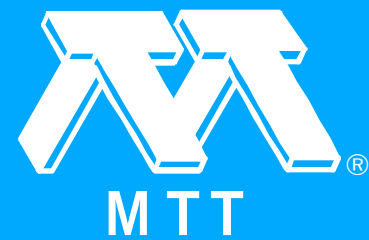


Abstracts

A Simplified Large-Signal Simulation of a Lumped Element TEO Based on a Phase Plane Technique (Short Papers)

A. McCowen and M.J. Howes. "A Simplified Large-Signal Simulation of a Lumped Element TEO Based on a Phase Plane Technique (Short Papers)." 1987 Transactions on Microwave Theory and Techniques 35.1 (Jan. 1987 [T-MTT]): 63-66.

The transferred electron device (TED) lumped circuit interaction is modeled by a phase plane technique. The results from this large-signal simulation are compared to those from a time-domain simulation based on the electron transport equations and are shown to be in good agreement. Results from the simulations are used as the design specifications for a J-band MIC TEO with excellent results indicating the potential of this CAD technique.



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Abstracts

Transient Analysis of Coupling Between Crossing Lines in Three-Dimensional Space (Short Papers)

S. Koike, N. Yoshida and I. Fukai. "Transient Analysis of Coupling Between Crossing Lines in Three-Dimensional Space (Short Papers)." 1987 Transactions on Microwave Theory and Techniques 35.1 (Jan. 1987 [T-MTT]): 67-71.

Coupling of crossing lines has not been studied extensively since it is very complicated and difficult to estimate. But recently with the development of high density wiring and large-scale integration rigorous analysis of coupling effects has become more important. In this analysis not only the electric and magnetic fields but also the Poynting vector are important. Especially, the variation of the spatial pattern of the Poynting vector in the time domain clarifies the dynamic coupling characteristics. In this paper the fundamental phenomena of coupling are demonstrated by considering the time variation of the distribution of the Poynting vector and the magnetic and electric fields for a Gaussian pulse in three-dimensional space.



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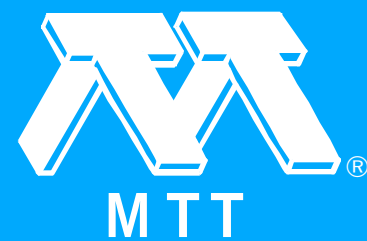


Abstracts

A Method for Measurement of Losses in the Noise-Matching Microwave Network While Measuring Transistor Noise Parameters (Short Papers)

G. Martines and M. Sannino. "A Method for Measurement of Losses in the Noise-Matching Microwave Network While Measuring Transistor Noise Parameters (Short Papers)." 1987 Transactions on Microwave Theory and Techniques 35.1 (Jan. 1987 [T-MTT]): 71-75.

A new method for measuring the loss of a tuner network used as the noise-source admittance transformer in a noise parameter test set is presented. Since the method is based on noise figure measurements, the tuner losses are determined on-line while performing measurements for determining transistor noise parameters. Experiments carried out on a coaxial slide-screw tuner by means of a computer-assisted measurement setup are reported.



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Abstracts

Small-Signal Second-Harmonic Generation by a Nonlinear Transmission Line (Comments)

D. Jager, A. Gasch and D. Kaiser. "Small-Signal Second-Harmonic Generation by a Nonlinear Transmission Line (Comments)." 1987 Transactions on Microwave Theory and Techniques 35.1 (Jan. 1987 [T-MTT]): 76-76.

In the above paper, the important problem of second-harmonic frequency generation along nonlinear transmission lines is studied. However, some remarks concerning the fundamental role of dissipation and dispersion should be given which are already known from the literature.



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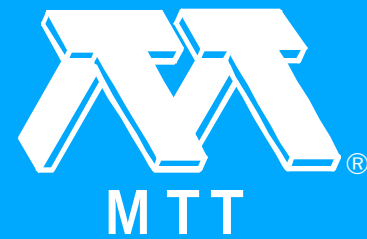


Abstracts

Design Curves for -3-dB Branchline Couplers (Corrections)

J.A.G. Malherbe and A.F. Celliers. "Design Curves for -3-dB Branchline Couplers (Corrections)." 1987 Transactions on Microwave Theory and Techniques 35.1 (Jan. 1987 [T-MTT]): 77-77.

In the above paper, the following corrections should be made.



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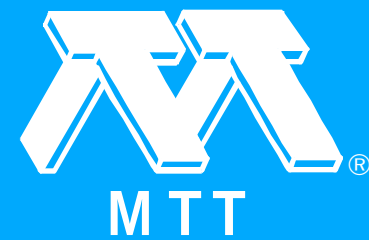
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Abstracts

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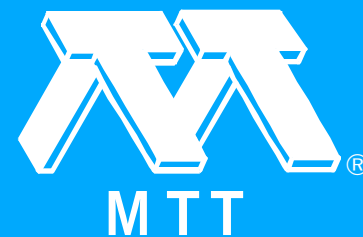
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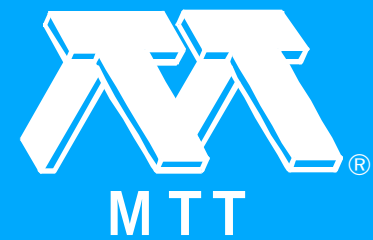
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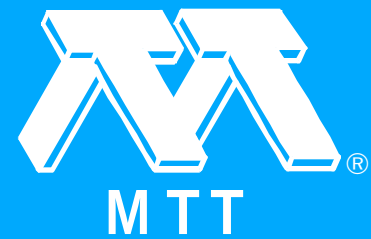
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The Calculus Tutoring Book (Advertisement) (Jan.1987 [T-MTT])

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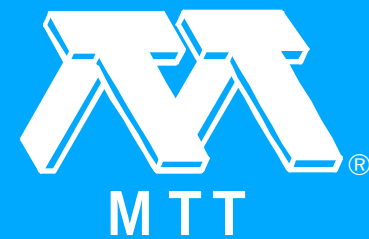
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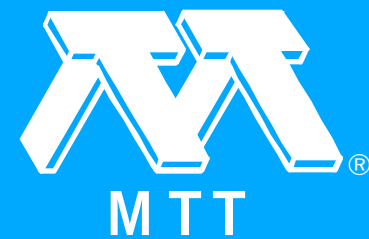
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Abstracts

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Radiation Characteristics of a Dielectric Slab Waveguide Periodically Loaded with Thick Metal Strips

M. Matsumoto, M. Tsutsumi and N. Kumagai. "Radiation Characteristics of a Dielectric Slab Waveguide Periodically Loaded with Thick Metal Strips." 1987 Transactions on Microwave Theory and Techniques 35.2 (Feb. 1987 [T-MTT]): 89-95.

A theoretical analysis is presented for the radiation characteristics of a dielectric slab waveguide periodically loaded with thick metal strips. A boundary-integral-equation formulation is employed to describe the fields in the grating layer. Through numerical calculations, we show that the leakage constant of the fundamental TM mode is much larger than that of the fundamental TE mode. This property will find application in mode filters for millimeter- and submillimeter-wave integrated circuits.

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Abstracts

Nondestructive Gyrotron Cold-Cavity Q Measurements

P.P. Woskoboinikow and W.J. Mulligan. "Nondestructive Gyrotron Cold-Cavity Q Measurements." 1987 Transactions on Microwave Theory and Techniques 35.2 (Feb. 1987 [T-MTT]): 96-100.

A novel method for cold testing a gyrotron resonator to determine its total Q is presented. Probing radiation is coupled into the resonator through its radiation pattern. A sensitive heterodyne receiver is used in the far field to detect the reradiated cavity resonances. Good agreement between measurement and calculated total Q is found for several 140-GHz gyrotron resonators in the TE/sub 031/, TE/sub 032/, TE/sub 231/, and TE/sub 611/ modes.



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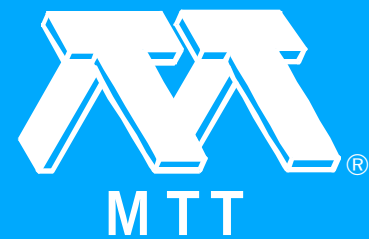
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Dispersion Characteristics of Open Microstrip Lines

M. Kobayashi and F. Ando. "Dispersion Characteristics of Open Microstrip Lines." 1987 Transactions on Microwave Theory and Techniques 35.2 (Feb. 1987 [T-MTT]): 101-105.

A method based on spectral-domain analysis is derived to compute effectively and automatically the effective relative permittivity of an open microstrip line. Simple but accurate closed-form expressions are used as the basis functions of the longitudinal and transverse current distributions. The numerical results are shown in tables and figures for various cases and compared with other available results. The results presented here are seen as having a high degree of accuracy and may be used as reference standards,

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A 432-MHz Local Hyperthermia System Using an Indirectly Cooled, Water-Loaded Waveguide Applicator

N.K. Uzunoglu, E.A. Angelikas and P.A. Cosmidis. "A 432-MHz Local Hyperthermia System Using an Indirectly Cooled, Water-Loaded Waveguide Applicator." 1987 Transactions on Microwave Theory and Techniques 35.2 (Feb. 1987 [T-MTT]): 106-111.

A water-loaded, indirectly cooled waveguide antenna with a small aperture size ($2 \times 5.5 \text{ cm}^2$) has been developed for local hyperthermia applications. The operation frequency is 432 MHz. The indirect cooling is achieved by circulating water in an external chamber having common walls with the waveguide, and good thermal and electrical stability is achieved for radiation powers up to 100 W. The water loading provides a good coupling of the radiated power into tissue. The observed variations in standing wave ratios and the concentration of the specific absorption rates (SAR's) are found to be satisfactory for localized superficial hyperthermia treatments. The matching of the water-loaded antenna into the power generator requires special attention because of two possible matching conditions corresponding to high- and low-power dissipations inside the antenna cavity. SAR distributions inside tissues have been computed and compared with thermographic measurements performed in phantoms. Preliminary results of trials in Wistar rats transplanted with Walker sarcoma are also reported.





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Wave Analysis of Noise in Interconnected Multiport Networks

N.G. Kanaglekar, R.E. McIntosh and W.E. Bryant. "Wave Analysis of Noise in Interconnected Multiport Networks." 1987 Transactions on Microwave Theory and Techniques 35.2 (Feb. 1987 [T-MTT]): 112-116.

The noise performance of multiport networks of arbitrary topology is treated using wave analysis. This approach has advantages over other methods when using computer-aided design programs that are based on scattering parameters. In this paper we discuss the wave representation of noise in two-ports and passive multiports. We indicate how to compute the noise performance of an arbitrary network and we demonstrate the effectiveness of this approach with an example.

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Finite-Element Analysis of Waveguide Modes: A Novel Approach that Eliminates Spurious Modes

T. Angkaew, M. Matsuhara and N. Kumagai. "Finite-Element Analysis of Waveguide Modes: A Novel Approach that Eliminates Spurious Modes." 1987 Transactions on Microwave Theory and Techniques 35.2 (Feb. 1987 [T-MTT]): 117-123.

An efficient finite-element method for analyzing the propagation characteristics of a wide variety of waveguides is presented. A variational expression suited for the finite-element method is formulated in terms of the transverse electric and magnetic field components. In this approach all guided-mode solutions are real, while the spurious-mode solutions are not real. Therefore, discrimination of the spurious-mode solutions can be achieved merely by imposing the simple condition that guided-mode solutions be real. Three numerical examples, two for the isotropic case and the other for the magnetic anisotropic case, are carried out.

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An Isotropic Electric-Field Probe with Tapered Resistive Dipoles for Broad-Band Use, 100 kHz to 18 GHz

M. Kanda and L.D. Driver. "An Isotropic Electric-Field Probe with Tapered Resistive Dipoles for Broad-Band Use, 100 kHz to 18 GHz." 1987 Transactions on Microwave Theory and Techniques 35.2 (Feb. 1987 [T-MTT]): 124-130.

A new broad-band electric-field probe, capable of accurately characterizing and quantifying electromagnetic (EM) fields, has been developed at the National Bureau of Standards (NBS). The probe's 8-mm resistively tapered dipole elements allow measurement of electric fields between 1 and 1600 V/m from 1 MHz to 15 GHz, with a flatness of ± 2 dB. A mutually orthogonal dipole configuration provides an overall standard deviation in isotropic response, with respect to angle, that is within ± 0.3 dB. Both the theoretical and developmental aspects of this prototype electric-field probe are discussed in this paper.

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Time-Domain Simulation of n Coupled Transmission Lines

F. Romeo and M. Santomauro. "Time-Domain Simulation of n Coupled Transmission Lines." 1987 Transactions on Microwave Theory and Techniques 35.2 (Feb. 1987 [T-MTT]): 131-137.

In this paper, a general SPICE model for n coupled transmission lines is presented. The model consists of two identical transformation networks and n single-transmission-line models. The transformation networks are realized with linear time-invariant voltage-controlled voltage sources (VCVS's) and current-controlled current sources (CCCS's) only. A simplified model designed to simulate connections on multilayer printed circuit boards is also presented. In this case, the coupling model is adequately described by a capacitance matrix C and an inductance matrix L that are Toeplitz, symmetric, and tridiagonal. The particular structure of C and L makes the computation of the parameters of the transformation network extremely easy and efficient because only simple function evaluations (cosines) are required. Furthermore, the transformation network depends only on the number of coupled lines and not on the parameters of those lines. Therefore, a library of such models needs to be determined only once, and only the characteristic impedances and time delays for the single lines have to be recomputed. The simulation results have been compared against experimental results, and the difference between the two is less than 1 percent.

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Abstracts

Spectral-Domain Analysis of Scattering from E-Plane Circuit Elements

Q. Zhang and T. Itoh. "Spectral-Domain Analysis of Scattering from E-Plane Circuit Elements." 1987 Transactions on Microwave Theory and Techniques 35.2 (Feb. 1987 [T-MTT]): 138-150.

The spectral-domain method is used for analysis of the scattering characteristics of E-plane circuit components such as nontouching E-plane fins. The method deals with inhomogeneous algebraic equations instead of integral equations. It provides a number of attractive features. Numerical results have been compared with those reported in the literature for special cases. Several data items useful for E-plane configurations are included.



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Abstracts

Variational Solutions on Two Opposite Narrow Resonant Strips in Waveguide

K. Chang. "Variational Solutions on Two Opposite Narrow Resonant Strips in Waveguide." 1987 Transactions on Microwave Theory and Techniques 35.2 (Feb. 1987 [T-MTT]): 151-158.

A variational analysis with experimental verification is made to calculate the discontinuities due to the two opposite narrow resonant strips in waveguide. The current ratio between the strips is determined and the mutual interactions are calculated. The analysis gives a closed-form solution which is quite general and which can be used to illustrate several special cases.



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Analysis and Optimization of Millimeter- and Submillimeter-Wavelength Mixer Diodes

T.W. Crowe and R.J. Mattauch. "Analysis and Optimization of Millimeter- and Submillimeter-Wavelength Mixer Diodes." 1987 Transactions on Microwave Theory and Techniques 35.2 (Feb. 1987 [T-MTT]): 159-168.

An analysis of the noise of millimeter- and submillimeter-wavelength mixers with GaAs Schottky diodes is presented. This analysis accounts for the correlation of the downconverted components of the time-varying hot-electron noise in the series resistance, and is thus accurate even for cryogenically cooled mixers operated at submillimeter wavelengths. This paper shows that the terms of the series-resistance noise correlation matrix are functions of the Fourier coefficients of the squared diode current $F(I^2)$ rather than the square of the Fourier coefficients of the diode current $[F(I)]^2$, as has been previously presented in the literature. The analysis is used to evaluate the optimization of cryogenic mixer diodes. It is shown that minimization of the diode's I-V slope parameter $V_{\text{sub } 0}$ is more critical than reduction of the parasitic elements for millimeter-wavelength operation, while at frequencies above 600 GHz ($\lambda < 0.5$ mm), the junction capacitance is the most crucial parameter. Experimental results from several research groups working with a variety of mixers are presented to substantiate these results.

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Analysis of Stripline Filled with a Multilayered Dielectric Medium

K.V.S. Rao, N. Adishesu and B.N. Das. "Analysis of Stripline Filled with a Multilayered Dielectric Medium." 1987 Transactions on Microwave Theory and Techniques 35.2 (Feb. 1987 [T-MTT]): 169-174.

An analysis has been carried out using conformal transformation for the case of a symmetric stripline filled with multilayered discrete dielectric media with their interfaces parallel to the ground planes. This has been applied to a stripline structure filled with a medium having a relative dielectric constant which is continuously varying in a direction perpendicular to the ground planes. Eight different distributions, such as Gaussian, parabolic, and semicircular, are considered for this variation of relative dielectric constant. Impedance data on stripline are presented for all these cases. The results of limiting cases obtained from this general formulation are compared with those existing in the literature.

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Power Optimization of GaAs Implanted FET's Based on Large-Signal Modeling

M. Weiss and D. Pavlidis. "Power Optimization of GaAs Implanted FET's Based on Large-Signal Modeling." 1987 Transactions on Microwave Theory and Techniques 35.2 (Feb. 1987 [T-MTT]): 175-188.

Large-signal models for ion-implanted, MMIC-compatible GaAs FET's are reported using different techniques. There are (i) S-parameter measurements, (ii) low-frequency capacitances combined with dc Z-V characteristics, and (iii) physical data. The results obtained with each model are compared to high-frequency power measurements, and the relative merits of each technique are discussed. The models permit investigation of the influence of frequency, implantation energy, doping density, drain bias, recess depth and gate length on the small- and large-signal FET parameter and saturation mechanisms. FET's fabricated with these data give optimum gain and power characteristics at the desired frequency of operation.

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Abstracts

The Application of a Frequency Multiplier Design Method to the Design of Microwave Parametric Dividers

Z. Nativ. "The Application of a Frequency Multiplier Design Method to the Design of Microwave Parametric Dividers." 1987 Transactions on Microwave Theory and Techniques 35.2 (Feb. 1987 [T-MTT]): 189-194.

A practical and efficient design method for microwave frequency dividers is described. The approach is based on the analogy between frequency multipliers and dividers at the same conditions of power levels and operating frequency. Hence, the well-known practical design procedure for frequency doublers, using published dynamic varactor parameters, may be used for designing frequency dividers.



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Practical Aspects of the Injection-Locked Hybrid Discriminator

T. Chattopadhyay. "Practical Aspects of the Injection-Locked Hybrid Discriminator." 1987 Transactions on Microwave Theory and Techniques 35.2 (Feb. 1987 [T-MTT]): 195-200.

This paper analyzes the performance of an X-band (I-band) injection-locked hybrid discriminator taking into consideration such practical circuit effects as the presence of signal delay in different parts of the circuit, amplitude perturbation of the locked oscillator, and the reflection arising from a detector mismatch. proposals are also made for the optimum design and the bandwidth extension of this tracking discriminator.

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Rectangular Waveguide with T-Shaped Septa

G.G. Mazumder and P.K. Saha. "Rectangular Waveguide with T-Shaped Septa." 1987 Transactions on Microwave Theory and Techniques 35.2 (Feb. 1987 [T-MTT]): 201-204.

Recently, a new rectangular waveguide with two T-shaped septa has been proposed by the authors as a superior alternative to conventional ridged guide. Here, numerical data on the cutoff and band-width characteristics of the dominant TE/sub 10/ mode of rectangular waveguide with a single T-septum are presented and compared with those of single-ridged guides. The gap impedances of both the double and single T-septum guides are also determined as functions of gap parameters.

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Finite-Element Analysis of Overmoded Waveguide Using Silvester's Algorithm (Short Papers)

R.W. Cravey, R. Sternlicht and C.E. Ryan, Jr.. "Finite-Element Analysis of Overmoded Waveguide Using Silvester's Algorithm (Short Papers)." 1987 Transactions on Microwave Theory and Techniques 35.2 (Feb. 1987 [T-MTT]): 205-206.

A general, high-order finite-element waveguide analysis program originated by Silvester has been used to analyze overmoded waveguides. The algorithm approximates arbitrarily shaped waveguides by triangular subsections and solves the Helmholtz equation subject to homogeneous Dirichlet or Neumann boundary conditions to obtain the eigenvalues (cutoff wavelengths) and the eigenvectors (scalar potentials). During these investigations of arbitrarily shaped overmoded waveguides, a computer program error was identified. This error resulted in incorrect higher-order mode potential functions. As this algorithm has been rather widely disseminated, it is the purpose of this communication to inform users of a correction which yields the correct higher-order-mode potential functions.

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Dyadic Green's Functions for Integrated Electronic and Optical Circuits (Short Papers)

J.S. Bagby and D.P. Nyquist. "Dyadic Green's Functions for Integrated Electronic and Optical Circuits (Short Papers)." 1987 Transactions on Microwave Theory and Techniques 35.2 (Feb. 1987 [T-MTT]): 207-210.

Layered structures play an important role in both integrated microwave circuits and optical integrated circuits. Accurate prediction of device behavior requires evaluation of fields in the system. An increasingly used mathematical formulation relies on integral equations the electric field in the device is expressed in terms of the device current integrated into an electric Green's function. Details of the development of the specialized Green's functions used by various researchers have not appeared in the literature. We present the development of general dyadic electric Green's functions for layered structures; this dyadic formulation allows extension of previous analyses to cases where currents are arbitrarily directed. The electric-field Green's dyads are found in terms of associated Hertzian potential Green's dyads, developed via Sommerfeld's classic method. Incidentally, boundary conditions for electric Hertzian potential are utilized; these boundary conditions, which have been a source of confusion in the research community, are developed in full generality. The dyadic forms derived herein are reducible in special cases to the Green's functions used by other workers.

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Abstracts

Excitation of an Enclosed Lossy Cylinder by an Aperture Source (Short Papers)

J.R. Wait. "Excitation of an Enclosed Lossy Cylinder by an Aperture Source (Short Papers)." 1987 Transactions on Microwave Theory and Techniques 35.2 (Feb. 1987 [T-MTT]): 210-212.

We present a formulation for an aperture-excited cylindrical structure of circular cross section and of finite length. The solution method is straightforward but it is sufficiently general to permit quantitative estimates of the internal heating. When the axial dependency of the fields is ignored, the solution reduces to one employed earlier in connection with hyperthermic heating of human torsos and limbs.



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Noise Reduction in GaAs Schottky Barrier Mixer Diodes (Short Papers)

K.M. Kattmann, T.W. Crowe and R.J. Mattauch. "Noise Reduction in GaAs Schottky Barrier Mixer Diodes (Short Papers)." 1987 Transactions on Microwave Theory and Techniques 35.2 (Feb. 1987 [T-MTT]): 212-214.

The sensitivity of heterodyne receivers operating at millimeter and submillimeter wavelengths is limited by the noise produced in the mixer element. In this paper we investigate the presence of excess noise in GaAs Schottky barrier mixer diodes. Comparison of the measured noise data with that predicted from noise models indicates that these devices typically exhibit excess noise. An additional fabrication step, which removes several hundred angstroms from the GaAs surface before the anode contact is formed, greatly reduces this excess noise. This additional step is outlined, and experimental evidence is presented.

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Abstracts

Phase Shifts in Single- and Dual-Gate GaAs MESFET's for 2-4-GHz Quadrature Phase Shifters (Comments)

H.-O. Vikes. "Phase Shifts in Single- and Dual-Gate GaAs MESFET's for 2-4-GHz Quadrature Phase Shifters (Comments)." 1987 Transactions on Microwave Theory and Techniques 35.2 (Feb. 1987 [T-MTT]): 215-215.

In the above paper, the authors have discussed the variation of transmission phase for single- and dual-gate GaAs MESFET's when the bias is changed.



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The Microstrip Step Discontinuity: A Revised Description (Correction)

N.H.L. Koster and R.H. Jansen. "The Microstrip Step Discontinuity: A Revised Description (Correction)." 1987 Transactions on Microwave Theory and Techniques 35.2 (Feb. 1987 [T-MTT]): 216-216.

In the above paper, three additional references were included during the revision procedure. However, the changes were not reflected in the numbers of the references given in the figures. In Figs. 3-8, reference numbers [34] and/or [35] should have been, respectively, [37] and/or [38]. In addition, the date of receipt of the manuscript should have been November 28, 1984.



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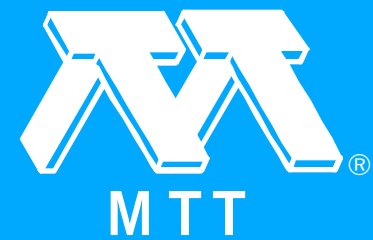
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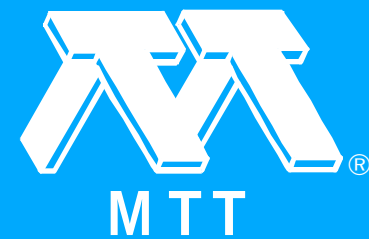
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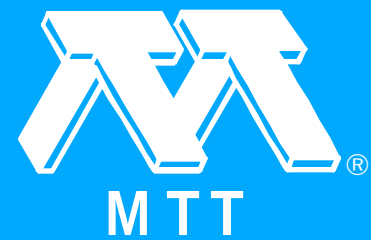
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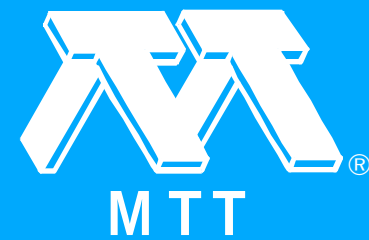
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Individual Learning Packages (Advertisement) (Feb. 1987 [T-MTT])

"Individual Learning Packages (Advertisement) (Feb. 1987 [T-MTT])." 1987 Transactions on Microwave Theory and Techniques 35.2 (Feb. 1987 [T-MTT]): 244-244.



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Abstracts

High-Speed Digital IC Performance Outlook

P.T. Greiling. "High-Speed Digital IC Performance Outlook." 1987 Transactions on Microwave Theory and Techniques 35.3 (Mar. 1987 [T-MTT]): 245-259.

This paper, which is a tutorial on high-speed GaAs digital IC's, was given as one of the 1984-1985 MTT-S Distinguished Microwave Lectures. It reviews GaAs FET technology and issues related to device/ circuit design and fabrication of digital circuits of MSI/LSI complexity operating at gigahertz clock frequencies; discusses limitations of the technology; compares GaAs technology with competing Si bipolar transistors, GaAlAs HEMT, and GaAlAs HBT technologies and projects performance of GaAs digital IC technology in applications where it will have a significant impact on microwave systems.



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Abstracts

Coplanar Waveguides for MMIC Applications: Effect of Upper Shielding, Conductor Backing, Finite-Extent Ground Planes, and Line-to-Line Coupling

G. Ghione and C.U. Naldi. "Coplanar Waveguides for MMIC Applications: Effect of Upper Shielding, Conductor Backing, Finite-Extent Ground Planes, and Line-to-Line Coupling." 1987 Transactions on Microwave Theory and Techniques 35.3 (Mar. 1987 [T-MTT]): 260-267.

Parasitic effects occurring in actual realizations of coplanar waveguides (CPW) for microwave integrated circuits on GaAs substrates, such as the influence of an upper shield, conductor backing, finite-extent ground planes, and line-to-line coupling, are discussed and evaluated. CAD-oriented analytical expressions are obtained for the electrical quasi-TEM parameters of the relevant waveguiding structures by means of exact or approximate conformal mapping techniques. Differences in electrical behavior with respect to ideal CPW's are highlighted, and practical design criteria are obtained for keeping cover height, ground-plane width, and line-to-line spacing effects to a minimum.



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Complex and Backward-Wave Modes in Inhomogeneously and Anisotropically Filled Waveguides

A.S. Omar and K.F. Schunemann. "Complex and Backward-Wave Modes in Inhomogeneously and Anisotropically Filled Waveguides." 1987 Transactions on Microwave Theory and Techniques 35.3 (Mar. 1987 [T-MTT]): 268-275.

A rigorous analysis of lossless inhomogeneously and anisotropically filled waveguides of arbitrarily shaped cross section is presented. The mode propagation constants squared appear as eigenvalues of a real infinite-dimensional characteristic matrix, which is, in the general case, nonsymmetric. Complex conjugate pairs of eigenvalues are then possible, which give rise to complex modes. Modes at cutoff are shown to be either TE or TM with real cutoff frequencies. An investigation of the power flow shows that backward-wave modes may exist as well. Different orthogonality relations are derived from which the power coupling between complex modes is investigated.



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An Efficient Technique for Computing the Potential Green's Functions for a Thin, Periodically Excited Parallel-Plate Waveguide Bounded by Electric and Magnetic Walls

W.F. Richards, K. McInturff and P.S. Simon. "An Efficient Technique for Computing the Potential Green's Functions for a Thin, Periodically Excited Parallel-Plate Waveguide Bounded by Electric and Magnetic Walls." 1987 Transactions on Microwave Theory and Techniques 35.3 (Mar. 1987 [T-MTT]): 276-281.

An efficient formulation is described for calculating all vector and scalar potential Green's functions for a thin, infinitely long waveguide with periodic excitation. The Green's functions are represented by the first few terms of the modal expansion plus a quasi-static correction. This allows one to compute the Green's functions over a wide band of frequencies with little additional effort over that required for a single frequency. An attractive feature of the method is that the $1/R$ free-space singularity exhibited by the potentials is explicitly extracted in the lowest order quasi-static term. This is convenient for evaluating method-of-moments self-term contributions in closed form. The Green's functions have application for problems involving stripline structures such as Rotman lenses.





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A Penetrable Dielectric Waveguide with Periodically Varying Circular Cross Section

S.L.G. Lundqvist. "A Penetrable Dielectric Waveguide with Periodically Varying Circular Cross Section." 1987 Transactions on Microwave Theory and Techniques 35.3 (Mar. 1987 [T-MTT]): 282-287.

For a penetrable dielectric waveguide with a periodically varying circular cross section, the modes that are exponentially decreasing in the cladding are considered. Their axial wavenumbers are determined by the null field approach and some plots are given showing their frequency dependence. From the numerical results, it is observed that two modes propagating in opposite directions interact destructively when the real parts of their axial wavenumbers differ by a multiple of the wavenumber of the corrugations. Both an upper and a lower cutoff frequency exists above (below) which only leaky modes exist.

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Abstracts

On the Numerical Solution of Fields in Cavities Using the Magnetic Hertz Vector

M. Couture. "On the Numerical Solution of Fields in Cavities Using the Magnetic Hertz Vector." 1987 Transactions on Microwave Theory and Techniques 35.3 (Mar. 1987 [T-MTT]): 288-295.

The possibility of using a representation of the electromagnetic fields in terms of a two-component magnetic Hertz vector to calculate fields and frequencies in cavities is examined. The governing equation is the vector Helmholtz equation, and the model is tested by calculating fields in axially symmetric cavities.



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The Matrix Amplifier: A High-Gain Module for Multioctave Frequency Bands

K.B. Niclas and R.R. Pereira. "The Matrix Amplifier: A High-Gain Module for Multioctave Frequency Bands." 1987 Transactions on Microwave Theory and Techniques 35.3 (Mar. 1987 [T-MTT]): 296-306.

The characteristics of a new type of amplifier that makes simultaneous use of the additive and the multiplicative amplification process in one and the same module is discussed. The device, which achieves high-gain performance over multioctave bands, is a relative of the distributed amplifier. Initial experimental results demonstrated a small-signal gain of $G = 13.8 \pm 0.8$ dB with -11.4 dB of maximum return loss between 2.0 and 21.5 GHz when using MESFET's manufactured on ion-implanted substrate material and $G = 16.8 \pm 0.9$ dB gain over the 2.3-20.3-GHz frequency band in the case of vapor-phase-epitaxial material. The principle, the theory, and the experimental results are discussed in detail.

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Two-Tone Intermodulation in Diode Mixers

S.A. Maas. "Two-Tone Intermodulation in Diode Mixers." 1987 Transactions on Microwave Theory and Techniques 35.3 (Mar. 1987 [T-MTT]): 307-314.

This paper explores, experimentally and theoretically, the problem of minimizing second- and third-order intermodulation distortion in diode mixers. A numerical technique is presented which can be used to calculate intermodulation levels with unprecedented accuracy, and it is used to identify circuit and diode parameters which maximize dynamic range. It is shown that intermodulation distortion is minimized by using low diode junction capacitance and series resistance, short-circuit embedding impedances, and high local-oscillator level. It is also shown that certain conditions which may optimize conversion loss, such as image enhancement, may severely exacerbate intermodulation.

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A Low-Loss Ku-Band Monolithic Analog Phase Shifter

C.-L. Chen, W.E. Courtney, L.J. Mahoney, M.J. Manfra, A. Chu and H.A. Atwater. "A Low-Loss Ku-Band Monolithic Analog Phase Shifter." 1987 Transactions on Microwave Theory and Techniques 35.3 (Mar. 1987 [T-MTT]): 315-320.

A GaAs monolithic Ku-band analog phase shifter integrating 90° branch line coupler with planar varactor diodes has been fabricated for the first time. A phase shift of $109^\circ \pm 3^\circ$ with an insertion loss of 1.8 ± 0.3 dB was measured from 16 to 18 GHz. A 360° phase shifter with 4.2 ± 0.9 dB insertion loss was realized in the same frequency range by connecting three phase-shifter chips in series. To our knowledge, this is the lowest insertion loss obtained by a 360° Ku-band phase shifter using monolithic circuits. In addition, hyperabrupt varactors using nonuniform doping profiles increased the phase shift by more than 30° and produced a more linear dependence of phase shift on control voltage.

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General Solution for Excitation by Slotted Aperture Source in Conducting Cylinder with Concentric Layering

J.R. Wait. "General Solution for Excitation by Slotted Aperture Source in Conducting Cylinder with Concentric Layering." 1987 Transactions on Microwave Theory and Techniques 35.3 (Mar. 1987 [T-MTT]): 321-325.

We present a general matrix analysis for the electromagnetic fields produced by an aperture source on the inner metallic surface of a concentrically layered structure. Each layer is homogeneous and characterized by arbitrary permittivity, conductivity and magnetic permeability. The structure itself is assumed to be of infinite length so Maxwell's equations yield separable solutions. An explicit result is given for the electric current density on the inner metallic cylindrical surface which could model the mandrel in a borehole logging tool.

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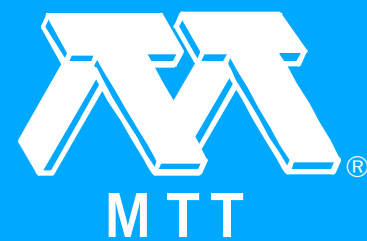


Abstracts

A Generalized Spectral-Domain Green's Function for Multilayer Dielectric Substrates with Application to Multilayer Transmission Lines

N.K. Das and D.M. Pozar. "A Generalized Spectral-Domain Green's Function for Multilayer Dielectric Substrates with Application to Multilayer Transmission Lines." 1987 Transactions on Microwave Theory and Techniques 35.3 (Mar. 1987 [T-MTT]): 326-335.

A generalized full-wave Green's function completely defining the field inside a multilayer dielectric structure due to a current element arbitrarily placed between any two layers is derived in two-dimensional spectral-domain form. It is derived by solving a "standard" form containing the current element with two substrates on either side of it, and using an iterative algorithm to take care of additional layers. Another iterative algorithm is then used to find the field in any layer in terms of the field expressions in the two layers of the "standard" form. The locations of the poles of the Green's function are predicted, and an asymptotic form is derived along with the asymptotic limit, by use of which the multilayer Green's function can be used in numerical methods as efficiently as the single-layer grounded-dielectric-substrate Green's function. This Green's function is then applied to a few multilayer transmission lines for which data are not found in the literature to date.



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A Spectral-Domain Analysis of Periodically Nonuniform Microstrip Lines

F.J. Glandorf and I. Wolff. "A Spectral-Domain Analysis of Periodically Nonuniform Microstrip Lines." 1987 Transactions on Microwave Theory and Techniques 35.3 (Mar. 1987 [T-MTT]): 336-343.

Periodically nonuniform microstrip lines are analyzed on the basis of a numerical field calculation. Floquet's theorem is used to express all field quantities in terms of their spatial harmonics, so that the problem can be treated similarly to the uniform microstrip line. The boundary-value problem for the microstrip line in an enclosure is formulated in a rigorous way and then solved using Galerkin's method in the Fourier-transform domain. Numerical and experimental results are presented for a sinusoidal and a zigzag-shaped microstrip line.



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A Low-Frequency Investigation into the Discontinuity Capacitance of a Coaxial Line Terminated in a Lossless, Dielectric-Loaded Circular Waveguide (Short Papers)

J.D. Mahony. "A Low-Frequency Investigation into the Discontinuity Capacitance of a Coaxial Line Terminated in a Lossless, Dielectric-Loaded Circular Waveguide (Short Papers)." 1987 Transactions on Microwave Theory and Techniques 35.3 (Mar. 1987 [T-MTT]): 344-346.

The problem of theoretically determining the normalized discontinuity capacitance of a dielectric-loaded coaxial termination has been reexamined and it is shown that, when frequency effects can be ignored, the solution to the problem may be expressed in the form of a rapidly convergent power series with power terms which depend only on the relative permittivity of the dielectrics and with coefficients which depend only on the line size. Values for the coefficients in the case of typical line sizes are presented and the accuracy of the power series solution is discussed.

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A Printed Circuit Stub Tuner for Microwave Integrated Circuits (Short Papers)

B.J. Minnis. "A Printed Circuit Stub Tuner for Microwave Integrated Circuits (Short Papers)." 1987 Transactions on Microwave Theory and Techniques 35.3 (Mar. 1987 [T-MTT]): 346-349.

A novel microwave tuning element capable of continuous adjustment has been realized in the form of a planar printed circuit. As such, it is suitable for incorporation into microwave integrated circuits (MIC's), where it can be used for fine-tuning the impedance match between two parts of a circuit when the two parts are either subject to variations due to manufacturing tolerances or are difficult to model. In either case, the tuner is a compact on-circuit tuning facility which does not have to be removed after use. The tuner has been shown to have unique impedance-transforming properties, being capable of matching any realizable impedance to a 50-Ohm load. Its main part consists of a coupled-line section and across the gap in the section at different places along its length are positioned two short-circuit bridge conductors. Movement of these bridges produces the variation in impedance transformation.

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Phase Noise Reduction in FET Oscillators by Low-Frequency Loading and Feedback Circuitry Optimization (Short Papers)

M. Prigent and J. Obregon. "Phase Noise Reduction in FET Oscillators by Low-Frequency Loading and Feedback Circuitry Optimization (Short Papers)." 1987 Transactions on Microwave Theory and Techniques 35.3 (Mar. 1987 [T-MTT]): 349-352.

Optimization of low-frequency loading allows reduction of $1/f$ converted noise in FET oscillators. Moreover, an appropriate low-frequency feedback between drain and gate gives an improvement over previous results. This improvement is explained by taking into account the properties of the noise autocorrelation function.

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A Fast and Reliable Method for Computer Analysis of Microwave Mixers (Comments)

M.E. Adamski. "A Fast and Reliable Method for Computer Analysis of Microwave Mixers (Comments)." 1987 Transactions on Microwave Theory and Techniques 35.3 (Mar. 1987 [T-MTT]): 353-353.

In Section IV of the above paper, Schuppert expressed conversion properties of the pumped diode junction in formulas (41)--(44). In general, that description does not satisfy well-known theory. The subscript notation for the coefficients of the conversion admittance matrix used by Schuppert in formulas (42) and (44) is inauspicious, and it is probably a source of the mistaken form of the conversion matrix in formula (41).

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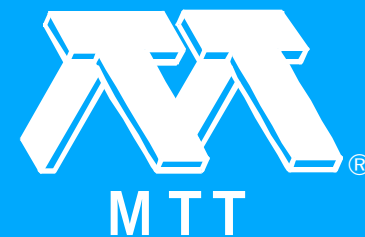
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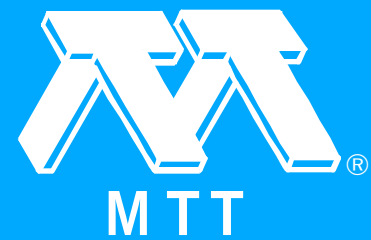
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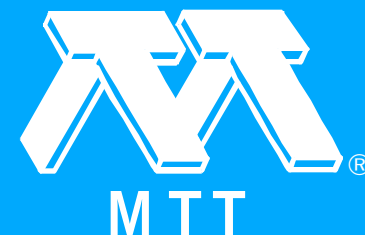
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Abstracts

Gain-Bandwidth Properties of a Class of Matched Feedback Amplifiers

D.J. Ahlgren and W.H. Ku. "Gain-Bandwidth Properties of a Class of Matched Feedback Amplifiers." 1987 Transactions on Microwave Theory and Techniques 35.4 (Apr. 1987 [T-MTT]): 361-369.

This paper considers the analysis and synthesis of small-signal feedback amplifiers which use shunt feedback around a generic gain block. The analysis presented leads to estimates of all network element values and predicts the closed-loop broad-band gain, bandwidth and quality of match at both ports. The tradeoff of gain for quality of match is made evident by a graphical technique. The paper also describes, a synthesis method and two illustrative design examples.



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Abstracts

A Symmetrical Condensed Node for the TLM Method

P.B. Johns. "A Symmetrical Condensed Node for the TLM Method." 1987 Transactions on Microwave Theory and Techniques 35.4 (Apr. 1987 [T-MTT]): 370-377.

A new symmetrical condensed node is developed for the analysis of electromagnetic waves by the transmission-line modeling (TLM) method of numerical analysis. The new node has the advantage of condensing the field components to one point in space at the node and removes the disadvantage of asymmetry in existing condensed nodes.



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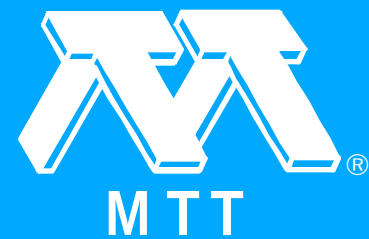


Abstracts

Numerical Results for the Symmetrical Condensed TLM Node

R. Allen, A. Mallik and P. Johns. "Numerical Results for the Symmetrical Condensed TLM Node." 1987 Transactions on Microwave Theory and Techniques 35.4 (Apr. 1987 [T-MTT]): 378-382.

Numerical calculations have been made in order to test the accuracy of the recently derived three-dimensional symmetrical condensed TLM node for electromagnetic. Demonstrations of its use in these areas are given. Analysis of dispersion characteristics shows that the velocity error bound for the new symmetrical condensed node is likely to be less than that for the expanded node. Predictions of the surface currents on an F-111 aircraft due to the scattering of an incident plane wave are in good agreement with other computed codes and measurements. Lastly, the introduction of stubs into the scattering node allows generalization to a cylindrical mesh, which is tested by finding coaxial cavity modes.



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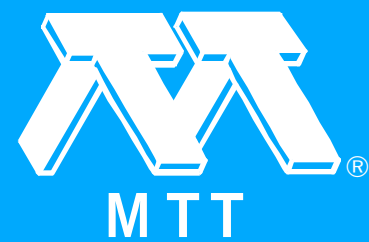
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Comparison of the FFT Conjugate Gradient Method and the Finite-Difference Time-Domain Method for the 2-D Absorption Problem

D.T. Borup, D.M. Sullivan and O.P. Gandhi. "Comparison of the FFT Conjugate Gradient Method and the Finite-Difference Time-Domain Method for the 2-D Absorption Problem." 1987 Transactions on Microwave Theory and Techniques 35.4 (Apr. 1987 [T-MTT]): 383-395.

The need for high-resolution distributive dosimetry demands a numerical method capable of handling finely discretized, arbitrarily inhomogeneous models of biological bodies. At present, two of the most promising methods in terms of numerical efficiency are the fast-Fourier-transform conjugate gradient method (FFT-CGM) and the finite-difference time-domain (FD-TD) method. In this paper, these two methods are compared with respect to their ability to solve the 2-D lossy dielectric cylinder problem for both the TM and TE incident polarizations. Substantial errors are found in the FFT-CGM solutions for the TE case. The source of these errors is explained and a modified method is developed which, although inefficient, alleviates the problem and illuminates the difficulties encountered in applying the pulse-basis method of moments to biological problems. In contrast, the FD-TD method is found to yield excellent solutions for both polarizations. This, coupled with the numerical efficiency of the FD-TD method, suggests that it is superior to the FFT-CGM for biological problems.



Abstracts

An Efficient Approach for Large-Signal Modeling and Analysis of the GaAs MESFET

V.D. Hwang and T. Itoh. "An Efficient Approach for Large-Signal Modeling and Analysis of the GaAs MESFET." 1987 Transactions on Microwave Theory and Techniques 35.4 (Apr. 1987 [T-MTT]): 396-402.

A nonlinear circuit model of the GaAs MESFET is developed by extracting circuit parameters from dc and small-signal RF measurements in a systematic manner. The circuit model is then analyzed by an efficient algorithm called the modified multiple-reflection method. For the first time, this method is applied to MESFET circuit analysis. Compared with the original multiple-reflection method, the modified multiple-reflection method shows a dramatic increase in convergence speed. The validity of the nonlinear MESFET model is confirmed by comparing the simulation results with experimental data.



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Abstracts

An Experimental Verification of a Simple Distributed Model of MIM Capacitors for MMIC Applications

J.P. Mondal. "An Experimental Verification of a Simple Distributed Model of MIM Capacitors for MMIC Applications." 1987 Transactions on Microwave Theory and Techniques 35.4 (Apr. 1987 [T-MTT]): 403-408.

A distributed model has been derived for MIM capacitors using a simple coupled-transmission-line approach. The model has been compared with measured S-parameter data from MIM capacitors having different aspect ratios fabricated on 4-mil GaAs substrates. The agreement is very good. The derived model will converge to the first-order capacitor model, generally given in the literature, under a few assumptions.



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On Reducing the Period of Input Pulse Trains Using Coupled-Line Networks

I. Sakagami, N. Nagai and K. Hatori. "On Reducing the Period of Input Pulse Trains Using Coupled-Line Networks." 1987 Transactions on Microwave Theory and Techniques 35.4 (Apr. 1987 [T-MTT]): 409-414.

The theoretical and experimental results on converting input pulse trains into bipolar pulse trains of higher speed are presented. The network used here for such functions consists of two strip-coupled lines and three resistors. The experiment shows good agreement with theory.

Abstracts

Analysis of a Class of Cylindrical Multiconductor Transmission Lines Using an Iterative Approach

C.H. Chan and R. Mittra. "Analysis of a Class of Cylindrical Multiconductor Transmission Lines Using an Iterative Approach." 1987 Transactions on Microwave Theory and Techniques 35.4 (Apr. 1987 [T-MTT]): 415-424.

A class of cylindrical multiconductor transmission lines is theoretically analyzed, and useful parameters, e.g., characteristic impedance and effective dielectric constant, are derived. Discretization of the continuous functions and exploitation of the periodicity of the cylindrical structure lead to a discrete convolution which can be carried out numerically rigorously and efficiently using the FFT algorithm. An iterative technique is employed in the spectral domain to derive the solution of integral equations for the charge distribution. Numerical results are presented and compared with available data.



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A GaAs MESFET Mixer with Very Low Intermodulation

S.A. Maas. "A GaAs MESFET Mixer with Very Low Intermodulation." 1987 Transactions on Microwave Theory and Techniques 35.4 (Apr. 1987 [T-MTT]): 425-429.

This paper describes the design and performance of a new type of resistive mixer, which uses the channel resistance of a GaAs MESFET to achieve frequency mixing. Because this resistance is highly linear, very low intermodulation results. The mixer can be analyzed via existing mixer theory, with good agreement with measured performance. At 10 dBm LO power, the X-band mixer achieves 6.5 dB conversion loss, 6.6 dB noise figure, 21.5 dBm output third-order intermodulation intercept point, and 9.1 dBm 1-dB compression point.

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Abstracts

Admittance of Irises in Coaxial and Circular Waveguides for TE/sub 11/-Mode Excitation

G.L. James. "Admittance of Irises in Coaxial and Circular Waveguides for TE/sub 11/-Mode Excitation." 1987 Transactions on Microwave Theory and Techniques 35.4 (Apr. 1987 [T-MTT]): 430-434.

The admittance of irises in both coaxial and circular waveguides is deduced from a mode-matching technique. Design data for the effective admittance to TE/sub 11/ -mode excitation are given for a range of waveguide and iris dimensions.



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Performance of Arrays of SIS Junctions in Heterodyne Mixers

D.-G. Crete, W.R. McGrath, P.L. Richards and F.L. Lloyd. "Performance of Arrays of SIS Junctions in Heterodyne Mixers." 1987 Transactions on Microwave Theory and Techniques 35.4 (Apr. 1987 [T-MTT]): 435-440.

We have made a systematic experimental study of the performance of millimeter-wave quasiparticle heterodyne mixers which use arrays of SIS tunnel junctions. Sets of arrays with $N = 1, 5, 10, 25$, and 50 junctions in series were fabricated by photolithography. All of the arrays in a given set were made on a single silicon wafer so that their response time parameter $\omega_{S/R/N/C}$ would be the same. Junction areas were scaled so that the total impedance was the same for each array in a set. Sets of arrays from four wafers with values of $\omega_{S/R/N/C}$ ranging from 2.6 to 13 were evaluated in mixers at 33 and 36 GHz. These measurements showed that the signal power required to saturate the mixers varies as N^2 and that the conversion efficiency is nearly independent of N for all values of $\omega_{S/R/N/C}$. The mixer noise temperature is independent of N for large values of $\omega_{S/R/N/C}$. Therefore, the dynamic range of an SIS quasiparticle mixer can increase in proportion to N^2 . For small values of $\omega_{S/R/N/C}$, however, the mixer noise increases systematically with N . This correlation suggests that the junction capacitance affects the coupling between junctions that can contribute to the noise.

Click on title for a complete paper.



Abstracts

Nonlinear Analysis of GaAs MESFET Amplifiers, Mixers, and Distributed Amplifiers Using the Harmonic Balance Technique

W.R. Curtice. "Nonlinear Analysis of GaAs MESFET Amplifiers, Mixers, and Distributed Amplifiers Using the Harmonic Balance Technique." 1987 Transactions on Microwave Theory and Techniques 35.4 (Apr. 1987 [T-MTT]): 441-447.

The harmonic balance technique with Newton's method is used to analyze several forms of large-signal operation of GaAs MESFET's, including, for the first time, a multiple-device configuration. Computer programs for the study of the MESFET mixer, intermodulation distortion in MESFET amplifiers, and the large-signal analysis of the MESFET distributed amplifier are described and examples of analyses are given. Convergence properties are excellent, even for cases with a large number of error functions. The choice of time period for analysis, the number of sampling points required, and factors critical to convergence are discussed. Time sampling at much larger than the Nyquist rate does not significantly improve the accuracy and greatly increases the program's execution time.



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Abstracts

Dispersion in Unilateral Finlines on Anisotropic Substrates (Short Papers)

A.-A.T.K. Shalaby and A. Kumar. "Dispersion in Unilateral Finlines on Anisotropic Substrates (Short Papers)." 1987 Transactions on Microwave Theory and Techniques 35.4 (Apr. 1987 [T-MTT]): 448-450.

The dispersion characteristics of the dominant and higher order modes in unilateral finlines on uniaxially anisotropic substrates have been obtained. The solution has been obtained by applying the equivalent transmission-line concept in the spectral domain and by using Galerkin's method. Numerical results for the propagation constant as a function of the slot-width ratio and frequency are presented.



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Waveform Standards for Electrooptics: A Pulse Duration Comparison (Short Papers)

R.A. Lawton and K. Meyer. "Waveform Standards for Electrooptics: A Pulse Duration Comparison (Short Papers)." 1987 Transactions on Microwave Theory and Techniques 35.4 (Apr. 1987 [T-MTT]): 450-453.

A transfer standard has been developed for use in comparing the measurement capability of the Automatic Pulse Measurement System (APMS) at the National Bureau of Standards to that of the recently developed electrooptic samplers. This transfer standard is a comb generator driven by a 90-MHz sine wave. Using this standard, measurements were made of the pulse waveform of a comb generator output with both the APMS and an electrooptic sampler. A comparison was then made of the pulse duration (full width at half maximum) obtained in the two waveform measurements. The result was a duration of 102 ps as measured by the APMS and 112 ps as measured by the electrooptic sampler. The signal-to-noise ratio at the comb generator input was improved over that of previous measurements, and a correction for pulse broadening was made to achieve this result. The pulse broadening was caused by the impedance mismatch between the sampler and the transmission system (50 Omega).

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



Abstracts

New Quasi-Static Models for the Computer-Aided Design of Suspended and Inverted Microstrip Lines (Short Papers)

R.S. Tomar and P. Bhartia. "New Quasi-Static Models for the Computer-Aided Design of Suspended and Inverted Microstrip Lines (Short Papers)." 1987 Transactions on Microwave Theory and Techniques 35.4 (Apr. 1987 [T-MTT]): 453-457.

New quasi-static models for the computer-aided design (CAD) and analysis of open suspended and inverted microstrip lines are reported. The models are obtained through generalizing those reported earlier and are applicable up to $\epsilon_r = 20$, thereby covering all the practically used substrate materials for these structures. The models also cover a larger range of dimension ratios and are accurate to within 0.6 percent for analysis and within 1 percent for synthesis.



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A Study of Measurements of Connector Repeatability Using Highly Reflecting Loads (Short Papers)

J.R. Juroshek. "A Study of Measurements of Connector Repeatability Using Highly Reflecting Loads (Short Papers)." 1987 Transactions on Microwave Theory and Techniques 35.4 (Apr. 1987 [T-MTT]): 457-460.

This paper investigates the repeatability of measurements of the reflection coefficient Γ of highly reflecting devices with changes in the RF connector joint. The changes in the connector joint are due to disconnecting and reconnecting the connector pair. It is shown that many of the measurement discrepancies observed in practice can be explained with a simple connector model. The paper shows that the sensitivity of measuring RF connector changes can be increased by using highly reflecting loads. The changes in Γ due to changes in resistance or reactance can be four times greater for highly reflecting devices ($|\Gamma| \approx 1$) than for nonreflecting devices ($|\Gamma| \approx 0$). Experiments on two devices with 14-mm connectors are described in order to compare them with theory. The basic principles described in this paper should be beneficial to connector designers who need to observe small changes in connector parameters and to the work of calibration standards designers, where small connector imperfections are a major part of their measurement uncertainty.

Click on title for a complete paper.



Abstracts

A Simple Technique for Investigating Defects in Coaxial Connectors (Short Papers)

W.C. Daywitt. "A Simple Technique for Investigating Defects in Coaxial Connectors (Short Papers)." 1987 Transactions on Microwave Theory and Techniques 35.4 (Apr. 1987 [T-MTT]): 460-464.

This paper describes a technique that uses swept-frequency automatic network analyzer (ANA) data for investigating electrical defects in coaxial connectors. The technique will be useful to connector and ANA manufacturers and to engineers interested in determining connector characteristics for error analyses. A simplified theory is presented and the technique is illustrated by applying it to perturbations caused by the center conductor gap in a 7-mm connector pair.



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Abstracts

Analysis of Waveguiding Structures Employing Surface Magnetoplasmons by the Finite-Element Method (Short Papers)

N. Mohsenian, T.J. Delph and D.M. Bolle. "Analysis of Waveguiding Structures Employing Surface Magnetoplasmons by the Finite-Element Method (Short Papers)." 1987 Transactions on Microwave Theory and Techniques 35.4 (Apr. 1987 [T-MTT]): 464-468.

The dispersion relation and electromagnetic field distributions for a gyroelectrically loaded waveguiding structure are obtained utilizing finite-element techniques. The structure considered consists of two layers, one a dielectric and the other a semiconductor, bounded by two perfectly conducting planes. The finite-element solution for the lowest real branches in the dispersion spectrum was compared against a numerical solution of the exact dispersion equation, and excellent agreement was found between the two. The structure, exhibiting nonreciprocal behavior, provides a suitable canonical model for the design of circuit components such as circulators, isolators, and phase shifters.



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Calculation of Cutoff Wavenumbers for TE and TM Modes in Tubular Lines with Offset Center Conductor (Comments)

J.G. Fikioris and J.A. Roumeliotis. "Calculation of Cutoff Wavenumbers for TE and TM Modes in Tubular Lines with Offset Center Conductor (Comments)." 1987 Transactions on Microwave Theory and Techniques 35.4 (Apr. 1987 [T-MTT]): 469-469.

In the paper by Vishen et al. [1], the authors refer to two papers of ours, numbered [8] and [10] in their list of references, and apparently without any elaboration make certain unwarranted comments on the method and results of [8], namely: Some of the tabulated parameters of [8] actually yield nonphysical results; also, symmetric and antisymmetric modes appear to be degenerate, which contradicts experimental observations.



Abstracts

Calculation of Cutoff Wavenumbers for TE and TM Modes in Tubular Lines with Offset Center Conductor (Additional Comments and Reply)

M. Davidovitz, A. Vishen, G.S. Singh and F.E. Gardiol. "Calculation of Cutoff Wavenumbers for TE and TM Modes in Tubular Lines with Offset Center Conductor (Additional Comments and Reply)." 1987 Transactions on Microwave Theory and Techniques 35.4 (Apr. 1987 [T-MTT]): 469-470.

Although Vishen et al. refer to the early work of Veselov and Semenov, no comparison is made between their formulation and the one found in [6]. I fail to recognize any essential differences between the two approaches. Furthermore, the authors state that the technique "based on Graf's addition theorem for Bessel functions" was developed by Singh and Kohtari, whereas in fact it appears that the same technique was employed in [6] considerably earlier.



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Abstracts

Millimetric Nonreciprocal Coupled-Slot Finline Components (Comments and Reply)

E. Jensen, C. Schieblich, L.E. Davis and D.B. Sillars. "Millimetric Nonreciprocal Coupled-Slot Finline Components (Comments and Reply)." 1987 Transactions on Microwave Theory and Techniques 35.4 (Apr. 1987 [T-MTT]): 470-472.

A statement is made concerning the feasibility of nonreciprocal components with ferrites magnetized in the direction of propagation.



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Abstracts

General Analysis of a Parallel-Plate Waveguide Inhomogeneously Filled with Gyromagnetic Media (Corrections)

M. Mrozowski and J. Mazur. "General Analysis of a Parallel-Plate Waveguide Inhomogeneously Filled with Gyromagnetic Media (Corrections)." 1987 Transactions on Microwave Theory and Techniques 35.4 (Apr. 1987 [T-MTT]): 472-472.

We would like to correct the following mistakes in our paper.



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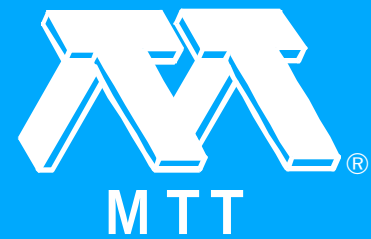


Abstracts

New Results in Dielectric-Loaded Resonators (Corrections)

K.A. Zaki. "New Results in Dielectric-Loaded Resonators (Corrections)." 1987 Transactions on Microwave Theory and Techniques 35.4 (Apr. 1987 [T-MTT]): 472-472.

In the above paper, an error was made in plots. The corrected plots are shown below.



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A New Model for the Apparent Characteristic Impedance of Finned Waveguide and Finlines (Corrections)

P. Pramanick and P. Bhartia. "A New Model for the Apparent Characteristic Impedance of Finned Waveguide and Finlines (Corrections)." 1987 Transactions on Microwave Theory and Techniques 35.4 (Apr. 1987 [T-MTT]): 473-473.

In the above paper, the coefficients of (25) should have read...



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Patent Abstracts (Apr. 1987 [T-MTT])

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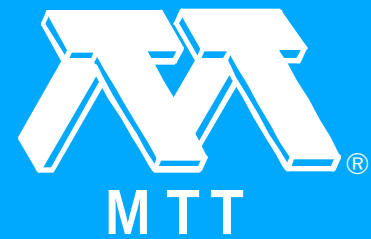
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IEEE Press Books (Advertisement) (Apr. 1987 [T-MTT])

"IEEE Press Books (Advertisement) (Apr. 1987 [T-MTT])." 1987 Transactions on Microwave Theory and Techniques 35.4 (Apr. 1987 [T-MTT]): 478-478.



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IEEE Individual Learning Packages (Advertisement) (Apr. 1987 [T-MTT])

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Abstracts

Numerical Analysis of Surface-Wave Scattering by Finite Periodic Notches in a Ground Plane

K. Uchida. "Numerical Analysis of Surface-Wave Scattering by Finite Periodic Notches in a Ground Plane." 1987 Transactions on Microwave Theory and Techniques 35.5 (May 1987 [T-MTT]): 481-486.

Surface-wave scattering by finite periodic notches loaded in a ground plane is investigated in terms of a full-wave theory. The analytical method presented is based on a spectral-domain analysis where the sampling theorem is applied in order to discretize the final equation to be solved. Numerical calculations are earned out for reflected, transmitted, and radiated waves. The numerical results show that maximnm reflection and radiation occur at frequencies somewhat different from those expected from the Bragg condition based on a first-order perturbation theory.



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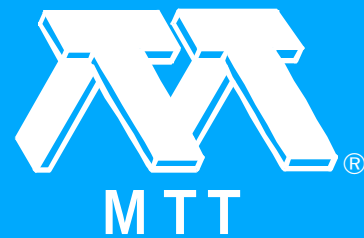


Abstracts

Distributed Equivalent-Circuit Model for Traveling-Wave FET Design

W. Heinrich. "Distributed Equivalent-Circuit Model for Traveling-Wave FET Design." 1987 Transactions on Microwave Theory and Techniques 35.5 (May 1987 [T-MTT]): 487-491.

Based on reliable theoretical results, a distributed MESFET model is developed. It consists of equivalent-circuit elements which can be evaluated directly from FET material constants and geometry. The deviations with respect to full-wave-analysis results are investigated and some applications are shown.



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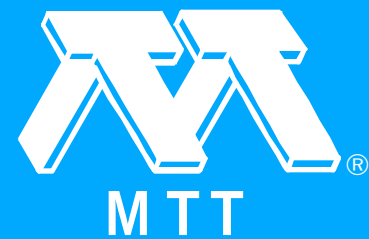
Distortion in p-i-n Diode Control Circuits

R.H. Caverly and G. Hiller. "Distortion in p-i-n Diode Control Circuits." 1987 Transactions on Microwave Theory and Techniques 35.5 (May 1987 [T-MTT]): 492-501.

Traditionally, distortion in p-i-n diodes has been thought to be only a function of the carrier lifetime and frequency of operation. This understanding is based on empirical evidence and is not entirely accurate. This paper will discuss the origins of p-i-n diode distortion and study the effects of various device parameters on distortion performance. Included in the investigation on single-diode circuits will be switching circuits and reflective attenuators. In switch circuits, the analysis shows that distortion can be minimized by maximizing the stored-to-charge resistance ratio in the diode. In attenuators, the analysis shows that maximizing the i-region thickness will minimize distortion, independent of the device carrier life-time. In attenuators where multiple p-i-n diodes are used (the bridged-tee and PI are discussed), maximizing the i-region thickness also minimizes the distortion, independent of carrier lifetime. The model accurately predicts distortion signal cancellation in both single and multiple p-i-n diode circuits.

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A Study of Electric-Field Breakdown in E-Plane Lines at Centimeter and Millimeter Wavelengths

M.M. Ney, S.R. Valluri, W. Yue, G.I. Costache and W.J.R. Hoefer. "A Study of Electric-Field Breakdown in E-Plane Lines at Centimeter and Millimeter Wavelengths." 1987 Transactions on Microwave Theory and Techniques 35.5 (May 1987 [T-MTT]): 502-509.

The microwave field breakdown in various E-plane transmission lines is investigated theoretically in the frequency range from 1 to 140 GHz. The influence of frequency, pressure, temperature, and inhomogeneity of the applied field on the breakdown field value is discussed. The peak power-handling capability of unilateral and bilateral finlines is determined theoretically using a quasi-static evaluation of the field distribution. It is found that finlines, even with small gap widths, can handle pulse power levels well above the capability of present solid-state devices. Preliminary breakdown measurements in X-band have confirmed the validity of the theoretical predictions.

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Cutoff Wavenumbers and Modes for Annular-Cross-Section Waveguide with Eccentric Inner Conductor of Small Radius

M. Davidovitz and Y.T. Lo. "Cutoff Wavenumbers and Modes for Annular-Cross-Section Waveguide with Eccentric Inner Conductor of Small Radius." 1987 Transactions on Microwave Theory and Techniques 35.5 (May 1987 [T-MTT]): 510-515.

Analytical expressions are derived for the cutoff wavenumbers and the corresponding modes in annular-cross-section waveguides having inner conductors of small radius. Waveguides with circular and rectangular outer boundary are considered. In the case of the circular eccentric annular waveguide, comparison is made between the values of cutoff wavenumbers computed from the expressions derived in this paper and data obtained by a more rigorous numerical technique.

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Characterization of Linear and Nonlinear Properties of GaAs MESFET's for Broad-Band Control Applications

R.J. Gutmann and D.J. Fryklund. "Characterization of Linear and Nonlinear Properties of GaAs MESFET's for Broad-Band Control Applications." 1987 Transactions on Microwave Theory and Techniques 35.5 (May 1987 [T-MTT]): 516-521.

GaAs MESFET's designed for control applications have improved switching performance compared to FET's designed for low-noise or high-power amplifiers. A broad-band switching cutoff frequency figure of merit close to 500 GHz has been achieved with both epitaxial and ion-implanted devices having $n_{\text{sup}} \pm$ surface layers and/or channel dopings above $2.0 \times 10^{17} \text{ cm}^{-3}$. Power handling under CW conditions is limited in the nonconducting state (FET dc biased into pinchoff) by the difference between the gate breakdown voltage and the pinchoff voltage, while conducting-state power handling is limited by the open-channel current-handling capability. For optimum switching frequency figure of merit, individual gate finger widths greater than those used in amplifier devices for the same maximum frequency of operation are necessary. The large ($\sim 5 \text{ k}\Omega$) resistor in series with the gate has important ramifications in optimizing the power-handling capability for broad-band applications.





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Analysis of Edge-Coupled Shielded Strip and Slabline Structures

S.M. Perlow. "Analysis of Edge-Coupled Shielded Strip and Slabline Structures." 1987 Transactions on Microwave Theory and Techniques 35.5 (May 1987 [T-MTT]): 522-529.

A method for the analysis of edge-coupled strip and slabline structures is presented which uses relatively simple algebraic expressions. The described procedure can be used to analyze directional couplers, interdigitated and comb line filters, and any other structures formed by an array of rectangular edge-coupled transmission lines, of arbitrary thickness, situated between two parallel plates. The analysis is complete in that it allows the conversion of the physical dimensions of the structure into a set of admittance parameters which completely describes its electrical behavior, including both conductor and dielectric losses.

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Abstracts

Transient Analysis of Partially Coupled Lines (Short Papers)

T. Razban. "Transient Analysis of Partially Coupled Lines (Short Papers)." 1987 Transactions on Microwave Theory and Techniques 35.5 (May 1987 [T-MTT]): 530-533.

We propose a time-domain analysis method for partially coupled lines by dividing them into "tubes." A tube of order N is a set of N coupled lines of equal lengths for which transient analysis based on modal decomposition is well known. An interface problem occurs at the junction of tubes of different orders. Such a case is analyzed by introducing two operators, called dilatation and shrinkage.



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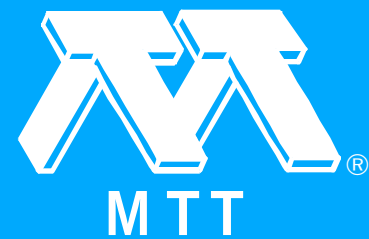
FM Noise in Multiple-Device Oscillators (Short Papers)

S. Sarkar and O.S. Gupta. "FM Noise in Multiple-Device Oscillators (Short Papers)." 1987 Transactions on Microwave Theory and Techniques 35.5 (May 1987 [T-MTT]): 533-535.

The FM noise in a multiple-device oscillator is analyzed. It is shown that FM noise depends on the circuit parameters and the number N of the constituent devices. For a circuit-dependent critical value of N , FM noise is maximum and it is proportional to $N^{\sup -1/2}$ when N is very large.

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Measurements of Microstrip Effective Relative Permittivities (Short Papers)

S. Deibele and J.B. Beyer. "Measurements of Microstrip Effective Relative Permittivities (Short Papers)." 1987 Transactions on Microwave Theory and Techniques 35.5 (May 1987 [T-MTT]): 535-538.

This paper presents normalized wide-bandwidth measurements of microstrip effective relative permittivities ($\epsilon_{\text{sub eff}}$) which were made on large-scale microstrip models. The experimental techniques are discussed, and the data are compared to the predictions of two recent closed-form design equations. These results agree favorably with the predictions of Kirschning and Jansen's model. In addition, suggestions concerning frequency limitations of microstrip use and comments on the reliability of CAD packages for microstrip circuits are made.

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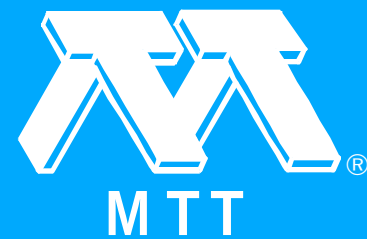
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Call for Papers - Quasi-Planar Millimeter-Wave Components and Subsystems (May 1987 [T-MTT])

"Call for Papers - Quasi-Planar Millimeter-Wave Components and Subsystems (May 1987 [T-MTT])." 1987 Transactions on Microwave Theory and Techniques 35.5 (May 1987 [T-MTT]): 543-543.



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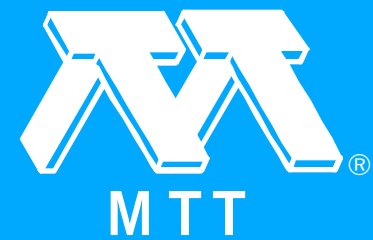
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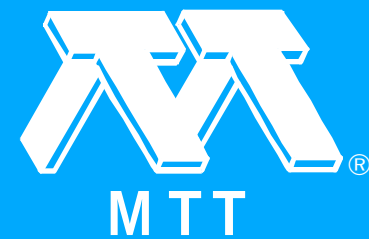
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Abstracts

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"Front Cover (Jun. 1987 [T-MTT])." 1987 Transactions on Microwave Theory and Techniques 35.6 (Jun. 1987 [T-MTT]): f1-f2.



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Abstracts

Quasi-TEM Analysis of "Slow-Wave" Mode Propagation on Coplanar Microstructure MIS Transmission Lines

Y.R. Kwon, V.M. Hietala and K.S. Champlin. "Quasi-TEM Analysis of "Slow-Wave" Mode Propagation on Coplanar Microstructure MIS Transmission Lines." 1987 Transactions on Microwave Theory and Techniques 35.6 (Jun. 1987 [T-MTT]): 545-551.

We present a simple quasi-TEM analysis of "slow-wave" mode propagation on micron-size coplanar MIS transmission lines on heavily doped semiconductors and compare theoretical results with measurements on four such structures at frequencies from 1.0 to 12.4 GHz. Excellent agreement is found, which shows that the "slow-wave" mode propagating on these transmission lines is, in fact, a quasi-TEM mode. Relatively low-loss propagation along with significant wavelength reduction is observed. Conduction losses of the metal, which have been tacitly ignored in previously published "full-wave" treatments of "slow-wave" mode propagation, are included in the theory and are shown to dominate the attenuation at frequencies below 25 GHz and to still be significant at frequencies up to at least 100 GHz.



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Field Theory Design of Ferrite-Loaded Waveguide Nonreciprocal Phase Shifters with Multisection Ferrite or Dielectric Slab Impedance Transformers

J. Uher, F. Arndt and J. Bornemann. "Field Theory Design of Ferrite-Loaded Waveguide Nonreciprocal Phase Shifters with Multisection Ferrite or Dielectric Slab Impedance Transformers." 1987 Transactions on Microwave Theory and Techniques 35.6 (Jun. 1987 [T-MTT]): 552-560.

Impedance-matched ferrite-loaded waveguide nonreciprocal phase shifters are designed using the method of field expansion into eigenmodes, which includes higher order mode interaction between the step discontinuities. Computer-optimized Ku -band ferrite stepped design examples, of 45° and 90° nonreciprocal differential phase shifts, attain typically about 2° phase error and less than -25 dB input reflection within a bandwidth of about 5 percent. Compact designs are achieved by thicker uniform ferrite slabs with dielectric transformer sections at each end. The theory is verified by comparison with available results from measurements and other methods.

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Modal-S-Matrix Design of Optimum Stepped Ridged and Finned Waveguide Transformers

J. Bornemann and F. Arndt. "Modal-S-Matrix Design of Optimum Stepped Ridged and Finned Waveguide Transformers." 1987 Transactions on Microwave Theory and Techniques 35.6 (Jun. 1987 [T-MTT]): 561-567.

Optimum stepped transformers from rectangular waveguide to ridged and all-metal finned waveguides are designed with the method of field expansion into eigenmodes, which includes higher order mode interaction between the step discontinuities. Computer-optimized design data are given for a Ku-band ridged waveguide prototype with a ridge width of 1 mm, as well as for Ku-band and E-band finned waveguide transformers with commercially available metal fin thicknesses of 0.19 mm and 0.1 mm, respectively, suitable for metal-etching manufacturing technique. The optimum designs achieve a minimum return loss of about 36 dB, or 34 dB for the whole Ku- or E-band, respectively. The theory is verified by comparison with measured results.

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Abstracts

The Method of Lines Applied to a Finline/Strip Configuration on an Anisotropic Substrate

B.M. Sherrill and N.G. Alexopoulos. "The Method of Lines Applied to a Finline/Strip Configuration on an Anisotropic Substrate." 1987 Transactions on Microwave Theory and Techniques 35.6 (Jun. 1987 [T-MTT]): 568-575.

The method of lines (MOL), a numerical scheme for the solution of partial differential equations that recently has been adapted to the full-wave dispersive characterization of planar waveguide structures, is modified to treat cases having uniaxially anisotropic dielectric regions. Anisotropy is present in commonly used substrate materials and typically leads to significant modeling error if neglected. The modus operandi of the method of lines is the discretization of spatial variables into a set of lines. Consequently, partial differential equations are reduced to ordinary kinds possessing simple, closed-form solutions. Being simple from the onset, the analysis effects an easily implemented method of good and controllable accuracy. The paper's formulation is exercised upon an interesting form of finline, one with both a fin and an isolated strip opposite one another on a uniaxial substrate. Computations providing dispersive effective permittivities and impedances highlight the errors incurred in neglecting anisotropy.



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Abstracts

Uniplanar MMIC Hybrids--A Proposed New MMIC Structure

T. Hirota, Y. Tarusawa and H. Ogawa. "Uniplanar MMIC Hybrids--A Proposed New MMIC Structure." 1987 Transactions on Microwave Theory and Techniques 35.6 (Jun. 1987 [T-MTT]): 576-581.

A new "uniplanar" circuit configuration for monolithic microwave integrated circuits (MMIC's) has been proposed. It uses a combination of coplanar waveguides and slotlines on one side of the substrate. The key components for the uniplanar structure are air bridges, which provide T junctions and transitions from coplanar waveguides to slotlines or vice versa. Novel hybrid circuits such as a magic T and a branch-line coupler have been fabricated and tested at K-band, and good performance has been achieved. This new circuit configuration is promising for applications in other microwave circuits.



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Unconditional Stability of a Three-Port Network Characterized with S-Parameters

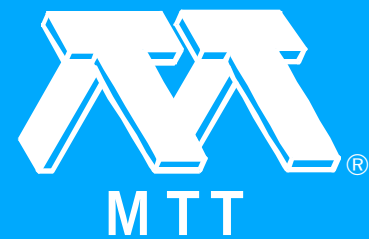
J.F. Boehm and W.G. Albright. "Unconditional Stability of a Three-Port Network Characterized with S-Parameters." 1987 Transactions on Microwave Theory and Techniques 35.6 (Jun. 1987 [T-MTT]): 582-586.

An analytical solution is presented which establishes nine conditions necessary for determining the unconditional stability of a network described with three-port S-parameters. In contrast to the unconditional stability conditions of a two-port network the unconditional stability conditions of a three-port network are dependent on both the three-port S-parameters and the port terminations. These criteria form the basis for three-port amplifier design, and are used to analyze measured three-port S-parameter data of a silicon BJT at 2.4 GHz.

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Guided Mode Characteristics of Metal-Clad Planar Optical Waveguides Produced by Diffusion (Short Papers)

S.J. Al-Bader and H.A. Jamid. "Guided Mode Characteristics of Metal-Clad Planar Optical Waveguides Produced by Diffusion (Short Papers)." 1987 Transactions on Microwave Theory and Techniques 35.6 (Jun. 1987 [T-MTT]): 587-591.

Analytical and numerical results for the guided mode characteristics of metal-clad planar waveguides produced by diffusion are developed. Values of the complex propagation constants are obtained numerically and are shown to be in good agreement with the analytical results. These give insight into how waveguide and material parameters determine the loss. Since the profile of the waveguide represents the variation of the refractive index of the diffused-channel waveguide with the depth dimension, the results obtained can be used to reduce the dimensionality of the diffused-channel waveguide and facilitate the application of the effective-index method.

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Abstracts

A Novel Low-Noise Downconverter System Using a Microstrip Coupled Transmission-Mode Dielectric Resonator (Short Papers)

M.P. Mitchell and G.R. Branner. "A Novel Low-Noise Downconverter System Using a Microstrip Coupled Transmission-Mode Dielectric Resonator (Short Papers)." 1987 Transactions on Microwave Theory and Techniques 35.6 (Jun. 1987 [T-MTT]): 591-594.

A low-noise downconverter system for microwave downlink applications is presented. Although most downconverters with an internally generated local oscillator have been designed utilizing MESFET's and DGFET's, the circuit described herein uses a silicon bipolar Darlington pair as its active device and a dielectric resonator for feedback. Downconverters of the latter type have been realized with noise figures as low as 4.57 dB and conversion gains of 7 dB over an intermediate frequency range from 0.6 to 1.8 GHz.



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Dosimetry of Occupational Exposure to RF Radiation: Measurements and Methods (Short Papers)

S. Tofani and G. Agnesod. "Dosimetry of Occupational Exposure to RF Radiation: Measurements and Methods (Short Papers)." 1987 Transactions on Microwave Theory and Techniques 35.6 (Jun. 1987 [T-MTT]): 594-597.

Workers engaged in the operation of RF industrial devices are exposed to electromagnetic radiation in the near-field zone that is characterized by high spatial and temporal gradients. The present paper is concerned with measurement methods and data analyses which allow the evaluation of the electromagnetic field exposure of the operator together with the SAR induced by near-field exposure accounting for the spatial and temporal variations. These methods are applied to the theoretical dosimetry of the occupational exposure to RF radiation emitted by 27.12-MHz plastic sealers. The data obtained are compared with those deducible through a conventional wide-band isotropic field meter.



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Abstracts

Decade Bandwidth Bias T's for MIC Applications up to 50 GHz (Short Papers)

B.J. Minnis. "Decade Bandwidth Bias T's for MIC Applications up to 50 GHz (Short Papers)." 1987 Transactions on Microwave Theory and Techniques 35.6 (Jun. 1987 [T-MTT]): 597-600.

A new design of bias T is described capable of carrying direct currents (dc) of a number of amperes while operating over RF bandwidths of more than a decade. Realized in microstrip or stripline, a design can operate up to at least 50 GHz as either a stand-alone component or as part of a microwave integrated circuit (MIC). The bias T circuit has been treated as a combination of HP, BP, and LP filters, the BP filter forming the major part. Design of the filter is by an exact transfer function synthesis procedure involving the application of the Richards transformation.



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The Effect of Fringing Fields on the Resistance of a Conducting Film (Comments)

M.S. Leong. "The Effect of Fringing Fields on the Resistance of a Conducting Film (Comments)." 1987 Transactions on Microwave Theory and Techniques 35.6 (Jun. 1987 [T-MTT]): 601-601.

We have read with great interest the above-mentioned paper and commend the authors for the meticulous manner in which they compare their results for the resistance with other available published results. We would like to draw their attention to our earlier related work [1], in which we formulated the same resistance problem directly without going via the resistance-capacitance analogue relation $RC = \epsilon/\sigma$. A generalization of the same problem to account for a slab having an inhomogeneous resistivity profile can be found in [2].



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Call for Papers - Quasi-Planar Millimeter-Wave Components and Subsystems (Jun. 1987 [T-MTT])

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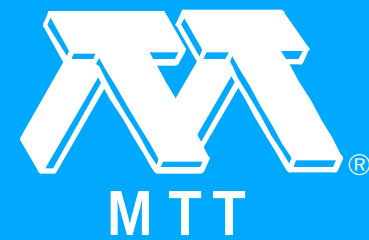
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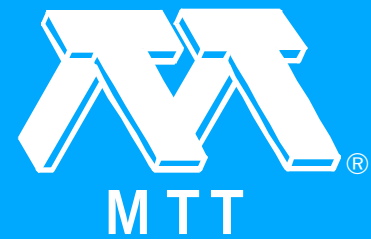
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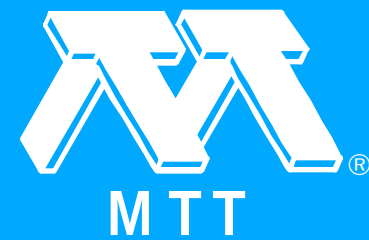
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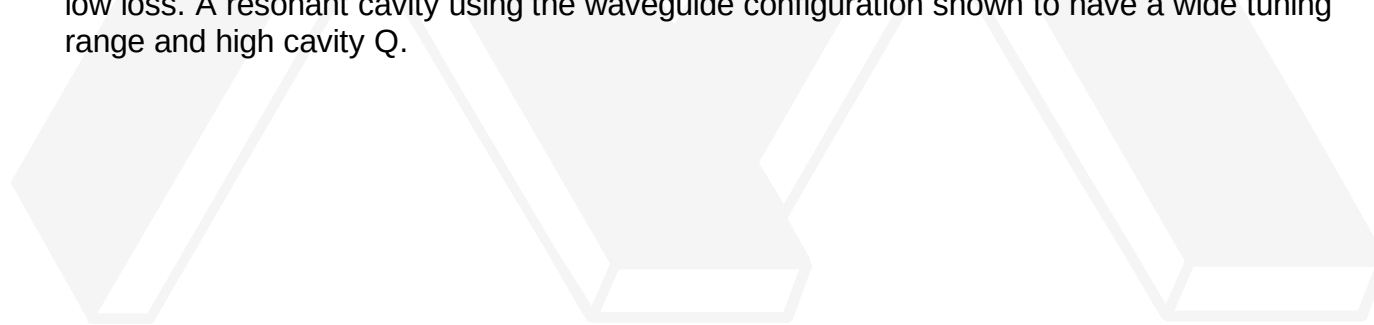
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Characteristics of Metallic Waveguides Inhomogeneously Filled with Dielectric Materials with Surface Plasma Layers

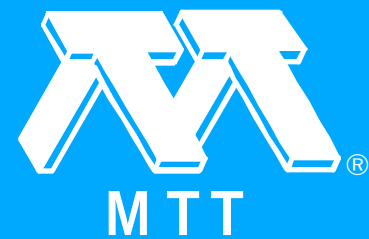
T.-F. Wu, J.K. Butler and M.W. Scott. "Characteristics of Metallic Waveguides Inhomogeneously Filled with Dielectric Materials with Surface Plasma Layers." 1987 Transactions on Microwave Theory and Techniques 35.7 (Jul. 1987 [T-MTT]): 609-614.

The propagation of millimeter waves in metallic waveguides inhomogeneously filled with dielectric materials having surface plasma layers is characterized. The modal phase shift and attenuation of a 94-GHz wave are computed for a 10- μ m plasma layer thickness as a function of carrier density. In the unexcited state, 90 percent of the millimeter-wave power is confined to the interior air region of the guide, while the remaining 10 percent propagates in the semiconductor insert. In the excited state at high injection levels, over 99 percent of the wave power propagates in the air region. Consequently, in this state, the waveguide will have a very low loss. A resonant cavity using the waveguide configuration shown to have a wide tuning range and high cavity Q.



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Characteristic Impedance and Effective Permittivity of Modified Microstrip Line for High Power Transmission

J. Zehentner. "Characteristic Impedance and Effective Permittivity of Modified Microstrip Line for High Power Transmission." 1987 Transactions on Microwave Theory and Techniques 35.7 (Jul. 1987 [T-MTT]): 615-620.

In a quasi-TEM approximation, the calculation of the characteristic impedance and effective permittivity of a modified microstrip line with the upper strip conductor edges turned up from the substrate is presented. Both these theoretically derived quantities are compared with experimental values. To further facilitate the analysis and synthesis of the modified microstrip line, closed-form approximations to the characteristic impedance and effective permittivity have been found containing elementary functions only. The modified microstrip can be used in the construction of lines capable of transmitting high power on substrates having high loss factor and low thermal conductivity, for example, on low-cost plastics.

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Design of Broad-Band Dielectric Waveguide 3-dB Couplers

P.K. Ikalainen and G.L. Matthaei. "Design of Broad-Band Dielectric Waveguide 3-dB Couplers." 1987 Transactions on Microwave Theory and Techniques 35.7 (Jul. 1987 [T-MTT]): 621-628.

It is shown how 3-dB couplers with bandwidths on the order of 30 percent can be designed by appropriately taking advantage of the dispersion and the frequency dependence of coupling per unit length between two dielectric waveguides with asymmetrical cross sections. Theoretical methods for computing frequency responses of such couplers are discussed. It is shown how the phase response can be simply compensated to give approximately symmetrical-coupler-type or "magic tee" coupler-type phase-difference responses over comparable bandwidths. Experimental results confirming theoretical calculations are presented.

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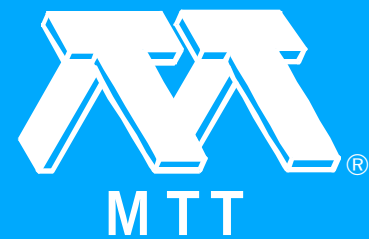
Analysis of Nonreciprocal Coupled Image Lines

D.B. Sillars and L.E. Davis. "Analysis of Nonreciprocal Coupled Image Lines." 1987 Transactions on Microwave Theory and Techniques 35.7 (Jul. 1987 [T-MTT]): 629-635.

The effective dielectric constant method is used to analyze the nonreciprocal coupling properties of coupled image lines separated by a longitudinally magnetized ferrite slab. Two structures are considered, one incorporating low-dielectric-constant image lines ($\epsilon_r = 2.56$), the other incorporating image lines consisting of high-dielectric-constant material ($\epsilon_r = 9.8$). Results of dispersion characteristics, coupling parameters, and field distributions are presented.

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Two Methods for the Measurement of Substrate Dielectric Constant

N.K. Das, S.M. Voda and D.M. Pozar. "Two Methods for the Measurement of Substrate Dielectric Constant." 1987 Transactions on Microwave Theory and Techniques 35.7 (Jul. 1987 [T-MTT]): 636-642.

Two methods for the accurate and convenient measurement of the dielectric constant of a microwave substrate are proposed. Both methods use the precision measurement capability of the HP-8510 Network Analyzer system and a rigorous theoretical analysis of multilayer transmission lines, and hence can also be used for the measurement of the frequency dependence of the relative dielectric constant. Accuracy on the order of 1.0 percent can be obtained by use of these techniques. Measurements were done for various substrates and gave results as predicted.

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Abstracts

Analysis and Design of MESFET Gate Mixers

C. Camacho-Penalosa and C.S. Aitchison. "Analysis and Design of MESFET Gate Mixers." 1987 Transactions on Microwave Theory and Techniques 35.7 (Jul. 1987 [T-MTT]): 643-652.

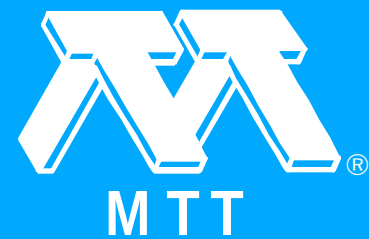
A general and efficient nonlinear/linear analysis of MESFET gate mixers is presented. In the nonlinear analysis, the Newton-Raphson algorithm is used in conjunction with a novel approach for computing partial derivatives required by the Jacobian. The study of conversion gain and stability characteristics of the mixer is based on S-parameter matrix theory. As a result of the analysis, the possibility of improving the conversion gain of X-band MESFET gate mixers by an appropriate choice of the RF drain termination has been theoretically and experimentally demonstrated.



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Thermal Lowering of the Threshold for Microwave Breakdown in Air-Filled Waveguides

D.G. Anderson, M. Lisak and P.T. Lewin. "Thermal Lowering of the Threshold for Microwave Breakdown in Air-Filled Waveguides." 1987 Transactions on Microwave Theory and Techniques 35.7 (Jul. 1987 [T-MTT]): 653-656.

It is demonstrated that the presence of absorbing inhomogeneities in an air-filled microwave waveguide may significantly lower the threshold for microwave breakdown. The underlying physical mechanism is locally enhanced microwave absorption and subsequent heating of the waveguide air. The results provide an explanation of the fact that break-down thresholds of microwave transmission systems are observed to be much lower than theoretical predictions.

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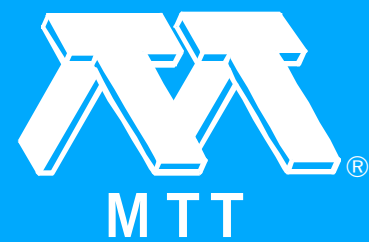
MMIC 14-GHz VCO and Miller Frequency Divider for Low-Noise Local Oscillators

T. Ohira, T. Hiraoka and H. Kato. "MMIC 14-GHz VCO and Miller Frequency Divider for Low-Noise Local Oscillators." 1987 Transactions on Microwave Theory and Techniques 35.7 (Jul. 1987 [T-MTT]): 657-662.

An MMIC voltage-controlled oscillator and an MMIC frequency divider are developed and applied to a 14-GHz low-noise local oscillator. To obtain both wide tuning range and low pulling figure, the source-follower FET circuit is used in the voltage-controlled oscillator. A wide-band balanced mixer and a filtering amplifier are integrated in a single chip and constitute the Miller frequency divider. The MMIC's were assembled into a 14-GHz phase-locked loop in order to demonstrate that they will operate as key components of low-noise oscillators. It is shown experimentally that even for low-Q MMIC circuitry, the carrier noise of the oscillator is reduced enough for practical purposes such as space-borne heterodyne receivers, transmitters, and radio repeaters in Ku-band satellite communication systems. Thus, prospects are bright for development of single-chip microwave low-noise oscillators.

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An Investigation of Parametric Noise in Millimeter-Wave IMPATT Oscillators

A. Rydberg and P.T. Lewin. "An Investigation of Parametric Noise in Millimeter-Wave IMPATT Oscillators." 1987 Transactions on Microwave Theory and Techniques 35.7 (Jul. 1987 [T-MTT]): 663-671.

The IMPATT oscillator used as an LO source in a receiver has often been found to contribute a large amount of excess noise to the system (sometimes more than 40 dB compared to a klystron). Often the IMPATT noise has been referred to as avalanche noise, but theoretically this should only reduce the carrier-to-noise ratio by 10-15 dB when compared to a klystron. In the following paper, we show that the excess noise far from the carrier frequency (i.e., sideband noise) is much more dependent on parametric oscillations excited below the cutoff frequency of the mount than, on avalanche noise. By modifying the Hines equation for parametric stability, we have been able to investigate the parametric noise properties of realistic millimeter-wave IMPATT oscillators. Using theoretical waveguide models, we have investigated how the sideband noise depends on various mount configurations, avalanche currents, and IMPATT diodes. The calculated curves show good correlation with the measured noise at 4 GHz from the carrier. It often has been found to be very difficult to completely reduce the parametric noise in avalanche oscillators. In these cases, the method of comparison between different mounts presented here for finding the diode-mount configuration which gives least parametric noise can be an aid in the construction of low-noise IMPATT oscillators.

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Abstracts

Spectral-Domain Analysis of Single and Coupled Cylindrical Striplines (Short Papers)

M.D. Deshpande and C.J. Reddy. "Spectral-Domain Analysis of Single and Coupled Cylindrical Striplines (Short Papers)." 1987 Transactions on Microwave Theory and Techniques 35.7 (Jul. 1987 [T-MTT]): 672-675.

A spectral-domain technique for finding the characteristic impedances of a single cylindrical stripline and a coupled pair of cylindrical striplines is presented. Assuming a charge distribution on the strip, the variational expression for the line capacitance for single cylindrical strip-line is derived. Good agreement with published results is obtained. The cylindrical coupled strip and microstrip lines are also analyzed and a comparison with their planar counterparts is made.



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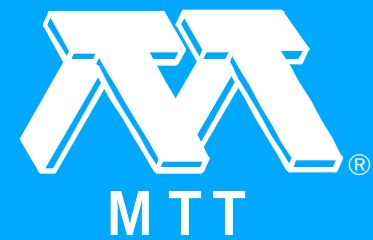
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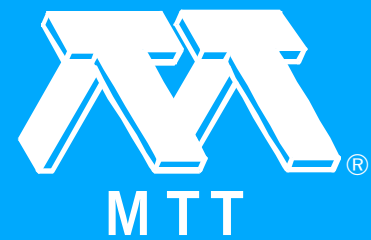
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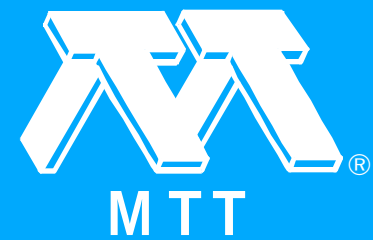
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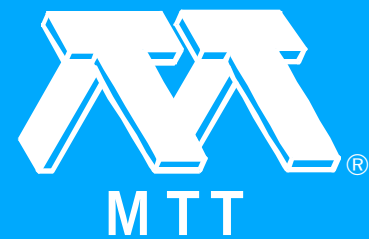
Wide-Band Directional Couplers in Dielectric Waveguide

J. Rodriguez and A. Prieto. "Wide-Band Directional Couplers in Dielectric Waveguide." 1987 Transactions on Microwave Theory and Techniques 35.8 (Aug. 1987 [T-MTT]): 681-687.

In this work, the II guide is proposed as an alternative in designing proximity directional couplers using dielectric guides in order to obtain coupling factors constant with the frequency, thus increasing the bandwidth of these devices. The propagation constants of the even and odd modes of the coupling zones are determined by means of Schelkunoff's method and the effective dielectric constant method (EDCM). Two directional couplers, 10 dB and 3 dB, made of polystyrene and Teflon respectively, were designed and measured to work in the millimetric frequency band (32-40 GHz). The inclusion of metallic walls in the curved zones avoids additional couplings and results in flat coupling. Furthermore, the metallic walls reduce the radiation losses and allow the coupling factor to be finely adjusted. The results obtained show a maximum coupling variation of ± 0.5 dB for 20-percent bandwidth.

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Three-Dimensional Finite-Difference Method for the Analysis of Microwave-Device Embedding

A. Christ and H.L. Hartnagel. "Three-Dimensional Finite-Difference Method for the Analysis of Microwave-Device Embedding." 1987 Transactions on Microwave Theory and Techniques 35.8 (Aug. 1987 [T-MTT]): 688-696.

The embedding of microwave devices is treated by applying the finite-difference method to three-dimensional shielded structures. A program package was developed to evaluate electromagnetic fields inside arbitrary transmission-line connecting structures and to compute the scattering matrix. The air bridge, the transition through a wall, and the bond wire are examined as interconnecting structures. Detailed results are given and discussed regarding the fundamental behavior of embedding.

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Abstracts

High-Speed Pulse Transmission Along a Slow-Wave CPW for Monolithic Microwave Integrated Circuits

C.-K.C. Tzuang and T. Itoh. "High-Speed Pulse Transmission Along a Slow-Wave CPW for Monolithic Microwave Integrated Circuits." 1987 Transactions on Microwave Theory and Techniques 35.8 (Aug. 1987 [T-MTT]): 697-704.

High-speed pulse transmission along a coplanar waveguide (CPW) integrated on a monolithic microwave integrated circuit (MMIC) is analyzed. The time-domain waveform is obtained by the inverse discrete Fourier transform (IDFT) of the frequency-domain data, namely, complex characteristic impedance and propagation constant. The full-wave mode-matching method (MMM) is employed to analyze the dispersion of the CPW. A simple wide-band matching scheme is found to be effective to make the slow-wave CPW a viable circuit element in applications such as a delay line or an interconnection line.



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Abstracts

A New Class of Basis Functions for the Solution of the E-Plane Waveguide Discontinuity Problem

M.-S. Leong, P.S. Kooi and Chandra. "A New Class of Basis Functions for the Solution of the E-Plane Waveguide Discontinuity Problem." 1987 Transactions on Microwave Theory and Techniques 35.8 (Aug. 1987 [T-MTT]): 705-709.

A class of basis functions which satisfies the edge condition explicitly is presented to improve the convergence of the mode-matching method. Using these basis functions, we analyse the 2-to-1 E-plane junction, make comparisons with other available methods of solution, and provide correction terms for its quasi-static solution.



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Abstracts

Microstrip Dispersion Including Anisotropic Substrates

B.E. Kretch and R.E. Collin. "Microstrip Dispersion Including Anisotropic Substrates." 1987 Transactions on Microwave Theory and Techniques 35.8 (Aug. 1987 [T-MTT]): 710-718.

A perturbation-iteration solution based on potential theory is developed for determining the effective dielectric constant, characteristic impedance, and current-charge distribution on a microstrip transmission line with isotropic and anisotropic substrates. The numerical implementation of the theory is described and is suitable for use on a personal computer. Computed data for several common substrate materials are included.



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Abstracts

Wide-Band, Forward-Coupling Microstrip Hybrids with High Directivity

P.K. Ikalainen and G.L. Matthaei. "Wide-Band, Forward-Coupling Microstrip Hybrids with High Directivity." 1987 Transactions on Microwave Theory and Techniques 35.8 (Aug. 1987 [T-MTT]): 719-725.

The common forms of microstrip hybrids are either "backward couplers" formed using parallel lines, or branch-line or rat-race hybrids. All of these tend to have degraded performance due to discontinuities, junction effects, or unequal even- and odd-mode velocities. In contrast, coupled-line microstrip forward couplers do not require any discontinuities or junctions and utilize the unequal mode velocities. As a result, forward couplers can tolerate unusually thick substrates and still achieve high directivity and very little radiation. Though they are relatively long, designs with sizable coupling gaps have reasonable lengths for many applications, particularly at millimeter-wave frequencies. A trial symmetrical design yielded a bandwidth of 15 percent for 1-dB maximum unbalance. By use of asymmetrical design, a bandwidth of 57 percent was achieved for the same tolerance. Either quadrature or "magic-T" hybrid performance can be approximated. Directivities of 37 dB or more were readily achieved.



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Abstracts

An Electromagnetic Time-Harmonic Analysis of Shielded Microstrip Circuits

J.C. Rautio and R.F. Harrington. "An Electromagnetic Time-Harmonic Analysis of Shielded Microstrip Circuits." 1987 Transactions on Microwave Theory and Techniques 35.8 (Aug. 1987 [T-MTT]): 726-730.

A Galerkin analysis of microstrip circuits of arbitrary planar geometry enclosed in a rectangular conducting box is described. The technique entails a time-harmonic electromagnetic analysis evaluating all fields and surface currents. This analysis is suitable for the accurate verification of microstrip designs prior to fabrication. A computer program implementing the analysis has been written in Pascal on a personal computer. Agreement with measurements of several microstrip structures suggests a high degree of accuracy.



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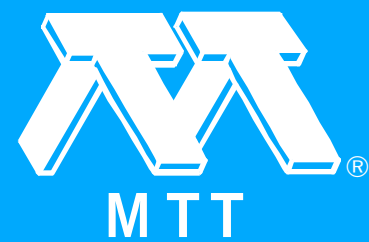
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Finite-Element Solution of Planar Inhomogeneous Waveguides for Magnetostatic Waves

Y. Long, M. Koshiba and M. Suzuki. "Finite-Element Solution of Planar Inhomogeneous Waveguides for Magnetostatic Waves." 1987 Transactions on Microwave Theory and Techniques 35.8 (Aug. 1987 [T-MTT]): 731-736.

A unified numerical approach based on the finite-element method is described for the solution of planar inhomogeneous waveguides for magnetostatic waves. Both magnetostatic volume wave and magnetostatic surface wave modes are treated. The validity of the method is confirmed by calculating the magnetostatic wave modes of layered YIG films. The numerical results of inhomogeneous YIG films with alpha-power magnetization profile are also presented, and the effects of magnetization inhomogeneities on the delay characteristics and potential profiles for magnetostatic forward volume wave, magnetostatic backward volume wave, and magnetostatic surface wave modes are examined.

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Abstracts

A New Leaky Waveguide for Millimeter Waves Using Nonradiative Dielectric (NRD) Waveguide-Part I: Accurate Theory

A. Sanchez and A.A. Oliner. "A New Leaky Waveguide for Millimeter Waves Using Nonradiative Dielectric (NRD) Waveguide-Part I: Accurate Theory." 1987 Transactions on Microwave Theory and Techniques 35.8 (Aug. 1987 [T-MTT]): 737-747.

An almost-rigorous analysis is presented for a new leaky waveguide of simple configuration based on a recent nonradiative modification of H guide suitable for millimeter wavelengths. The analysis employs a transverse equivalent network that yields a dispersion relation in closed form, and contains some interesting and subtle features. Numerical values are presented for the phase and leakage constants in terms of the different geometric parameters and the dielectric constant comparisons with measurements are made in the companion paper, part II.



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A New Leaky Waveguide for Millimeter Waves Using Nonradiative Dielectric (NRD) Waveguide-Part II: Comparison with Experiments

H. Qing, A.A. Oliner and A. Sanchez. "A New Leaky Waveguide for Millimeter Waves Using Nonradiative Dielectric (NRD) Waveguide-Part II: Comparison with Experiments." 1987 Transactions on Microwave Theory and Techniques 35.8 (Aug. 1987 [T-MTT]): 748-752.

Accurate measurements were taken of the leakage constant of a leaky-wave structure based on nonradiative dielectric (NRD) waveguide in order to verify the theory derived in the companion paper, part I. Although the structure is intended for millimeter-wave use, measurements were made on a model scaled to X band ($\lambda = 3$ cm) to improve the accuracy of the experimental results. The measurements were taken by probing the electric near field strength along the longitudinal direction. Comparisons with accurate theoretical data are presented for different frequencies and geometrical parameters, and very good agreement is found between the measurements and the theory.

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Longitudinal Impedance of Simple Cylindrically Symmetric Structures

S.A. Kheifets. "Longitudinal Impedance of Simple Cylindrically Symmetric Structures." 1987 Transactions on Microwave Theory and Techniques 35.8 (Aug. 1987 [T-MTT]): 753-760.

A method derived for calculation of the electromagnetic fields of a point charge moving along an axis of cylindrically symmetric structures is applied here to cavities and collimators with side tubes. The longitudinal impedance for such structures is calculated. In particular, the impedance for a pipe loaded with a thin washer is also calculated. It is shown that for large particle energy and for high frequencies, the longitudinal impedance of a collimator can be found analytically and that it is a constant over a broad range of frequencies.



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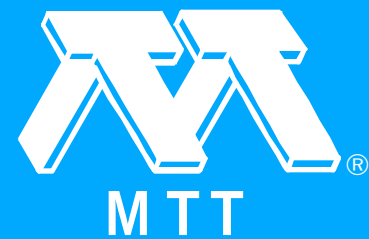
Analysis of Thermal Radiation from an Inhomogeneous Cylindrical Human Body Model

N.K. Uzunoglu, P.G. Cottis and P.S. Papakonstantinou. "Analysis of Thermal Radiation from an Inhomogeneous Cylindrical Human Body Model." 1987 Transactions on Microwave Theory and Techniques 35.8 (Aug. 1987 [T-MTT]): 761-768.

The thermal radiation from a cylindrical human body model at microwave frequencies is treated analytically. The human body model is taken to be a homogeneous cylinder at temperature T having a localized internal thermal inhomogeneity at temperature $T + \Delta T$. The mean energy density for the near field outside the cylinder is determined by employing the dyadic Green's function of the homogeneous cylinder and the fluctuation-dissipation theorem. Analytical results are derived for the contributions of the homogeneous cylinder and the inhomogeneity region. Numerical results are presented for several geometries at low microwave frequencies where a reasonable transparency of tissues is expected. The possibility of using microwave radiometry techniques to measure temperature distributions in depth is discussed in relation to hyperthermia and the development of noninvasive diagnostic techniques. It is shown that the emission from surrounding tissues limits the detectability of thermal inhomogeneities inside the body and that by using low microwave frequencies (~ 1 GHz), temperature measurement at depths up to 2 cm can be performed.

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Some Properties of T-Septum Waveguides

Y. Zhang and W.T. Joines. "Some Properties of T-Septum Waveguides." 1987 Transactions on Microwave Theory and Techniques 35.8 (Aug. 1987 [T-MTT]): 769-775.

Equations and curves giving cutoff frequency and impedance are presented for rectangular waveguide having a T-septum on one or both sides. It is shown that the T-septum waveguide has a lower cutoff frequency and wider bandwidth than a ridged waveguide of the same gap parameters. The impedance characteristic is shown to be almost the same as that of the ridged guide. Equations and charts are presented to facilitate the design of T-septum waveguides. Experimental measurements show a good agreement with the theoretical predictions. The theoretical results are obtained by the formulation of an integral eigenvalue equation which is subsequently solved numerically by application of the Ritz-Galerkin method. The eigenvalue spectrum is also discussed.

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Near-Field Absorption Characteristics of Biological Models in the Resonance Frequency Range (Short Papers)

M.F. Iskander, S.C. Olson and J.F. McCalmont. "Near-Field Absorption Characteristics of Biological Models in the Resonance Frequency Range (Short Papers)." 1987 Transactions on Microwave Theory and Techniques 35.8 (Aug. 1987 [T-MTT]): 776-780.

In this paper, we utilized the new iterative extended boundary condition method (IEBCM) to calculate the near-field absorption characteristics of a spheroidal model of man in the resonance frequency range. These calculations complement our previous near-field results in the preresonance frequency range. Calculations were made for simple sources such as an electric dipole and a small current loop antenna. The near fields of these sources are known exactly and hence helped in explaining the absorption results in terms of the field components of the incident radiation. Numerical results for the normalized average SAR values are presented as a function of frequency for different near-field separation distances from the sources. It is generally observed that while the far-field results converge to the plane wave values, different near-field absorption characteristics occur for the two different sources. It was possible in both cases to explain the differences in the near-field average SAR values in terms of the incident near fields from the sources.

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Abstracts

AM-AM and AM-PM Measurements Using the PM Null Technique (Short Papers)

J.F. Moss. "AM-AM and AM-PM Measurements Using the PM Null Technique (Short Papers)." 1987 Transactions on Microwave Theory and Techniques 35.8 (Aug. 1987 [T-MTT]): 780-782.

This paper describes a new method for measuring AM-AM and AM-PM nonlinearities in microwave radio components. This new method is called the PM null technique. This method is accurate and easy to implement. Both the carrier and modulation frequencies can be changed easily. Results of AM-AM and AM-PM measurements performed on a 8-GHz amplifier are given. This new method was compared with Moffatt's parabolic phase method and found to be in good agreement.



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Abstracts

Analysis of a Buried Layer Millimeter-Wave Phase Shifter (Short Papers)

M.W. Scott, T.F. Wu and J.K. Butler. "Analysis of a Buried Layer Millimeter-Wave Phase Shifter (Short Papers)." 1987 Transactions on Microwave Theory and Techniques 35.8 (Aug. 1987 [T-MTT]): 783-784.

The results of an analysis of an optically controlled millimeter-wave phase shifter are presented. The phase shift is obtained when electron-hole pairs are created in a thin region in the interior of a semiconductor waveguide. The device exhibits maximum phase shifts for the transverse electric mode. This behavior is different from phase shifters using surface excitation, which give maximum phase shifts for the transverse magnetic mode. The new configuration gives higher phase shifts per decibel attenuation than devices employing surface excitation.



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Abstracts

A Procedure for Calculating Fields Inside Arbitrarily Shaped, Inhomogeneous Dielectric Bodies Using Linear Basis Functions with the Moment Method (Comments and Reply)

M.J. Hagmann, C.-T. Tsai, H. Massoudi, C.H. Durney and M.F. Iskander. "A Procedure for Calculating Fields Inside Arbitrarily Shaped, Inhomogeneous Dielectric Bodies Using Linear Basis Functions with the Moment Method (Comments and Reply)." 1987 Transactions on Microwave Theory and Techniques 35.8 (Aug. 1987 [T-MTT]): 785-786.

The above paper recently described the use of a linear basis with polyhedral cells, which is a significant modification from previous block model solutions which have used a pulse-function basis (PFB) with cubical cells (PFBC). It is reasonable to expect greater accuracy when the same number of cells is used with the new procedure, but some of the comments regarding earlier PFBC models may be misleading.



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Abstracts

Spectral-Domain Analysis of Scattering from E-Plane Circuit Elements (Corrections)

Q. Zhang and T. Itoh. "Spectral-Domain Analysis of Scattering from E-Plane Circuit Elements (Corrections)." 1987 Transactions on Microwave Theory and Techniques 35.8 (Aug. 1987 [T-MTT]): 786-788.

In the above paper, the expressions for LSM modes should have read as follows.



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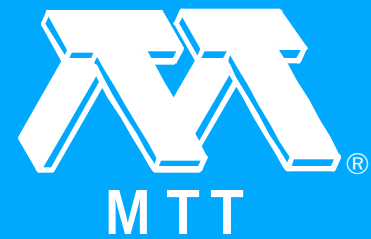
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Call for Papers - Quasi-Planar Millimeter-Wave Components and Subsystems (Aug. 1987 [T-MTT])

"Call for Papers - Quasi-Planar Millimeter-Wave Components and Subsystems (Aug. 1987 [T-MTT])." 1987 Transactions on Microwave Theory and Techniques 35.8 (Aug. 1987 [T-MTT]): 793-793.



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Low-Temperature Electronics (Advertisement) (Aug. 1987 [T-MTT])

"Low-Temperature Electronics (Advertisement) (Aug. 1987 [T-MTT])." 1987 Transactions on Microwave Theory and Techniques 35.8 (Aug. 1987 [T-MTT]): 794-794.



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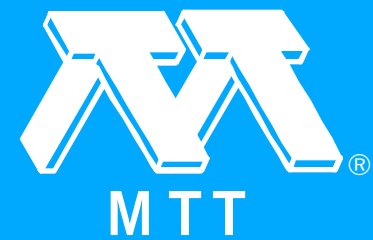
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Abstracts

IEEE on Microfilm (Advertisement) (Aug. 1987 [T-MTT])

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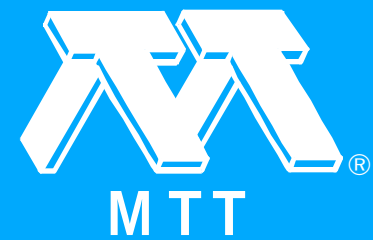
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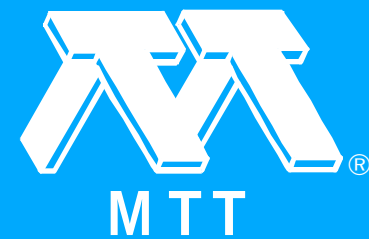
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Back Cover (Aug. 1987 [T-MTT])

"Back Cover (Aug. 1987 [T-MTT])." 1987 Transactions on Microwave Theory and Techniques 35.8 (Aug. 1987 [T-MTT]): b1-b2.



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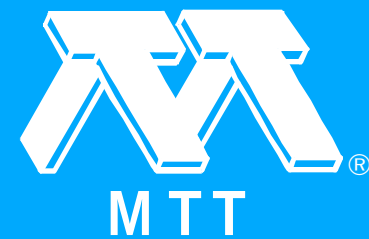
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Front Cover (Sep. 1987 [T-MTT])

"Front Cover (Sep. 1987 [T-MTT])." 1987 Transactions on Microwave Theory and Techniques 35.9 (Sep. 1987 [T-MTT]): f1-f2.



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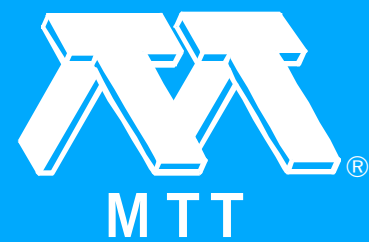
Complex Gyrator Circuit of an Evanescent-Mode E-Plane Junction Circulator Using H-Plane Turnstile Resonators

J. Helszajn. "Complex Gyrator Circuit of an Evanescent-Mode E-Plane Junction Circulator Using H-Plane Turnstile Resonators." 1987 Transactions on Microwave Theory and Techniques 35.9 (Sep. 1987 [T-MTT]): 797-806.

The E-plane circulator is of considerable practical interest but its development has lagged somewhat compared to that of the more common H-plane device. The purpose of this paper is to experimentally investigate the eigenvalue problem and the complex gyrator circuit of an E-plane evanescent-mode junction loaded with one or two H-plane turnstile ferrite resonators symmetrically coupled by three standard rectangular waveguides. The condition for which the eigenvalues of the demagnetized junction are in antiphase has been met with the physical variables at hand, but the more important one for which they are also commensurate has not. A transformer coupled device using quarter-wave-long impedance sections at each port is also described. Its frequency coincides with the even solution of two coupled resonators.

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Sidelobe Suppression in Low and High Time-Bandwidth Products of Linear FM Pulse Compression Filters

K.M. El-Shennawy, O.A. Alim and M.A. Ezz-El-Arab. "Sidelobe Suppression in Low and High Time-Bandwidth Products of Linear FM Pulse Compression Filters." 1987 Transactions on Microwave Theory and Techniques 35.9 (Sep. 1987 [T-MTT]): 807-811.

The peak sidelobe suppression of unweighed linear FM surface acoustic wave filters limits the dynamic range of pulse compression systems. Using a discrete inverse Fourier transform "sampling technique" and complex Fresnel integral algorithms, this paper extends previous results of other authors from a time-bandwidth product of 50 up to the high value of 720. In the present work, the weighting is applied in the frequency domain, employing an external Hamming weighting function. The output waveforms are determined for different sampling rates. The results show that a peak sidelobe suppression of -38 dB from the main lobe is achieved for high time-bandwidth product ($TB = 720$) at a sampling rate of 512 with broadening in the main lobe, while it is -41 dB for a low time-bandwidth product of $TB = 50$. Also, the paper contains charts showing the sidelobe suppression of unweighed and Hamming externally weighted linear FM pulse compression filters at different values of time-bandwidth products TB (50,100,250,370,510,720) with different central frequencies, dispersion times, and bandwidths B . The skirt steepness, sidelobe ripple rejection, Gibbs ripples of the wave spectrum, reduction of the insertion loss, and suppression of Fresnel ripples are also compared.

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Bias-Tuned Injection-Locked Discriminators

B.N. Biswas, S. Chatterjee, S. Sarkar, A.K. Bhattacharyya and S.K. Ray. "Bias-Tuned Injection-Locked Discriminators." 1987 Transactions on Microwave Theory and Techniques 35.9 (Sep. 1987 [T-MTT]): 812-818.

A new form of microwave FM discriminator using simultaneously the technique of injection synchronization and automatic bias tuning has been proposed. The present discriminator basically consists of an injection-synchronized Gunn oscillator and an arrangement for bias tuning of the oscillator in correspondence to a measure of the instantaneous phase/frequency error between the incoming signal and the Gunn oscillator output. A detailed analysis on the discriminator performance, which closely fits in with the experimental results, has been presented. The performance of the present discriminator is much better than that of the conventional one.



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A New Constant-Resistance ASK Modulator Using Double-Sided MIC

Y. Tarusawa, H. Ogawa and T. Hirota. "A New Constant-Resistance ASK Modulator Using Double-Sided MIC." 1987 Transactions on Microwave Theory and Techniques 35.9 (Sep. 1987 [T-MTT]): 819-822.

A new constant-resistance ASK modulator using double-sided MIC techniques is proposed. (The term "double-sided MIC" refers to a circuit that utilizes both substrate surfaces.) The circuit consists of two quarter-wavelength slotlines, two variable-resistance elements, and a slot-to-microstrip transition. A balanced circuit configuration is used to obtain a high ON/OFF ratio at high frequencies. The modulator does not require circulators or hybrid couplers for perfect matching. The conditions required for impedance matching are also calculated. The experimental results are obtained in the frequency range from 25.0 to 29.5 GHz. The minimum insertion loss obtained is 2.8 dB, and the ON/OFF ratio is greater than 40 dB. The return loss is kept above 12 dB in the frequency range. This new modulator should prove useful for various applications such as variable equalizers and variable attenuators.

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Rigorous Analysis and Network Modeling of the Inset Dielectric Guide

T. Rozzi and S.J. Hedges. "Rigorous Analysis and Network Modeling of the Inset Dielectric Guide." 1987 Transactions on Microwave Theory and Techniques 35.9 (Sep. 1987 [T-MTT]): 823-834.

The inset dielectric guide (IDG) is an easy-to-fabricate alternative to image line and is also less sensitive to loss by radiation at discontinuities. This paper presents a rigorous variational analysis in space domain based on field and network considerations (transverse resonance diffraction). This approach yields an accurate transverse equivalent network for the fundamental mode suitable for evaluation by a desktop calculator. Theoretical and experimental results are in excellent agreement.

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TM/sub 0n0/- and TM/sub m10/-Mode Oversized Cylindrical Cavity Power Combiners

S. Nogi and K. Fukui. "TM/sub 0n0/- and TM/sub m10/-Mode Oversized Cylindrical Cavity Power Combiners." 1987 Transactions on Microwave Theory and Techniques 35.9 (Sep. 1987 [T-MTT]): 835-842.

TM/sub m10/-mode power combining is treated in addition to conventional TM/sub 0n0/-mode combining in a multiple-device oversized cylindrical cavity having a window output structure. Mode analysis gives the condition for stable power-combining operation in the desired mode. By experiments both on TM/sub 0n0/-mode combining ($n = 2, 3$, and 4) and on TM/sub m10/-mode combining ($m = 2$ and 8), it is shown that almost perfect power combining in the TM/sub 210/ mode can be achieved as in the TM/sub 020/ mode and that the power combining efficiency decreases gradually with increasing n or m . A possible advantage of TM/sub m10/-mode combining in an oversized cavity is suggested based on the experimental result that power combining in the TM/sub 810/ mode gives higher efficiency than in the TM/sub 040/ mode.

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Cylindrical Substrate Microstrip Line Characterization

N.G. Alexopoulos and A. Nakatani. "Cylindrical Substrate Microstrip Line Characterization." 1987 Transactions on Microwave Theory and Techniques 35.9 (Sep. 1987 [T-MTT]): 843-849.

In this article, quasi-static and dynamic solutions are derived for microstrip transmission lines on circularly symmetric cylindrical substrates. Novel numerical techniques have evolved which lead to very efficient algorithms. The model is applicable to substrates of arbitrary thickness and cylinder size. Furthermore, it has been checked against a variety of limiting cases, including microstrip on a flat substrate, and it has been found to provide results with excellent accuracy. The analytical extraction of the quasi-static behavior from the dynamic Green's function introduces considerable simplicity in developing the algorithm.

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Abstracts

Analysis and Design of Microslab Waveguide

B. Young and T. Itoh. "Analysis and Design of Microslab Waveguide." 1987 Transactions on Microwave Theory and Techniques 35.9 (Sep. 1987 [T-MTT]): 850-857.

Microslab, a novel low-loss semiplanar waveguide, is studied to provide design charts for the propagation constant and characteristic impedance. A parallel-plate analysis is performed to provide design guide-lines based on frequency, conductor loss, and size. A mode-matching procedure is then used to build the design charts. Results are provided for Microslab implementation on GaAs substrates.



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Abstracts

Attenuation and Power-Handling Capability of T-Septum Waveguides

Y. Zhang and W.T. Joines. "Attenuation and Power-Handling Capability of T-Septum Waveguides." 1987 Transactions on Microwave Theory and Techniques 35.9 (Sep. 1987 [T-MTT]): 858-861.

In this paper, the attenuation characteristics and power-handling capabilities of single T-septum waveguides are presented. The analysis is based upon numerical solutions employing the Ritz- Galerkin technique. The analysis was verified by applying it to the known results obtained for the ridged waveguide, which is treated as a special case of the T-septum guide. A good agreement has been achieved compared with the results from Hopfer. It is found that the single T-septum guide can handle less power, but has lower attenuation than the single-ridged guide with identical gap parameters. Equations and charts are presented to facilitate the design of T-septum waveguides.



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Abstracts

Effective Impedance of a Load Filling a Circumferential Slot in a Coaxial Transmission Line (Short Papers)

A.D. Wunsch. "Effective Impedance of a Load Filling a Circumferential Slot in a Coaxial Transmission Line (Short Papers)." 1987 Transactions on Microwave Theory and Techniques 35.9 (Sep. 1987 [T-MTT]): 862-865.

A terminal load uniformly filling a narrow slot placed in the outer conductor of a coaxial transmission line presents a certain effective impedance to TEM waves propagating in the line. The relationship between this value of impedance and the voltage-to-current ratio at this load is established. The two are not necessarily equal. A numerical example is considered.



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Depth of Penetration of Fields from Rectangular Apertures Into Lossy Media (Short Papers)

E. Cheever, J.B. Leonard and K.R. Foster. "Depth of Penetration of Fields from Rectangular Apertures Into Lossy Media (Short Papers)." 1987 Transactions on Microwave Theory and Techniques 35.9 (Sep. 1987 [T-MTT]): 865-867.

A widely used device for biomedical applications of microwave energy is the dielectric-loaded waveguide operating in the TE/sub 10/ mode. We have calculated the (1/e) energy penetration depth from such antennas, modeled as rectangular apertures radiating into a lossy medium with dielectric properties resembling those of tissue. The results are presented in nondimensional form from which the characteristics of practical antennas can be estimated. Depending on the dielectric properties of the medium and the size of the aperture, the effective penetration depth can be limited by either the aperture size or the plane-wave penetration depth. Practical antennas fall between these two extremes. Experimental results confirm the calculations.

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



Cryogenic Operation of a Monolithic Slow-Wave Variable Phase Shifter (Short Papers)

C.M. Krowne and E.J. Cukauskas. "Cryogenic Operation of a Monolithic Slow-Wave Variable Phase Shifter (Short Papers)." 1987 Transactions on Microwave Theory and Techniques 35.9 (Sep. 1987 [T-MTT]): 868-871.

A GaAs slow-wave variable phase shifter has been investigated at 4.2, 77, and 300 K ambient temperatures over the 2-18-GHz frequency range. Differential phase shift $\Delta\theta$ has been measured and presented as a set of curves parameterized in terms of temperature covering the entire frequency range. Analytical explanations are provided for the phase shift θ and insertion loss L behavior as functions of temperature, frequency, and bias voltage. The Schottky microstrip line resistivity ratio at 77 K is found to vary between 4 and 6 over the frequency range studied, giving about a 5:1 reduction in resistivity (or a 2:1 reduction in L) by going to liquid nitrogen temperature.

Abstracts

On the Relationship Between TLM and Finite-Difference Methods for Maxwell's Equations (Comments)

W.K. Gwarek. "On the Relationship Between TLM and Finite-Difference Methods for Maxwell's Equations (Comments)." 1987 Transactions on Microwave Theory and Techniques 35.9 (Sep. 1987 [T-MTT]): 872-873.

In the above paper, Mr. Johns compares the finite-difference time-domain (FD-TD) and transmission-line matrix (TLM) methods and concludes that: In the three-dimensional TLM method operated in the above way, there are three field quantities available at each shunt and series node. This, for example, allows the boundary description for TLM to be twice as fine as for finite differences. In two dimensions, if boundaries are described only at nodes as in finite differences, the incident pulses need only be at alternate nodes at any instant. Thus, an average of two stores for link lines, not four, is required at each node.



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Indefinite Integrals Useful in the Analysis of Cylindrical Dielectric Resonators (Letters)

D. Kajfez. "Indefinite Integrals Useful in the Analysis of Cylindrical Dielectric Resonators (Letters)." 1987 Transactions on Microwave Theory and Techniques 35.9 (Sep. 1987 [T-MTT]): 873-874.

Little-known integrals are listed, useful for the evacuation of stored electric energy in cylindrical regions, such as often appear in the analysis of cylindrical dielectric resonators.

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



Abstracts

Patent Abstracts (Sep. 1987 [T-MTT])

"Patent Abstracts (Sep. 1987 [T-MTT])." 1987 Transactions on Microwave Theory and Techniques 35.9 (Sep. 1987 [T-MTT]): 875-879.



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Abstracts

Low-Temperature Electronics (Advertisement) (Sep. 1987 [T-MTT])

"Low-Temperature Electronics (Advertisement) (Sep. 1987 [T-MTT])." 1987 Transactions on Microwave Theory and Techniques 35.9 (Sep. 1987 [T-MTT]): 880-880.



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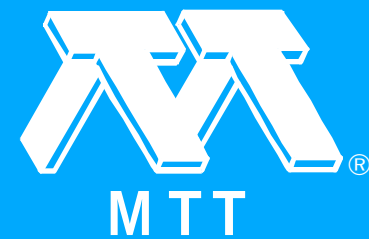
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Back Cover (Sep. 1987 [T-MTT])

"Back Cover (Sep. 1987 [T-MTT])." 1987 Transactions on Microwave Theory and Techniques 35.9 (Sep. 1987 [T-MTT]): b1-b2.



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Front Cover (Oct. 1987 [T-MTT])

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Dynamic Analysis of Microstrip Lines and Finlines on Uniaxial Anisotropic Substrates

M.R. De Garcia Maia, A.G. D'Assuncao and A.J. Giarola. "Dynamic Analysis of Microstrip Lines and Finlines on Uniaxial Anisotropic Substrates." 1987 Transactions on Microwave Theory and Techniques 35.10 (Oct. 1987 [T-MTT]): 881-886.

Dyadic Green's functions in the Fourier transform spectral domain are obtained for open microstrip lines and bilateral finlines on uniaxial anisotropic substrates. These functions are written in an impedance matrix form by expressing the electric and magnetic fields in terms of Hertz vector potentials oriented along the optical axis. In combination with Galerkin's method, they are used to obtain the propagation characteristics of single and parallel coupled microstrip lines on uniaxial anisotropic substrates having the optical axis in an arbitrary direction in a transverse plane and of bilateral finlines with the three optical axis orientations of the uniaxial anisotropic substrate that result in the diagonal permittivity tensor.

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



Abstracts

Proposal for a Boundary-Integral Method Without Using Green's Function

N. Kishi and T. Okoshi. "Proposal for a Boundary-Integral Method Without Using Green's Function." 1987 Transactions on Microwave Theory and Techniques 35.10 (Oct. 1987 [T-MTT]): 887-892.

A new method for solving electromagnetic boundary-value problems is presented. The new method is a modification of the conventional boundary-element method; the conventional method is modified by using the reciprocity theorem derived from Green's identity, making the use of Green's function unnecessary. To confirm the validity of the new method, numerical analyses are presented for Dirichlet- and Neumann-type boundary-value problems of a two-dimensional scalar wave equation.



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Theory of Time-Domain Quasi-TEM Modes in Inhomogeneous Multiconductor Lines

I.V. Lindell and Q. Gu. "Theory of Time-Domain Quasi-TEM Modes in Inhomogeneous Multiconductor Lines." 1987 Transactions on Microwave Theory and Techniques 35.10 (Oct. 1987 [T-MTT]): 893-897.

Theory for quasi-TEM modes propagating in a transversely inhomogeneous (multidielectric), longitudinally uniform transmission line, previously derived for time-harmonic waves, is derived for transient signals. It is seen that, while the starting point for the theory is completely different, the result is similar to the time-harmonic theory, and previously derived properties for propagating modes also apply in the transient case. The range of applicability is discussed with a simple example.

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



Abstracts

Analysis of Time Response of Lossy Multiconductor Transmission Line Networks

A.R. Djordjevic and T.K. Sarkar. "Analysis of Time Response of Lossy Multiconductor Transmission Line Networks." 1987 Transactions on Microwave Theory and Techniques 35.10 (Oct. 1987 [T-MTT]): 898-908.

Systems are considered consisting of an arbitrary number of multiconductor transmission lines joined and terminated by arbitrary linear networks. The lines are assumed to be lossy, with frequency-dependent parameters. The system is analyzed in the frequency domain, and the inverse Fourier transform is used to obtain the time-domain response.



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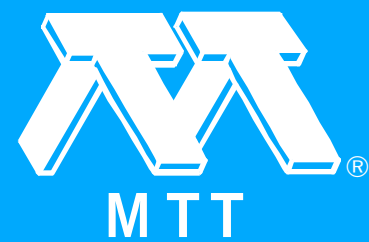
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9-GHz Complex Permittivity Measurements of High-Loss Liquids Using a Variable-Length Reflection Cavity and a Dual-Channel, Double Superheterodyne Signal Processing System

H.A. Buckmaster, T.H.T. Van Kalleveen, H. Zaghloul and C.H. Hansen. "9-GHz Complex Permittivity Measurements of High-Loss Liquids Using a Variable-Length Reflection Cavity and a Dual-Channel, Double Superheterodyne Signal Processing System." 1987 Transactions on Microwave Theory and Techniques 35.10 (Oct. 1987 [T-MTT]): 909-916.

This paper evaluates those factors which limit the accuracy with which microwave complex permittivity measurements of high-loss liquids can be made using a variable-length reflection sample cell spectrometer. Measurements made at 0.001-in increments from a cell length of 0.11 into 0.31 in were found to be statistically independent of the reflector diameter in the interval 0.5 in to 4.25 in. The data were analyzed using expressions for the amplitude and phase derived assuming a plane wave model. It is found that the permittivity ϵ' and the loss ϵ'' can be determined typically to a precision of 0.3 percent and 0.5 percent, respectively, using a 9.354-GHz dual-channel, double superheterodyne signal processing system. However, there is a discrepancy of about two standard deviations between the values of ϵ' and ϵ'' obtained from the phase data and those obtained from the amplitude data. Moreover, it is also found that the values of ϵ' and ϵ'' calculated from these data differ by more than three standard deviations from those obtained using a variable-length transmission sample cell and the same signal processing system. These discrepancies, which exceed 1 percent are attributed to deficiencies in the plane wave model. It has been confirmed using 0.011 and 0.051 mol l/sup -1/ KCl solutions that the sensitivity achievable with the reflection cell is less by a factor of 100 than that with a transmission sample cell, which is in agreement with the estimated precision obtainable with these two different types of sample cells.



Abstracts

GaAs Ultra-High-Speed Prescaler/Phase Frequency Comparator Using LSCFL (Short Papers)

K. Osafune, T. Takada, N. Kato and K. Ohwada. "GaAs Ultra-High-Speed Prescaler/Phase Frequency Comparator Using LSCFL (Short Papers)." 1987 Transactions on Microwave Theory and Techniques 35.10 (Oct. 1987 [T-MTT]): 917-918.

A high-speed, low-power prescaler/phase frequency comparator (PFC) medium scale integration (MSI) circuit for a phase-locked stable oscillator is designed and fabricated using GaAs MESFET low-power source-coupled FET logic (LSCFL) circuitry. The construction of the 1/64 frequency divider prescaler/PFC is designed to obtain high-speed and low-power operation. The fabrication process used is buried p-layer SAINT with a 0.5- μ m gate length. The fabricated prescaler/PFC MSI circuit, mounted on a newly developed high-frequency package, operates up to 7.6 GHz with a power dissipation of 730 mW.



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Application of a Projection Method to a Mode-Matching Solution for Microstrip Lines with Finite Metallization Thickness (Short Papers)

F. Bogelsack and I. Wolff. "Application of a Projection Method to a Mode-Matching Solution for Microstrip Lines with Finite Metallization Thickness (Short Papers)." 1987 Transactions on Microwave Theory and Techniques 35.10 (Oct. 1987 [T-MTT]): 918-921.

It will be demonstrated that the convergence behavior of the well-known mode-matching technique can be improved significantly by a general projection method. The advantage of this approach becomes obvious in the discussion of the electromagnetic field distribution near metal edges. The implementation is rather simple and will be described below. Numerical results and the validity of this method are discussed for shielded microstrip lines with finite metallization thickness.

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Parametric Equations for Surface Waves In Dielectric Slab (Short Papers)

J.C. Hantgan. "Parametric Equations for Surface Waves In Dielectric Slab (Short Papers)." 1987 Transactions on Microwave Theory and Techniques 35.10 (Oct. 1987 [T-MTT]): 921-922.

For the dielectric slab it is shown that 1) the dispersion curve for the n th surface wave can be found using parametric equations in which the normalized inside wavenumber K_{x1} and the mode number are the parameters, 2) the dispersion curve for the n th surface wave mode can also be found by using parametric equations in which the mode number and a modified wavenumber x' with common domain $[0, \pi/2]$ are the parameters, and 3) an TE or all TM dispersion curves for surface waves are related to each other by a simple algebraic equation using the mode numbers and the normalized propagation constants K_0 and β as the variables.

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GaAs Monolithic DC-6.4-GHz Variable-Gain Feedback Amplifier (Short Papers)

M. Shigaki, S. Yokogawa, H. Kurihara and K. Yamada. "GaAs Monolithic DC-6.4-GHz Variable-Gain Feedback Amplifier (Short Papers)." 1987 Transactions on Microwave Theory and Techniques 35.10 (Oct. 1987 [T-MTT]): 923-925.

A GaAs dc-6.4-GHz variable-gain two-stage feedback amplifier with 11 dB gain has been developed. The wide bandwidth is achieved by combining a microwave matching circuit with a direct-coupled circuit. This design improves the bandwidth significantly. This circuit also has a reduced chip size. Since no interstage capacitor is necessary, the chip size is only 0.5 x 1.5 mm². Active resistance was used in the second stage feedback circuit for variable gain. Au/WSi self-alignment technology with a 1- μ m gate length was used to improve the high-frequency characteristics of the FET.

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Abstracts

A Quasi-Static Analysis of Open-Ended Coaxial Lines (Short Papers)

D.K. Misra. "A Quasi-Static Analysis of Open-Ended Coaxial Lines (Short Papers)." 1987 Transactions on Microwave Theory and Techniques 35.10 (Oct. 1987 [T-MTT]): 925-928.

A quasi-static analysis of an open-ended coaxial line terminated by a semi-infinite medium on ground plane is presented in this paper. The analysis is based on a variation formulation of the problem. A comparison of results obtained by this method with the experimental and the other theoretical approaches shows an excellent agreement. This analysis is expected to be helpful in the inverse problem of calculating the permittivity of materials in vivo for a given input impedance of the coaxial line.



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Abstracts

Transient Analysis of Single and Coupled Lines with Capacitively-Loaded Junctions (Comments)

K.S. Olson, G.-W. Pan and B.K. Gilbert. "Transient Analysis of Single and Coupled Lines with Capacitively-Loaded Junctions (Comments)." 1987 Transactions on Microwave Theory and Techniques 35.10 (Oct. 1987 [T-MTT]): 929-930.

In the above paper, the authors have developed an analysis method for determining the transient behavior of a pair of coupled lines with a varied number of crossing strips--a method which appears to give correct results. Certain typographical errors occur within the paper and are pointed out here in order to assist those who are using the paper in their work.



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Abstracts

Impedance Calculation of Three Narrow Resonant Strips on the Transverse Plane of a Rectangular Waveguide (Comments)

A. Hongming. "Impedance Calculation of Three Narrow Resonant Strips on the Transverse Plane of a Rectangular Waveguide (Comments)." 1987 Transactions on Microwave Theory and Techniques 35.10 (Oct. 1987 [T-MTT]): 930-930.

It has been called to the author's attention that the solution of (5) in the above paper can be modified.



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"Patent Abstracts (Oct. 1987 [T-MTT])." 1987 Transactions on Microwave Theory and Techniques 35.10 (Oct. 1987 [T-MTT]): 931-934.



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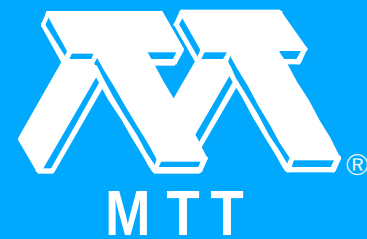
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Call for Papers - Quasi-Planar Millimeter-Wave Components and Subsystems (Oct. 1987 [T-MTT])

"Call for Papers - Quasi-Planar Millimeter-Wave Components and Subsystems (Oct. 1987 [T-MTT])." 1987 Transactions on Microwave Theory and Techniques 35.10 (Oct. 1987 [T-MTT]): 935-935.



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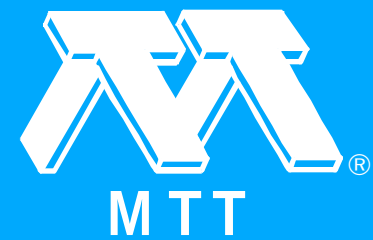
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Abstracts

IEEE on Microfilm (Advertisement) (Oct. 1987 [T-MTT])

"IEEE on Microfilm (Advertisement) (Oct. 1987 [T-MTT])." 1987 Transactions on Microwave Theory and Techniques 35.10 (Oct. 1987 [T-MTT]): 936-936.



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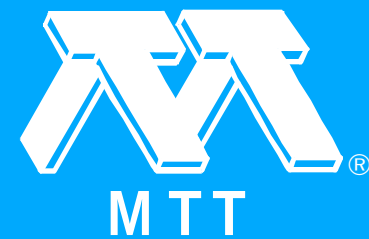
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Unified Approach to Wave Diffraction by Space-Time Periodic Anisotropic Media

K. Rokushima, J. Yamakita, S. Mori and K. Tominaga. "Unified Approach to Wave Diffraction by Space-Time Periodic Anisotropic Media." 1987 Transactions on Microwave Theory and Techniques 35.11 (Nov. 1987 [T-MTT]): 937-945.

The diffraction properties of electromagnetic waves propagating in a planar anisotropic medium with tensor permittivity which is modulated periodically with respect to space and time are analyzed by extending the previous theory for time-invariant anisotropic dielectric gratings. The method applies to any isotropic or anisotropic medium, any polarization of the incident plane wave, and any orientation of the grating vector. The analysis is formulated in a unified matrix form so that calculations can be performed systematically. As numerical examples of the general analysis, the optical diffractions by an acoustic wave in a birefringent crystal and by a cholesteric liquid crystal are treated, where the approximate two-wave analysis is also derived and the accuracy is discussed by comparison with the rigorous analysis.

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Single-Particle Motion in a Large-Orbit Gyrotron

H.P. Bluem, P.E. Latham, W.G. Lawson and C.D. Striffler. "Single-Particle Motion in a Large-Orbit Gyrotron." 1987 Transactions on Microwave Theory and Techniques 35.11 (Nov. 1987 [T-MTT]): 946-955.

The perturbation on the zeroth-order motion of individual particles in an axis-encircling, large-orbit gyrotron due to a constant-amplitude TE_{01n} electromagnetic (em) wave is studied analytically and numerically. Single-particle phenomena such as phase bunching and trapping are studied as a function of the frequency difference between the cyclotron motion and the em wave. Analytic solutions are developed for both trapped and untrapped particles and are compared with exact numerical results. The analytic solutions yield the percentage of trapped particles and an expression for the minimum em field necessary for trapping. It is shown that energy loss depends on first-order terms for trapped particles and on second-order terms for untrapped particles. A specific set of parameters is used to display the results.

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Characterization of the Finline Step Discontinuity on Anisotropic Substrates

H.-Y. Yang and N.G. Alexopoulos. "Characterization of the Finline Step Discontinuity on Anisotropic Substrates." 1987 Transactions on Microwave Theory and Techniques 35.11 (Nov. 1987 [T-MTT]): 956-963.

An analysis of the finline step discontinuity in either uniaxial or biaxial substrates is presented. The method is based on a spectral-domain hybrid-mode expansion in an enclosed finline cavity in conjunction with Galerkin's method. A numerically stable scattering matrix formulation is used. The effect of substrate anisotropy is described. The results are also compared with published experimental data or those by the modal matching method when the substrate is isotropic. The comparison shows very good agreement.

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Monolithic Capacitors as Transmission Lines

M. Ingalls and G. Kent. "Monolithic Capacitors as Transmission Lines." 1987 Transactions on Microwave Theory and Techniques 35.11 (Nov. 1987 [T-MTT]): 964-970.

The results of network analyzer measurements of high-Q multilayer (monolithic) chip capacitors show that the devices have the characteristics of open-circuited transmission lines. Both standard sizes (MIL-CDR-14 and MIL-CDR-12), ranging in capacitance values from 4.7 to 1000 pF, were tested on microstrip lines. A simple model of a periodically loaded line provides a dispersion relation that accounts for the distribution of resonant frequencies. The orientation of the capacitor with respect to the microstrip affects the occurrence and nature of resonances. This phenomenon is shown to result from a distributed excitation source. The unfolding of the capacitor to produce the periodic line is shown to produce anomalies in the dissipation loss when skin depth and electrode thickness are comparable.

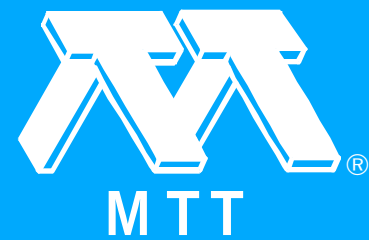


Abstracts

A Comparative Statistical Study of Some Proposed Six-Port Junction Designs

M. Berman, P.I. Somlo and M.J. Buckley. "A Comparative Statistical Study of Some Proposed Six-Port Junction Designs." 1987 Transactions on Microwave Theory and Techniques 35.11 (Nov. 1987 [T-MTT]): 971-977.

Reflection coefficient measurements obtained from six-port reflectometers are analyzed from a statistical and geometrical point of view. The analysis concentrates on the effect of using noisy power meters, and a simply computed, geometrically interpretable estimator of the reflection coefficient possessing certain optimality properties is derived. A suitable performance measure for this estimator is calculated for a number of different six-port designs as the true reflection coefficient ranges over the area of the Smith chart. For each design, a contour map of the measure allows for easy comparison of the designs in different regions of the Smith chart.



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A Coupled-Mode Approach to the Analysis of Fields in Space-Curved and Twisted Waveguides

X.-S. Fang and Z.-Q. Lin. "A Coupled-Mode Approach to the Analysis of Fields in Space-Curved and Twisted Waveguides." 1987 Transactions on Microwave Theory and Techniques 35.11 (Nov. 1987 [T-MTT]): 978-983.

A coupled-mode approach for solving Maxwell's equations in terms of unitary and reciprocal unitary vectors is deduced in a twisted space-curved coordinate system. Application of this method to the analysis of fields in a space-curved and twisted single-mode optical fiber and a twisted rectangular microwave waveguide is presented and compared with the results from existing literature.



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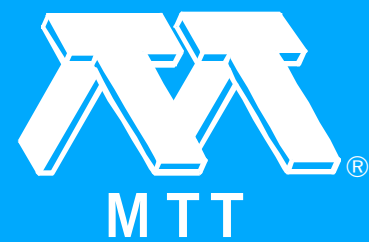
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Measurement of Shielding Effectiveness of Microwave-Protective Suits

A.W. Guy, C.-K. Chou, J.A. McDougall and C. Sorensen. "Measurement of Shielding Effectiveness of Microwave-Protective Suits." 1987 Transactions on Microwave Theory and Techniques 35.11 (Nov. 1987 [T-MTT]): 984-994.

With more restrictive exposure standards and greater public concern about safety from nonionizing radiation, protective clothing to shield workers from dangerous levels of electromagnetic radiation has become imminently important. Tests were conducted of the shielding effectiveness of a number of microwave suits. Fabric attenuations at 10 selected locations on the suit were measured by the waveguide-transmission-loss method to evaluate the material, and relative field strengths at the surface of a full-sized phantom man model exposed to 2450-MHz free-field radiation fields with and without the suit were measured to evaluate the entire suit. The ratio of the incident power required to produce the same output from a diode E-field sensor placed against the synthetic tissue of the model exposed with and without the suit was used as a measure of attenuation. The waveguide measurements are important for a comparative evaluation of the different fabrics, and the free-field measurements are important for evaluating the fabric as well as the suit design and configuration in shielding effectiveness. The Navy suit provided the best performance in terms of shielding effectiveness, with attenuation varying from 34.5 to 48.7 dB, but its flammability constitutes a safety hazard. The Wave Guard suit was second best, with attenuation varying from 13.2 to 35 dB. The Milliken (20.3-33.7 dB attenuation) and Invascreen (18.7-24.5 dB attenuation) suits provide acceptable protection for E-field polarization parallel to the long axis of the body, but poor protection (2.0- 19.2 dB for the former and 0.4-21.1 dB for the latter) for E-field polarization perpendicular to the body. Localized high-power-density exposures of up to 1000 mW/cm² for 1 h from a waveguide aperture did not cause material damage to any of the suit fabrics. The Milliken was the most fire retardant, but its shielding performance was the poorest, owing to the large number of openings at the pockets, cuffs, sleeves, and collar. The Invascreen suit is well designed to eliminate the problem, but the shielding of the fabric is less effective.

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Shielding Effectiveness of Improved Microwave-Protective Suits

C.-K. Chou, A.W. Guy and J.A. McDougall. "Shielding Effectiveness of Improved Microwave-Protective Suits." 1987 Transactions on Microwave Theory and Techniques 35.11 (Nov. 1987 [T-MTT]): 995-1001.

The shielding effectiveness of microwave-protective suits was determined by measuring the attenuation of sections of fabric by a waveguide-transmission-loss method. The attenuation of the entire suit on a full-sized phantom man model was determined by measuring the E fields at the surface of ten locations on the phantom by diode sensors during exposure to 915- and 2450-MHz radiation fields from standard gain horns in an anechoic chamber. The results indicate that both the material attenuation and the design of the suit contribute to its shielding effectiveness. A novel material which is fire retardant and provides good ventilation was tested. The attenuation of the fabric is 35 to 40 dB for the frequency range of 1.5 to 11 GHz and 28-35 dB for frequencies between 0.65 and 1.15 GHz. The final version of the suit has at least 25 dB shielding at 2450 MHz for the ten locations tested and 20 dB at 915 MHz at the head and torso of the model. It is concluded that the suit can provide good protection for microwave frequencies in the 0.65 to 11 GHz range in which the tests were made. More work is needed in developing a suit for broadcasting and shortwave bands.

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Capacitance and Inductance Matrices for Multistrip Structures in Multilayered Anisotropic Dielectrics

F. Medina and M. Horno. "Capacitance and Inductance Matrices for Multistrip Structures in Multilayered Anisotropic Dielectrics." 1987 Transactions on Microwave Theory and Techniques 35.11 (Nov. 1987 [T-MTT]): 1002-1008.

In this paper we present a unified variational approach to determine the capacitance and inductance matrices of generalized multistrip systems embedded in a multilayered iso/anisotropic dielectric lossless medium. The analysis is carried out in the spectral domain to take advantage of previously obtained recurrence relations which calculate the Green's function in the spectral domain. The method leads to a low-order system of linear equations, which is shown explicitly. Examples and comparison with previously published results have been included.

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



Abstracts

Finite Element Method Applied to Skin-Effect Problems in Strip Transmission Lines

G.I. Costache. "Finite Element Method Applied to Skin-Effect Problems in Strip Transmission Lines." 1987 Transactions on Microwave Theory and Techniques 35.11 (Nov. 1987 [T-MTT]): 1009-1013.

This paper describes a two-dimensional finite element approach to the quasi-static TEM analysis of shielded or open conducting strips with applications to VLSI parasitic elements and transmission line characteristics of printed circuits. The approach uses a combination of two-dimensional and one-dimensional finite elements to solve the field problems in terms of the magnetic vector potential in the frequency domain. The method and the algorithm can be applied to shielded or open conducting strips and takes into account the skin effect and proximity effect between structures. The ac resistance and reactance calculated by using this approach can be used as input parameters to a circuit analysis program such as SPICE or similar programs.



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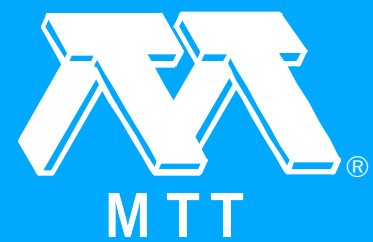
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Optoelectronic Pulse Compression of Microwave Signals

P. Paulus, L. Stoll and D. Jager. "Optoelectronic Pulse Compression of Microwave Signals." 1987 Transactions on Microwave Theory and Techniques 35.11 (Nov. 1987 [T-MTT]): 1014-1018.

Optically switched transmission line resonators are shown to generate short microwave pulses of higher output peak power than the CW input signal. This kind of pulse compression is achieved by using the resonator as a storage element and an optoelectronic switch as the output mirror. A theoretical analysis of the efficiency of this device is presented. Experimentally, a peak power enhancement of 14 has been observed at a frequency of 1 GHz. A comparison with numerical results is finally carried out.



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An Efficient Finite Element Method for Nonconvex Waveguide Based on Hermitian Polynomials

M. Israel and R. Miniowitz. "An Efficient Finite Element Method for Nonconvex Waveguide Based on Hermitian Polynomials." 1987 Transactions on Microwave Theory and Techniques 35.11 (Nov. 1987 [T-MTT]): 1019-1026.

An efficient finite element method (FEM.) in waveguide analysis is described. The method rises Hermitian polynomials to interpolate the field compohent ($E_{\text{sub } z}$ or $H_{\text{sub } z}$) and some of its derivatives at the nodal points, rather than the field components, as in the Lagrangian interpolation case. Element matrices, for a standard triangle, are given for third- and fifth-degree Hermitian polynomials. The appropriate transformations that relate the element matrices of a general triangle to the standard triangle element have been derived. Compared to the broadly used Lagrangian interpolation FEM, the Hermitian FEM has the following advantages 1) a significant reduction of the matrix order needed to compute the eigenvalues and eigenfunction; 2) smooth axial components ($E_{\text{sub } z}$ or $H_{\text{sub } z}$) and continuous transverse field components; 3) low-cost refinement of the mesh near nonconvex corners of the waveguide. These advantages are illustrated by comparing the FEM, with Hermitian polynomials solution, to other solutions for rectangular and ridged waveguides.



Abstracts

Surface-to-Surface Transition via Electromagnetic Coupling of Coplanar Waveguides

R.W. Jackson and D.W. Matolak. "Surface-to-Surface Transition via Electromagnetic Coupling of Coplanar Waveguides." 1987 Transactions on Microwave Theory and Techniques 35.11 (Nov. 1987 [T-MTT]): 1027-1032.

A transition is investigated which couples coplanar waveguide on one substrate surface (a motherboard) to coplanar waveguide on another substrate surface (a semiconductor chip or subarray) placed above the first. No wire bonds are necessary. A full-wave analysis using coupled line theory is presented and verified experimentally. The use of this transition for coupling to millimeter-wave integrated circuits is discussed.



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Radiation of Millimeter Waves from a Leaky Dielectric Waveguide with a Light-Induced Grating Layer

M. Matsumoto, M. Tsutsumi and N. Kumagai. "Radiation of Millimeter Waves from a Leaky Dielectric Waveguide with a Light-Induced Grating Layer." 1987 Transactions on Microwave Theory and Techniques 35.11 (Nov. 1987 [T-MTT]): 1033-1042.

A theoretical analysis is presented for the radiation characteristics of millimeter waves in a periodic dielectric waveguide having a light-induced grating layer. The waveguide is assumed to be composed of an insulator (sapphire) slab whose one surface is coated with a high-resistivity semiconductor (silicon) film. A boundary-integral-equation formulation is employed to obtain characteristic solutions of the waveguide. Numerical calculations are made at 94 GHz for both TM and TE polarizations. Estimations of the illumination power required to produce the grating are given. The waveguide presented in this paper, in conjunction with a high-power semiconductor diode laser array as a light source, may be developed to operate as an electronically beam-steerable leaky-wave antenna at millimeter-wave frequencies.

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Coupling Between an Abruptly Terminated Optical Fiber and a Dielectric Planar Waveguide

C.N. Capsalis and N.K. Uzunoglu. "Coupling Between an Abruptly Terminated Optical Fiber and a Dielectric Planar Waveguide." 1987 Transactions on Microwave Theory and Techniques 35.11 (Nov. 1987 [T-MTT]): 1043-1051.

The coupling between an optical fiber and a dielectric planar waveguide is analyzed when both guides are terminated abruptly and are facing each other. Mixed spectrum eigenwave representations of fields are employed inside the waveguides while Fourier integrals are utilized to describe the field in the space between the two guides. A coupled system of integral equations is derived by satisfying the boundary conditions on the terminal planes of both waveguides. A weak guidance approximation is assumed to facilitate the analysis. Numerical results are presented for several coupling geometries. Misalignment losses and coupling optimization phenomena are investigated.

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Optimized E-Plane T-Junction Series Power Dividers

F. Arndt, I. Ahrens, U. Papziner, U. Wiechmann and R. Wilkeit. "Optimized E-Plane T-Junction Series Power Dividers." 1987 Transactions on Microwave Theory and Techniques 35.11 (Nov. 1987 [T-MTT]): 1052-1059.

A rigorous design theory for compact rectangular waveguide power dividers with unsymmetrical series E-plane T-junctions of suitably optimized different waveguide heights and distances is described. The method is based on field expansion in normalized eigenmodes which yield directly the modal S-matrix of two appropriate key building blocks. The immediate modal S-matrix combination of the individual structures includes the effects of all step discontinuities and their mutual higher order mode interaction. Computer-optimized -3.01 dB, -4.77 dB, and -6.02 dB power divider examples achieve about ± 0.25 dB coupling deviation at the output ports, together with about 30 dB return loss at the input port, for the chosen design frequencies of 12 GHz, 31.6 GHz, and 15.5 GHz. The -4.77 dB power divider provides a bandwidth of about 8 percent. The theory is verified by measurements.

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



Abstracts

Improved Error-Correction Technique for Large-Signal Load-Pull Measurements (Short Papers)

I. Hecht. "Improved Error-Correction Technique for Large-Signal Load-Pull Measurements (Short Papers)." 1987 Transactions on Microwave Theory and Techniques 35.11 (Nov. 1987 [T-MTT]): 1060-1062.

This article presents an improved vector error-corrected calibration technique for the well-known system used for large-signal characterization of oscillator and power amplifier transistors. The calibration procedure is very similar to conventional automatic network analyzer calibration procedures, and all its measurements, except for one power measurement, are performed by the system itself. Therefore, reflection coefficient and power level measurement accuracies of the system at both the input and output ports of the DUT are excellent, and are of the same order of magnitude as those of the automatic network analyzer.



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Latching Ferrite Quadrupole-Field Devices (Short Papers)

Y. Xu. "Latching Ferrite Quadrupole-Field Devices (Short Papers)." 1987 Transactions on Microwave Theory and Techniques 35.11 (Nov. 1987 [T-MTT]): 1062-1065.

In this paper a brief survey of research and development on latching ferrite quadrupole-field devices in China is presented. Initially, theoretical analyses and some general roles for these kinds of devices are given. Some practical construction techniques and experimental results are also presented. Finally, many practical devices are described (e.g. reciprocal phase shifters with fast switching polarizations, reciprocal phase shifters with transverse magnetization, duplex phase shifters). In general, latching ferrite quadrupole-field devices have many advantages, among them simplicity, ruggedness, and rapid switching.

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Generalized Lorentz Gauge and Boundary Conditions in Partially Dielectric-Loaded Cylindrical Waveguide (Short Papers)

J.-S. Choi, D.-I. Choi and S.-C. Yang. "Generalized Lorentz Gauge and Boundary Conditions in Partially Dielectric-Loaded Cylindrical Waveguide (Short Papers)." 1987 Transactions on Microwave Theory and Techniques 35.11 (Nov. 1987 [T-MTT]): 1065-1066.

A generalized Lorentz gauge condition for the set of Vlasov-Maxwell equations is introduced. The condition is applied to the free-electron-laser instability of a relativistic electron beam in a partially dielectric-loaded waveguide. For the dielectric-loaded system with the external wiggler magnetic field, the potential approach with the generalized Lorentz gauge rather than the field approach is shown to be more convenient in the self-consistent study of free-electron-laser instability. We also derive the boundary conditions for potentials to be satisfied at the vacuum-dielectric interface and show that they are equivalent to the B_{θ} and E_{θ} continuous conditions in the field approach. An example is discussed to illustrate the equivalence between the two approaches of potentials and fields.

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SIS Mixer to HEMT Amplifier Optimum Coupling Network (Short Papers)

S. Weinreb. "SIS Mixer to HEMT Amplifier Optimum Coupling Network (Short Papers)." 1987 Transactions on Microwave Theory and Techniques 35.11 (Nov. 1987 [T-MTT]): 1067-1069.

The coupling network between a superconductor-insulator-superconductor (SIS) mixer and a high-electron-mobility-transistor (HEMT) amplifier is investigated from the point of view of minimizing the overall noise temperature and also increasing the saturation level of the mixer. The effect of a negative output impedance of the mixer upon the amplifier noise is considered and an optimum negative source resistance is found. The amplifier noise at this optimum negative source resistance is shown to be related to the noise wave coming out of the amplifier input terminals. Key words: SIS, HEMT, low-noise, negative resistance.

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Abstracts

Plotting Vector Fields with a Personal Computer (Short Papers)

D. Kajfez and J.A. Gerald. "Plotting Vector Fields with a Personal Computer (Short Papers)." 1987 Transactions on Microwave Theory and Techniques 35.11 (Nov. 1987 [T-MTT]): 1069-1072.

A combination of a personal computer and an x-y plotter is utilized for generating high-quality graphical displays of vector fields. The input data file must specify values of the vector field at a number of equidistant points. Starting points of field lines are determined so that the partial fluxes between any two adjacent field lines are made equal to each other. The construction of the field lines proceeds in a two-step method, utilizing the interpolated values of the field data.



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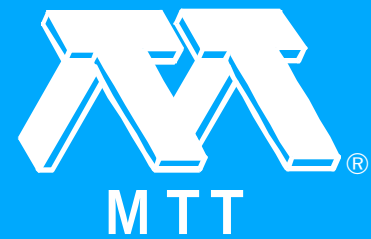


Abstracts

Design of Coupled Microstrip Lines by Optimization Methods (Short Papers)

S. Rosloniec. "Design of Coupled Microstrip Lines by Optimization Methods (Short Papers)." 1987 Transactions on Microwave Theory and Techniques 35.11 (Nov. 1987 [T-MTT]): 1072-1074.

The design of two coupled microstrip lines is converted into an optimization problem, which is then solved by two methods of nonlinear mathematical programming. New formulas for calculating the first approximation of the solution, i.e., the starting point of the optimization, are given.



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Accuracy of Equations for Coupled Slab Lines (Letters)

P.W. Van der Walt. "Accuracy of Equations for Coupled Slab Lines (Letters)." 1987 Transactions on Microwave Theory and Techniques 35.11 (Nov. 1987 [T-MTT]): 1075-1076.

The determination of the characteristic impedance of coupled slab lines has been a subject of investigation for many years. Following on Frankel's pioneering work, Chisholm obtained an accurate analytical solution for the odd-mode impedance of a pair of coupled slab lines. In 1980, Levy presented Chisholm's equations, together with those due to McDermott for the even-mode impedance, in a general form suitable for calculation. He also confirmed the accuracy of the equations with an efficient numerical procedure.

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Abstracts

New Quasi-Static Models for the Computer-Aided Design of Suspended and Inverted Microstrip Lines (Corrections)

P. Bhartia. "New Quasi-Static Models for the Computer-Aided Design of Suspended and Inverted Microstrip Lines (Corrections)." 1987 Transactions on Microwave Theory and Techniques 35.11 (Nov. 1987 [T-MTT]): 1076-1076.

The following errors appeared in the equations of the above paper.



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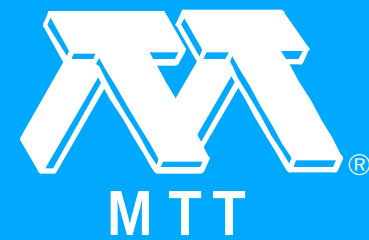
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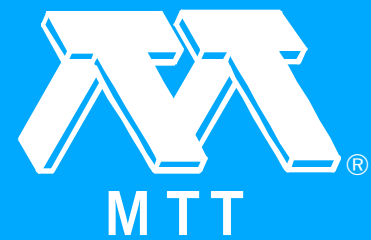
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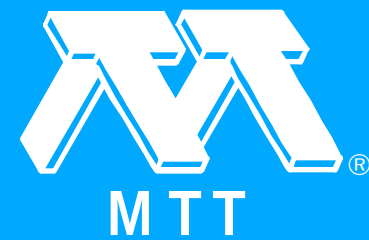
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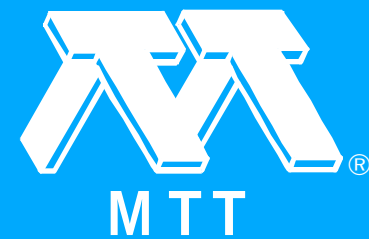
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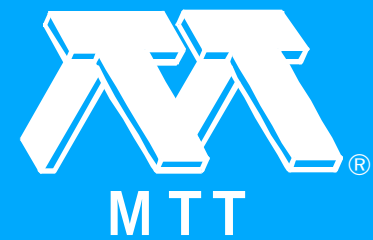
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Abstracts

Editor's Overview (Dec. 1987 [T-MTT])

V.K. Tripathi. "Editor's Overview (Dec. 1987 [T-MTT])." 1987 Transactions on Microwave Theory and Techniques 35.12 (Dec. 1987 [T-MTT] (1987 Symposium Issue)): 1087-1087.

This special issue of the Transactions on Microwave Theory and Techniques represents the final chapter in the 1987 International Microwave Symposium activities. The 1987 MTT-S International Microwave Symposium and the Microwave and Millimeter Wave Monolithic Circuits Symposium were held in Las Vegas.



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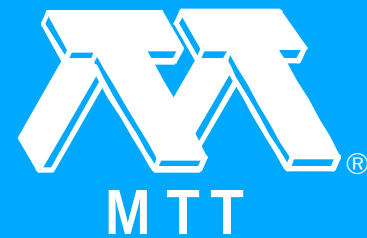
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S.L. March. "1987 MTT-S International Microwave Symposium (Dec. 1987 [T-MTT])." 1987 Transactions on Microwave Theory and Techniques 35.12 (Dec. 1987 [T-MTT] (1987 Symposium Issue)): 1089-1099.



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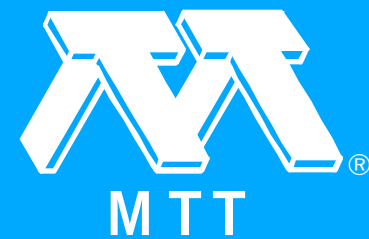
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L. Besser. "1987 IEEE MTT-S International Microwave Symposium Keynote Address (Dec. 1987 [T-MTT])." 1987 Transactions on Microwave Theory and Techniques 35.12 (Dec. 1987 [T-MTT] (1987 Symposium Issue)): 1105-1111.



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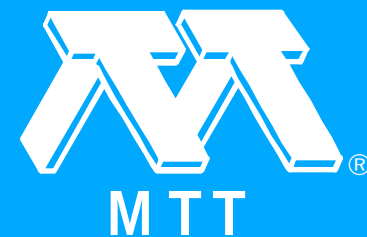
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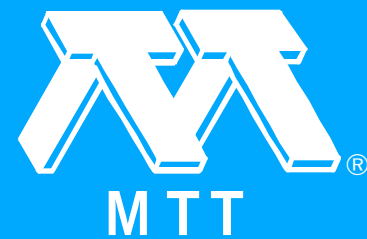
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Table of Contents, 1987 IEEE Microwave and Millimeter-Wave Monolithic Circuits Symposium Digest (Dec. 1987 [T-MTT])

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Millimeter-Wave Characteristics of Phase-Correcting Fresnel Zone Plates

D.N. Black and J.C. Wiltse. "Millimeter-Wave Characteristics of Phase-Correcting Fresnel Zone Plates." 1987 Transactions on Microwave Theory and Techniques 35.12 (Dec. 1987 [T-MTT] (1987 Symposium Issue)): 1122-1129.

A focusing element called the phase-correcting Fresnel zone plate is described, and its characteristics are given when used in the millimeter-wave region for imaging or frequency filtering in place of a lens. Two versions are discussed, one where alternate concentric annular grooves are cut in a single piece of low-loss dielectric, and a second where two (or more) dielectrics are used in alternate concentric rings. For the latter case, an appropriate choice of parameters produces a design of constant thickness (i.e., a flat disk), named the "planar lens." Design formulas and curves, as well as measured results, are given for both types, and an analytical description is derived for the far-field patterns. Compared with lenses, zone plates are simpler to construct and have lower absorption loss, thickness, and weight.

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Canonical and Longitudinal Dual-Mode Dielectric Resonator Filters without Iris

K.A. Zaki, C. Chen and A.E. Atia. "Canonical and Longitudinal Dual-Mode Dielectric Resonator Filters without Iris." 1987 Transactions on Microwave Theory and Techniques 35.12 (Dec. 1987 [T-MTT] (1987 Symposium Issue)): 1130-1135.

Two bandpass filter realizations using dual-mode dielectric resonators in simple tubular enclosures are described. The new configurations do not require iris to achieve the couplings among the resonators. This eliminates the need for the most expensive machined parts of the filters, which require tight tolerances. The realizations also achieve lower midband insertion losses than comparable filters with iris, because conduction currents on the metallic cavity ends are eliminated. Measured results on two four-pole elliptic function experimental filters realized in the new structures agreed closely with theory.

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Coupling of Non-Axially Symmetric Hybrid Modes in Dielectric Resonators

K.A. Zaki and C. Chen. "Coupling of Non-Axially Symmetric Hybrid Modes in Dielectric Resonators." 1987 Transactions on Microwave Theory and Techniques 35.12 (Dec. 1987 [T-MTT] (1987 Symposium Issue)): 1136-1142.

A method for the rigorous calculation of the coupling coefficient between dielectric resonators excited in non-axially symmetric hybrid modes is developed. A simplified model is derived which allows approximate accurate calculations of coupling, without solving the detailed boundary value problem. Experimental measurements of the coupling between the two lowest hybrid modes were performed to verify the models, and are found to be in excellent agreement with the calculations.

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Application of Dual TM Modes to Triple- and Quadruple-Mode Filters

R.R. Bonetti and A.E. Williams. "Application of Dual TM Modes to Triple- and Quadruple-Mode Filters." 1987 Transactions on Microwave Theory and Techniques 35.12 (Dec. 1987 [T-MTT] (1987 Symposium Issue)): 1143-1149.

The cylindrical cavity dual orthogonal transverse magnetic (TM) mode is introduced as a basic building block for the realization of microwave multiple-coupled-cavity bandpass filters. This concept is shown to offer significant advantages in the design of triple-mode filters and permits the design of the new quadruple-mode filter. Experimental verification is provided by the realization of a triple-mode, six-pole elliptic function bandpass filter with dual TM/sub 110/ and single TE/sub 211/ (transverse electric) modes and a quadruple-mode, eight-pole bandpass filter with dual TM/sub 110/ and dual TE/sub 112/ mode cavities. All units exhibit good agreement between theory and experiment.

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Dielectric High-Power Bandpass Filter Using Quarter-Cut TE/sub 01delta/ Image Resonator for Cellular Base Stations (Dec. 1987 [T-MTT])

T. Nishikawa, K. Wakino, K. Tsunoda and Y. Ishikawa. "Dielectric High-Power Bandpass Filter Using Quarter-Cut TE/sub 01delta/ Image Resonator for Cellular Base Stations (Dec. 1987 [T-MTT])." 1987 Transactions on Microwave Theory and Techniques 35.12 (Dec. 1987 [T-MTT] (1987 Symposium Issue)): 1150-1155.

A dielectric high-power bandpass filter using "quarter-cut TE/sub 01delta/ image resonators" has been developed. The resonator has a high unloaded Q over 7000 and its construction provides a sufficient thermal diffusion path to the metal housing. The insertion loss and the attenuation level of the eight-pole elliptic function type filter are 0.37 dB and 95 dB, respectively. The physical size of the dielectric filter is 280x135x 65 mm, one third to one fifth the volume of conventional cavity resonator filters.

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Precise Design of a Bandpass Filter Using High-Q Dielectric Ring Resonators

Y. Kobayashi and M. Minegishi. "Precise Design of a Bandpass Filter Using High-Q Dielectric Ring Resonators." 1987 Transactions on Microwave Theory and Techniques 35.12 (Dec. 1987 [T-MTT] (1987 Symposium Issue)): 1156-1160.

A precise design is presented for a bandpass filter constructed by placing TE_{01δ} dielectric ring resonators coaxially in a TE₀₁ cutoff circular waveguide. On the basis of a rigorous analysis by the mode-matching technique, the interresonator coupling coefficients are determined accurately from the calculation of two resonant frequencies f_{sh} and f_{op} when the structurally symmetric plane is short- and open-circuited. For the TE_{01δ} ring resonator, the resonant frequency f_0 , the temperature coefficient τ_f , the unloaded Q(Q_u), and the other resonances are also calculated accurately in a similar way. From the calculations, the optimum dimensions are determined to obtain the maximum Q_u , as $F_r = f_r / f_0$ is kept constant, where f_r is the next higher resonant frequency the ring resonator using low-loss ceramics ($\epsilon_r = 24.3$, $\tan \delta = 5 \times 10^{-5}$) has $Q_u = 16800$ at 12 GHz and $\tau_f = 0.1 \pm 0.5$ ppm/°C, while the rod one has $Q_u = 14700$. A four-stage Chebyshev filter having ripple of 0.04 dB and equiripple bandwidth of 27.3 MHz at $f_0 = 11.958$ GHz is fabricated using these resonator; the measured frequency responses agree well with theory. The insertion loss is 0.9 dB, which corresponds to $Q_u = 9800$.





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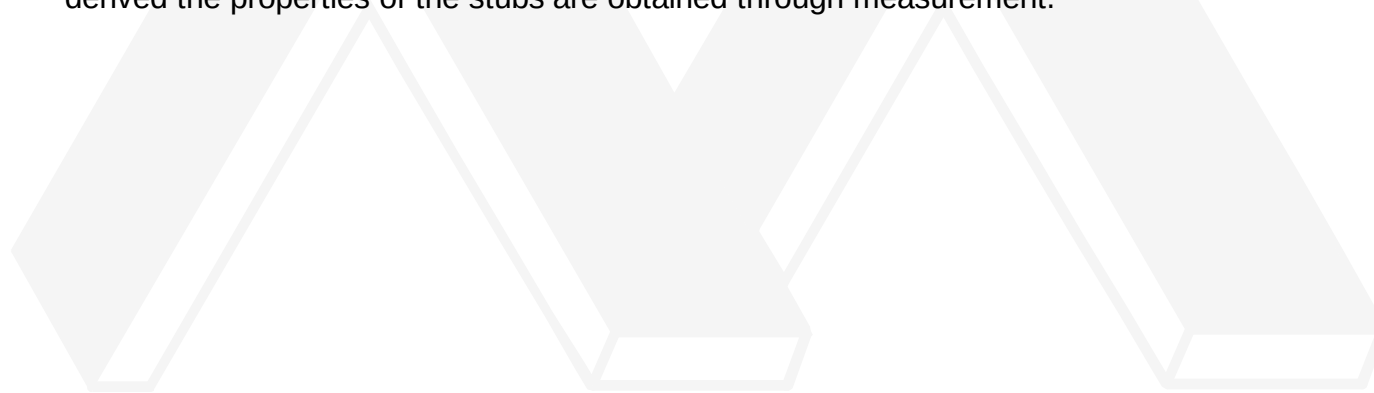
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Bandstop Filter in Nonradiative Dielectric Waveguide Using Rectangular Resonators (Dec. 1987 [T-MTT])

J.A.G. Malherbe and J.C. Coetzee. "Bandstop Filter in Nonradiative Dielectric Waveguide Using Rectangular Resonators (Dec. 1987 [T-MTT])." 1987 Transactions on Microwave Theory and Techniques 35.12 (Dec. 1987 [T-MTT] (1987 Symposium Issue)): 1161-1163.

A bandstop filter realized by means of rectangular resonators coupled to the center dielectric strip of a nonradiative dielectric (NRD) waveguide is described. This filter has the advantage that it is simple to manufacture, making use of a center dielectric of standard cross section. The design procedure is similar to the conventional strip line design procedure, with the stubs replaced by "stubs" of dielectric, or resonators. The design equations for the stub coupling are derived the properties of the stubs are obtained through measurement.



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Abstracts

Performance of Acoustic Charge Transport Chirp Filters (Dec. 1987 [T-MTT])

F.M. Fliegel, R.L. Martin and F. Guediri. "Performance of Acoustic Charge Transport Chirp Filters (Dec. 1987 [T-MTT])." 1987 Transactions on Microwave Theory and Techniques 35.12 (Dec. 1987 [T-MTT] (1987 Symposium Issue)): 1164-1168.

The measured performance of acoustic charge transport (ACT) based linear FM dispersive delay line filters is presented and compared to modelled performance. The excellent agreement between the theoretically predicted device performance and the measured results shows clearly that anodization of the nondestructive sensing array is an effective means for achieving weighted ACT filter responses.



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Abstracts

Whispering-Gallery Modes of Dielectric Structures: Applications to Millimeter-Wave Bandstop Filters (Dec. 1987 [T-MTT])

X.H. Jiao, P. Guillon, L.A. Bermudez and P. Auxemery. "Whispering-Gallery Modes of Dielectric Structures: Applications to Millimeter-Wave Bandstop Filters (Dec. 1987 [T-MTT])." 1987 Transactions on Microwave Theory and Techniques 35.12 (Dec. 1987 [T-MTT] (1987 Symposium Issue)): 1169-1175.

The purpose of this paper is to show the feasibility of millimeter-wave resonators utilizing whispering-gallery (WG) modes excited in planar and cylindrical dielectric structures. Measured resonant frequencies and quality factors in Ka- and W-bands are reported. Their applications to millimeter-wave integrated circuits are also dealt with. For this, a bandstop filter obtained by coupling two WG-mode dielectric resonators to a dielectric image guide is presented at about 35 GHz.



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Abstracts

Compact Grating Structure for Application to Filters and Resonators in Monolithic Microwave Integrated Circuits

T.-H. Wang and T. Itoh. "Compact Grating Structure for Application to Filters and Resonators in Monolithic Microwave Integrated Circuits." 1987 Transactions on Microwave Theory and Techniques 35.12 (Dec. 1987 [T-MTT] (1987 Symposium Issue)): 1176-1182.

Possible high-Q circuits based on a new crosstie overlay slow-wave structure are proposed for monolithic microwave integrated circuits. Configurations and results of slow-wave factors are presented. This structure is used for construction of a frequency-selective reflector with a compact size. The effect of loss is considered.



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Abstracts

The Use of Matched Four-Port Filters to Realize Switched Multiplexer Having Low Amplitude and Group Delay Ripple

C.I. Mobbs. "The Use of Matched Four-Port Filters to Realize Switched Multiplexer Having Low Amplitude and Group Delay Ripple." 1987 Transactions on Microwave Theory and Techniques 35.12 (Dec. 1987 [T-MTT] (1987 Symposium Issue)): 1183-1191.

A design method for channelizers and multiplexers is presented with particular emphasis on simplicity of design and alignment. By using two recombining multiplexers, one for the odd-numbered channels and one for the even-numbered channels, a high-performance switched multiplexer may be realized. The key to this performance is a multiplexer based on channel filters with integral hybrids which is designed to be matched in both passband and stopband. The design criteria for such devices are presented for filters having finite Q structures. An eight-channel switched multiplexer in S-band is described, with experimental results in close agreement with theory.



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Abstracts

A 0.5-4.0-GHz Tunable Bandpass Filter Using YIG Film Grown by LPE (Dec. 1987 [T-MTT])

Y. Murakami, T. Ohgihara and T. Okamoto. "A 0.5-4.0-GHz Tunable Bandpass Filter Using YIG Film Grown by LPE (Dec. 1987 [T-MTT])." 1987 Transactions on Microwave Theory and Techniques 35.12 (Dec. 1987 [T-MTT] (1987 Symposium Issue)): 1192-1198.

A tunable bandpass filter using YIG film grown by liquid phase epitaxy (LPE) has been developed. Taking advantage of the very low resonance frequency in the perpendicular resonance of YIG film, an operation frequency of 0.5 GHz has been achieved. In order to make this filter operate up to 4.0 GHz, a new technique for multioctave tuning has been developed and applied to the filter. Over the wide tuning range from 0.5 GHz to 4.0 GHz, low insertion loss and high spurious suppression have been achieved. The performance of this filter satisfies the requirements for use as a tracking preselector in a microwave spectrum analyzer.



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Abstracts

The Deformable-Channel Model - A New Approach to High-Frequency MESFET Modeling (Dec. 1987 [T-MTT])

F.J. Crowne, A. Eskandarian, H.B. Sequeira and R. Jakhete. "The Deformable-Channel Model - A New Approach to High-Frequency MESFET Modeling (Dec. 1987 [T-MTT])." 1987 Transactions on Microwave Theory and Techniques 35.12 (Dec. 1987 [T-MTT] (1987 Symposium Issue)): 1199-1207.

High-frequency small-signal circuit parameters are evaluated for a saturated-channel MESFET by including transit-time effects in a rigorous way through a study of induced shape changes in the saturated-channel region. Results agree well with empirical equivalent-circuit parameters for a physical MESFET.



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Microwave Noise Characterization of GaAs MESFET's: Evaluation by On-Wafer Low-Frequency Output Noise Current Measurement

M.S. Gupta, O. Pitzalis, Jr., S.E. Rosenbaum and P.T. Greiling. "Microwave Noise Characterization of GaAs MESFET's: Evaluation by On-Wafer Low-Frequency Output Noise Current Measurement." 1987 Transactions on Microwave Theory and Techniques 35.12 (Dec. 1987 [T-MTT] (1987 Symposium Issue)): 1208-1218.

A simplified noise equivalent circuit is presented for submicron-gate-length MESFET's in the common-source configuration, consisting of five linear circuit elements: the gate-to source capacitance C_{gs} , the total input resistance R_T , the transconductance g_m , the output resistance R_O , and a noise current source of spectral density S_{io} at the output port. All of these elements can be determined by on-wafer measurements, and the noise current can be measured at a low frequency. The minimum noise figure of the device calculated from this model, as well as the bias and frequency dependence of the noise figure, is shown to be in agreement with microwave noise figure measurements. Thus a technique has been established for determination of the minimum noise figure of a device solely by on-wafer measurements rather than by the usual microwave measurements. The proposed technique can be employed rapidly, conveniently, without the need for tuning, and at the wafer stage of device fabrication.





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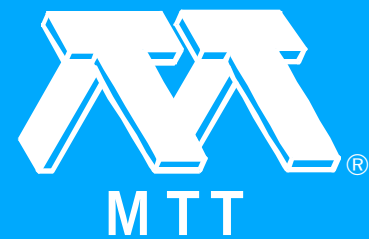
A New Type of Fast-Switching Dual-Mode Ferrite Phase Shifter

W.E. Hord, C.R. Boyd, Jr. and D. Diaz. "A New Type of Fast-Switching Dual-Mode Ferrite Phase Shifter." 1987 Transactions on Microwave Theory and Techniques 35.12 (Dec. 1987 [T-MTT] (1987 Symposium Issue)): 1219-1225.

A new type of dual-mode phase shifter which uses a transversely magnetized variable field section is described. The device retains the features of the conventional dual-mode phase shifter--low insertion loss, moderate amplitude modulation, adequate frequency bandwidth, simple physical geometry-- which allow it to be considered for use in two-dimensional scanning arrays. However, because of the transverse magnetizing field, the shorted-turn resistance is increased, which results in either reduced switching time or reduced switching energy when compared with the conventional dual-mode unit which utilizes a longitudinal magnetizing field.

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Magnetostatic Waves in a Normally Magnetized Waveguide Structure (Dec. 1987 [T-MTT])

M. Radmanesh, C.-M. Chu and G.I. Haddad. "Magnetostatic Waves in a Normally Magnetized Waveguide Structure (Dec. 1987 [T-MTT])." 1987 Transactions on Microwave Theory and Techniques 35.12 (Dec. 1987 [T-MTT] (1987 Symposium Issue)): 1226-1230.

In this paper, the propagation of magnetostatic waves (MSW's) in a normally magnetized low-loss ferrite slab (such as a yttrium iron garnet (YIG) slab) placed inside a waveguide is investigated theoretically. This case has never been studied before, and is analyzed here for the first time. A dispersion relation for the modes of propagation in terms of an infinite determinant can be obtained. With proper truncation procedures, sample numerical calculations for dispersion relations and group time delay per unit length were obtained and are presented herein. The general formulation in this paper contains all the information provided by the degenerate cases previously published. One special case of interest, i.e., that of a multilayer planar structure, is derived from our general formulation. The derivations of other special cases follow the same procedure.

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An Automatic Decomposition Approach to Optimization of Large Microwave Systems

J.W. Bandler and Q.-J. Zhang. "An Automatic Decomposition Approach to Optimization of Large Microwave Systems." 1987 Transactions on Microwave Theory and Techniques 35.12 (Dec. 1987 [T-MTT] (1987 Symposium Issue)): 1231-1239.

We present a novel and general technique applicable to the optimization of large microwave systems. Using sensitivity information obtained from a suitable Monte Carlo analysis, we extract possible decomposition properties which could otherwise be deduced only through a detailed physical and topological investigation. The overall problem is automatically separated into a sequence of subproblems, each being characterized by the optimization of a subset of circuit functions w.r.t. variables which are sensitive to the selected responses. A heuristic algorithm for automatic decomposition is developed. The decomposition patterns are dynamically updated until a satisfactory solution is reached. The partitioning approach proposed by Kondoh for FET modeling problems is verified. The technique was successfully tested on large-scale optimization of microwave multiplexer involving 16 channels, 399 nonlinear functions, and 240 variables.

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Abstracts

An Adaptive Spectral Response Modeling Procedure for Multiport Microwave Circuits

J.-F. Lee and Z.J. Cendes. "An Adaptive Spectral Response Modeling Procedure for Multiport Microwave Circuits." 1987 Transactions on Microwave Theory and Techniques 35.12 (Dec. 1987 [T-MTT] (1987 Symposium Issue)): 1240-1247.

An adaptive scheme is proposed to generate the spectral response of waveguide junctions in minimum computation time. The procedure uses the newly developed transfinite element method to determine the fields in junctions at a few adaptively selected frequencies and then employs these solutions to generate the spectral response throughout the frequency range of interest. In typical problems, the method converges in five or six iterations to the full spectral response evaluated at 100 points. We show by solving example problems that the new procedure is orders of magnitude faster than the alternatives.



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Generalized Power Series Analysis of Intermodulation Distortion in a MESFET Amplifier: Simulation and Experiment (Dec. 1987 [T-MTT])

G.W. Rhyne and M.B. Steer. "Generalized Power Series Analysis of Intermodulation Distortion in a MESFET Amplifier: Simulation and Experiment (Dec. 1987 [T-MTT])." 1987 Transactions on Microwave Theory and Techniques 35.12 (Dec. 1987 [T-MTT] (1987 Symposium Issue)): 1248-1255.

The design of microwave integrated circuits requires accurate simulation tools capable of predicting a variety of nonlinear distortion effects, including gain compression and intermodulation distortion. This paper uses the recently developed generalized power series analysis to simulate a MESFET amplifier. The simulations are in agreement with experimental results for single-tone and two-tone inputs, thereby validating the analysis method. This analysis is suited to nonlinear microwave circuits having arbitrarily spaced input frequencies.

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Abstracts

Measurements and Modeling of Kinetic Inductance Microstrip Delay Lines (Dec. 1987 [T-MTT])

J.M. Pond, J.H. Claassen and W.L. Carter. "Measurements and Modeling of Kinetic Inductance Microstrip Delay Lines (Dec. 1987 [T-MTT])." 1987 Transactions on Microwave Theory and Techniques 35.12 (Dec. 1987 [T-MTT] (1987 Symposium Issue)): 1256-1262.

Superconducting microstrip, with phase velocities of about $0.01c$, employing kinetic inductance have been fabricated using niobium nitride and a silicon dielectric. Delay lines using this phenomenon have several advantages for analog signal processing, including low loss and very compact size. Measurements of kinetic inductance microstrip delay lines were made in the frequency domain and the time domain. The results were compared to theoretical predictions and an accurate circuit model was developed. The circuit model was used to determine the frequency- and temperature-dependent losses of the delay line.



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Abstracts

Experimental Characterization of Multimode Microwave Resonators Using Automated Network Analyzer

W.P. Wheless, Jr. and D. Kajfez. "Experimental Characterization of Multimode Microwave Resonators Using Automated Network Analyzer." 1987 Transactions on Microwave Theory and Techniques 35.12 (Dec. 1987 [T-MTT] (1987 Symposium Issue)): 1263-1270.

A computer-assisted procedure for accurate determination of microwave resonator lumped-element equivalent circuit parameters is described. The technique is based on vector network analyzer measurements, and is applicable to multiple resonant modes in close frequency proximity as well as isolated single resonances. Data from either reflection or reaction type measurements may be numerically processed by the same procedure. Results are presented and discussed for several shielded dielectric resonator cases of practical interest.



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Microstrip-Fed Planar Frequency-Multiplying Space Combiner

S. Nam, T. Uwano and T. Itoh. "Microstrip-Fed Planar Frequency-Multiplying Space Combiner." 1987 Transactions on Microwave Theory and Techniques 35.12 (Dec. 1987 [T-MTT] (1987 Symposium Issue)): 1271-1276.

A frequency-multiplying power combining array has been made of slots in the ground plane on a substrate with a microstrip feedline on the back side. The second harmonic generated by a diode in each slot is combined in free space. A design procedure and experimental results are presented.

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GHz-Band Monolithic Modem IC's (Dec. 1987 [T-MTT])

H. Kikuchi, S. Konaka and M. Umehira. "GHz-Band Monolithic Modem IC's (Dec. 1987 [T-MTT])." 1987 Transactions on Microwave Theory and Techniques 35.12 (Dec. 1987 [T-MTT] (1987 Symposium Issue)): 1277-1282.

GHz-band monolithic modem IC's, such as a double balanced mixer IC, a 90° phase shifter IC, and a carrier switch IC, for high-speed QPSK modems have been developed using monolithic lumped constant circuit techniques and advanced silicon bipolar process technology and are discussed in this paper. A double balanced mixer with unbalance-balance converters and a common-mode feedback circuit has achieved an amplitude error of less than 0.2 dB/sub p-p/ and a phase error of less than 1.7° p-p at 1 GHz local oscillator frequency. A precise monolithic 90° phase shifter for the 1-GHz band was constructed by using variable RC phase shifters. An ON/OFF ratio of more than 65 dB for frequencies below 1 GHz has been achieved by employing a carrier switch consisting of a differential stage with a cascode circuit configuration. These IC's are applicable to QPSK modems transmitting baseband signals to the extent of 400 Mb/s at 1 GHz local oscillator frequency.

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High-Performance GaAs MMIC Oscillators

S.B. Moghe and T.J. Holden. "High-Performance GaAs MMIC Oscillators." 1987 Transactions on Microwave Theory and Techniques 35.12 (Dec. 1987 [T-MTT] (1987 Symposium Issue)): 1283-1287.

A number of monolithic single-ended and push-pull oscillator chips were developed for C-band through Ku-band applications. The chips were used to build both, dielectric resonator oscillators (DRO's) and voltage-controlled oscillators (VCO's) in these frequency bands. These MMIC's also have an integrated buffer amplifier at the oscillator output to provide better load isolation and power output stability. The oscillators demonstrated performance similar to conventional hybrid circuit however, the MMIC circuits provide circuit simplicity with improved reliability, decreased size, and reduced manufacturing cost.

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Abstracts

On the Study of Microstrip Ring and Varactor-Tuned Ring Circuits

K. Chang, S. Martin, F. Wang and J.L. Klein. "On the Study of Microstrip Ring and Varactor-Tuned Ring Circuits." 1987 Transactions on Microwave Theory and Techniques 35.12 (Dec. 1987 [T-MTT] (1987 Symposium Issue)): 1288-1295.

Equivalent circuits have been derived for microstrip ring and varactor-tuned ring resonators. It was found that the resonant frequency is slightly lower as the coupling gap becomes smaller. Varactor-tuned ring resonators have been developed with up to 15 percent tuning bandwidth using packaged varactor diodes. A dielectrically loaded microstrip ring circuit with lower loss was demonstrated. The results should have many applications in electronically tunable oscillators and filters in both hybrid and monolithic integrated circuits.



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Multiple-Port Power Divider/Combiner Circuits Using Circular Microstrip Disk Configurations (Dec. 1987 [T-MTT])

M.D. Abouzahra and K.C. Gupta. "Multiple-Port Power Divider/Combiner Circuits Using Circular Microstrip Disk Configurations (Dec. 1987 [T-MTT])." 1987 Transactions on Microwave Theory and Techniques 35.12 (Dec. 1987 [T-MTT] (1987 Symposium Issue)): 1296-1302.

A generalized method for evaluating the scattering parameters of a multiport center-fed circular microstrip disk power divider/combiner circuits is presented. The method is based on the planar circuit approach in which the two-dimensional Green's function of a circular segment is used. Various symmetrical power divider/combiner circuits have been designed and tested. The effect of introducing additional shorted ports between the circumferential output ports on the reduction of spurious radiation losses is discussed. Experimental results verifying the design methodology are given.

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Impedance-Transforming 3-dB 90° Hybrids (Dec. 1987 [T-MTT])

R.K. Gupta, S.E. Anderson and W.J. Getsinger. "Impedance-Transforming 3-dB 90° Hybrids (Dec. 1987 [T-MTT])." 1987 Transactions on Microwave Theory and Techniques 35.12 (Dec. 1987 [T-MTT] (1987 Symposium Issue)): 1303-1307.

Design techniques and performance results for impedance-transforming branch-line and coupled-line 3-dB 90° hybrids are discussed, and designs equations for a single-section impedance-transforming branch-line coupler are presented. Test results for a 50- to 25- Ω branch-line hybrid show approximately 20-percent bandwidth at a 5.4-GHz center frequency with 3.15 ± 0.25 -dB amplitude balance. A. broad-band hybrid with 50- to 20- Ω impedance transformation has also been realized by tandem connection of coupled-line sections.

Measured results show an amplitude balance of 3.7 ± 0.68 dB over the 3-5-GHz range for a section coupling of 11.44 dB. The amplitude balance is improved to ± 0.2 dB for a design with section coupling of 12.1 dB. Test results for a 50- Ω tandem hybrid are also presented.

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Millimeter-Wave Heterojunction MITATT Diodes

N.S. Dogan, J.R. East, M.E. Elta and G.I. Haddad. "Millimeter-Wave Heterojunction MITATT Diodes." 1987 Transactions on Microwave Theory and Techniques 35.12 (Dec. 1987 [T-MTT] (1987 Symposium Issue)): 1308-1315.

A design theory, a fabrication procedure, and experimental results for heterojunction millimeter-wave transit-time devices operating in the IMPATT (impact ionization avalanche transit-time), MITATT (mixed panel-avalanche transit-time), or TUNNETT (tunnel transit-time) mode are presented. An approximate large-signal analysis is developed to investigate the power and efficiency of heterojunction transit-time devices. The results show that significant improvements in efficiency can be achieved by heterojunction structures. The fabrication process developed for the heterojunction diodes and the millimeter-wave oscillator circuits used in the work are presented. The diodes were operated as oscillators between 65 and 93 GHz. A typical power output of 45 mW at 72 GHz for a 1-percent duty cycle, 1- μ m pulse width operation was obtained.

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Abstracts

A New Type of Lightweight Low-Frequency Electromagnetic Hyperthermia Applicator

R.H. Johnson, A.W. Preece, J.W. Hand and J.R. James. "A New Type of Lightweight Low-Frequency Electromagnetic Hyperthermia Applicator." 1987 Transactions on Microwave Theory and Techniques 35.12 (Dec. 1987 [T-MTT] (1987 Symposium Issue)): 1317-1321.

A new applicator is described which consists of a resonant circuit formed from a current-carrying sheet in the absence of a ground plane and which can be easily matched to a coaxial feeder. Designs for operation at frequencies in a range exceeding 10 to 1000 MHz are possible, and aperture dimensions can be chosen almost independently of frequency.



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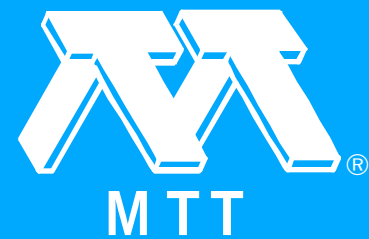
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Optimal Source Distribution for Hyperthermia at the Center of a Sphere of Muscle Tissue

C.M. Rappaport and F.R. Morgenthaler. "Optimal Source Distribution for Hyperthermia at the Center of a Sphere of Muscle Tissue." 1987 Transactions on Microwave Theory and Techniques 35.12 (Dec. 1987 [T-MTT] (1987 Symposium Issue)): 1322-1327.

In noninvasive electromagnetic hyperthermia it is important that applicators deposit as least as much power at the tumor as anywhere else in the intervening tissue. This study determines the ideal penetration limits for heating the center of a volume of muscle tissue according to this constraint. First, it is shown that the most efficiently heated volume is a sphere. Then, using both a diffraction integral formulation and a spherical harmonic modal approach, field distributions within the sphere are derived. It is shown that combining odd harmonics can generate a nearly uniform surface power distribution, and that this distribution is optimal. The power deposition patterns for these distributions for various standard frequencies are presented. It is concluded that 915 MHz is the best frequency for heating spheres less than 9.5 cm in radius.

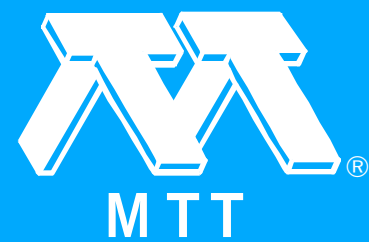
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Analysis of Long-Term Frequency Drift in FET Oscillators

K.K. Agarwal and C. Ho. "Analysis of Long-Term Frequency Drift in FET Oscillators." 1987 Transactions on Microwave Theory and Techniques 35.12 (Dec. 1987 [T-MTT] (1987 Symposium Issue)): 1328-1333.

This study was undertaken to analyze the long-term frequency drift observed in 11-GHz GaAs FET dielectric resonator oscillators. The analysis is based on device modeling. It is found that the dominant contributor to the long-term frequency drift is the gate-to-source channel capacitance of the GaAs FET. Results agree with the trends observed on dielectric resonator oscillators, and good correlation between theory and measured data has been achieved. The observations are general and applicable to all oscillators with GaAs FET's as active devices.



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Frequency Stability of L-Band, Two-Port Dielectric Resonator Oscillators (Dec. 1987 [T-MTT])

M.J. Loboda, T.E. Parker and G.K. Montress. "Frequency Stability of L-Band, Two-Port Dielectric Resonator Oscillators (Dec. 1987 [T-MTT])." 1987 Transactions on Microwave Theory and Techniques 35.12 (Dec. 1987 [T-MTT] (1987 Symposium Issue)): 1334-1339.

Dielectric resonator oscillators operating at 1.5 GHz and 2.0 GHz, based on a two-port resonator design incorporated into a basic feedback loop oscillator configuration, were evaluated and show state-of-the art, close-to-carrier phase noise performance. Typically, at 1-kHz carrier offset frequency the single-sideband phase noise levels were -130 dBc/Hz and -120 dBc/Hz for the 1.5-GHz and 2.0-GHz oscillators, respectively. Vibration sensitivity was also investigated and the resonators show fractional frequency changes per g in the range of 10^{-7} to 10^{-9} for the 1.5-GHz and 2.0-GHz designs. Finally, measurements were performed to characterize both the static and dynamic temperature sensitivities of the 2.0-GHz dielectric resonator oscillator design. The static temperature coefficient was found to be approximately -1.40 ppm/°C, while the dynamic temperature coefficient was nominally -3000 ppm/°C/s, at 27.5°C.



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A Generalized Approach to the Design of Microwave Oscillators

Y. Xuan and C.M. Snowden. "A Generalized Approach to the Design of Microwave Oscillators." 1987 Transactions on Microwave Theory and Techniques 35.12 (Dec. 1987 [T-MTT] (1987 Symposium Issue)): 1340-1347.

A new approach to the design of microwave oscillators is presented which allows both frequency and power output to be predicted. The main feature of this technique is that it allows the optimum performance to be obtained from the active device. This is achieved by employing a generalized substitution theorem, which is described and mathematically proven. A design example and experimental results are given for a 12-GHz MESFET oscillator. The experimental results were found to be within 9 percent of the predicted values for both frequency and power, without any experimental adjustment adjustment.

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Optimum Design of Nonlinear FET Amplifiers

C. Guo, M. Camiade, D. Rousset, A. Cessey, J.J. Obregon and A. Bert. "Optimum Design of Nonlinear FET Amplifiers." 1987 Transactions on Microwave Theory and Techniques 35.12 (Dec. 1987 [T-MTT] (1987 Symposium Issue)): 1348-1354.

In this paper, an efficient approach to the optimum design of power amplifier stages is described. The impedances presented to the FET are optimized independently of the topology chosen for their realization. They are then synthesized by the usual methods of linear circuits. The proposed method has been applied to the design of broad-band power FET amplifiers. The realizations have given a good correlation between the theoretical and experimental results. Moreover, the method is being used in the optimum design of power FET multipliers.

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Characterization Method and Simple Design Formulas of MCS Lines Proposed for MMIC's (Dec. 1987 [T-MTT])

E. Yamashita, K.R. Li and Y. Suzuki. "Characterization Method and Simple Design Formulas of MCS Lines Proposed for MMIC's (Dec. 1987 [T-MTT])." 1987 Transactions on Microwave Theory and Techniques 35.12 (Dec. 1987 [T-MTT] (1987 Symposium Issue)): 1355-1362.

The proximity effects between microstrip lines and ground on monolithic microwave integrated circuits are estimated by using the rectangular boundary division method. The attenuation constant is calculated based on a new form of the incremental inductance rule. Micro-coplanar strip (MSC) lines are then proposed to avoid the proximity effects. Some results of structural design parameters of MCS lines are expressed in simple polynomial formulas for CAD.

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Uniplanar MIC Balanced Multiplier-A Proposed New Structure for MIC's

H. Ogawa and A. Minagawa. "Uniplanar MIC Balanced Multiplier-A Proposed New Structure for MIC's." 1987 Transactions on Microwave Theory and Techniques 35.12 (Dec. 1987 [T-MTT] (1987 Symposium Issue)): 1363-1368.

A novel uniplanar MIC (microwave integrated circuit) and a balanced MIC multiplier are proposed and their characteristics discussed. The circuits use a combination of coplanar waveguides, slotlines, and bonding wires on one side of the substrate. A uniplanar MIC multiplier is designed for use in the 13- and 26-GHz bands and fabricated on an alumina substrate. Good performance with respect to isolation between RF ports is achieved.

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Characterization of Strip Line Crossing by Transverse Resonance Analysis

T. Uwano, R. Sorrentino and T. Itoh. "Characterization of Strip Line Crossing by Transverse Resonance Analysis." 1987 Transactions on Microwave Theory and Techniques 35.12 (Dec. 1987 [T-MTT] (1987 Symposium Issue)): 1369-1376.

A method of analysis is described for characterizing the discontinuities made of two orthogonally crossed strip lines on a suspended substrate. The method of analysis is based on the generalized transverse resonant technique extended here to four-port configurations. The technique is used for determination of resonant structure at a given frequency and subsequently the equivalent circuit parameters of the discontinuities.

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Abstracts

Analysis of Double-Layered Finlines Containing a Magnetized Ferrite (Dec. 1987 [T-MTT])

M. Geshiro and T. Itoh. "Analysis of Double-Layered Finlines Containing a Magnetized Ferrite (Dec. 1987 [T-MTT])." 1987 Transactions on Microwave Theory and Techniques 35.12 (Dec. 1987 [T-MTT] (1987 Symposium Issue)): 1377-1381.

The characteristics of propagation of the dominant mode in magnetized-ferrite-loaded double-layered finlines are studied. The analysis is based on Galerkin's method applied in the Fourier transform domain. Numerical results are presented for various values of structural and material parameters.



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Abstracts

A Unified Hybrid-Mode Analysis for Planar Transmission Lines with Multilayer Isotropic/Anisotropic Substrates

R.R. Mansour and R.H. MacPhie. "A Unified Hybrid-Mode Analysis for Planar Transmission Lines with Multilayer Isotropic/Anisotropic Substrates." 1987 Transactions on Microwave Theory and Techniques 35.12 (Dec. 1987 [T-MTT] (1987 Symposium Issue)): 1382-1391.

A unified hybrid-mode analysis is presented for determining the propagation characteristics of multiconductor, multilayer planar transmission lines. The analysis employs the conservation of complex power technique, and the emphasis is on numerical efficiency and simplicity. Numerical results, for finline and microstrip configurations, aim at the clarification of the effects of the metalization thickness, dielectric anisotropy, and substrate mounting grooves.



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Coupled Microstrip Lines on a Cylindrical Substrate

A. Nakatani and N.G. Alexopoulos. "Coupled Microstrip Lines on a Cylindrical Substrate." 1987 Transactions on Microwave Theory and Techniques 35.12 (Dec. 1987 [T-MTT] (1987 Symposium Issue)): 1392-1398.

The characterization of quasi-static and frequency-dependent coupled microstrip lines on a cylindrical substrate is presented in this article. The dyadic Green's function is involved for the full-wave analysis, and the dispersive properties are determined by solving a pair of coupled Fourier summation equations with the Galerkin method. It is shown that the transverse current component effect becomes significant when the odd mode is characterized. Careful numerical treatment reveals the transverse current behavior when the lines are tightly coupled.

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Abstracts

Numerical Spectral Matrix Method for Propagation in General Layered Media: Application to Isotropic and Anisotropic Substrates

A.A. Mostafa, C.M. Krowne and K.A. Zaki. "Numerical Spectral Matrix Method for Propagation in General Layered Media: Application to Isotropic and Anisotropic Substrates." 1987 *Transactions on Microwave Theory and Techniques* 35.12 (Dec. 1987 [T-MTT] (1987 Symposium Issue)): 1399-1407.

A full-wave analysis technique for generalized anisotropic layered media based on a 4x4 field matrix method is applied to calculate the propagation constant of a number of microstriplike transmission structures. This technique is very versatile, and allows simultaneous permittivity, permeability, and optical activity anisotropy. Data for higher order modes of single and coupled strip lines in isotropic layered media in the millimeter-wave region are presented. New dispersion data for both low- and high-anisotropy dielectric layered structures are generated for different principal axis crystallographic orientations.



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Exact Calculation of Scattering Parameters of the Coplanar-Slot Transition in Unilateral Finline Technology

O. Picon, V.F. Hanna, J. Citerne and J.-P. Lefevre. "Exact Calculation of Scattering Parameters of the Coplanar-Slot Transition in Unilateral Finline Technology." 1987 Transactions on Microwave Theory and Techniques 35.12 (Dec. 1987 [T-MTT] (1987 Symposium Issue)): 1408-1413.

The dominant and higher order modes, in both a unilateral finline and coupled unilateral finlines in the even and odd modes, are accurately described from a thorough spectral-domain approach. Then, coupling coefficients between eigenmodes at a coplanar-slot transition in unilateral finline technology, which are to be used in the generalized scattering matrix formulation, are directly computed in the spectral domain. Scattering parameters of the dominant mode in the Ka -band are presented for both even- and odd-mode excitation of the coupled unilateral finlines.

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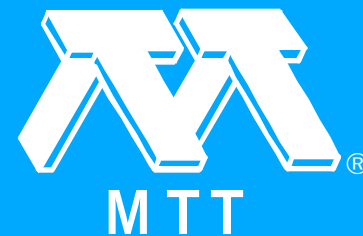


Abstracts

Measuring Beam Leaded Diodes Nondestructively

J.F. White and S.J. Parisi. "Measuring Beam Leaded Diodes Nondestructively." 1987 Transactions on Microwave Theory and Techniques 35.12 (Dec. 1987 [T-MTT] (1987 Symposium Issue)): 1414-1418.

A vacuum fixture for the characterization of beam leaded diodes (BLD's) is described along with measurement data showing that nominal 0.020-pF p-i-n diodes can be evaluated with ± 0.01 pF and ± 0.24 Omega.



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A Practical Method for Calibrating a Coaxial Noise Source with a Waveguide Standard (Dec. 1987 [T-MTT])

Y. Kato and I. Yokoshima. "A Practical Method for Calibrating a Coaxial Noise Source with a Waveguide Standard (Dec. 1987 [T-MTT])." 1987 Transactions on Microwave Theory and Techniques 35.12 (Dec. 1987 [T-MTT] (1987 Symposium Issue)): 1419-1423.

A practical method for calibrating a coaxial noise source with a waveguide standard has been developed by extending the adaptor-changing method proposed by Engen. A practical equation for its noise temperature, the measurement procedure, and the error analysis are described.



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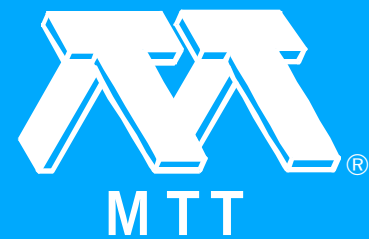
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Measurement of the Dielectric Properties of Biological Substances Using an Improved Open-Ended Coaxial Line Resonator Method

D. Xu, L. Liu and Z. Jiang. "Measurement of the Dielectric Properties of Biological Substances Using an Improved Open-Ended Coaxial Line Resonator Method." 1987 Transactions on Microwave Theory and Techniques 35.12 (Dec. 1987 [T-MTT] (1987 Symposium Issue)): 1424-1428.

An improved open-ended coaxial line resonator method for measuring the complex permittivity of biological substances is presented. By considering the end radiation losses and higher order mode effects, the upper frequency limit is extended from 4 GHz to 11 GHz. A novel $\lambda/4$ open-ended coaxial line resonator, which uses a thin copper diaphragm for a coupling structure, was developed. Experiments show that the structure is very flexible, convenient, and reliable. Experimental results for several canine organs as well as human skin are given. The method has useful applications to microwave medicine and bioelectromagnetic studies.

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Abstracts

Measurement of Nonplanar Dielectric Samples Using an Open Resonator

W.F.P. Chan and B. Chambers. "Measurement of Nonplanar Dielectric Samples Using an Open Resonator." 1987 Transactions on Microwave Theory and Techniques 35.12 (Dec. 1987 [T-MTT] (1987 Symposium Issue)): 1429-1434.

Conventional microwave methods for measuring permittivity often utilize samples in flat sheet form. In practice, however, it is sometimes desirable to measure samples having curved surfaces, for example, parts of lenses or small radomes. This paper describes an open resonator technique for achieving this and compares measurements made at 11.6 GHz on samples of polymethyl methacrylate in both curved and flat sheet form.



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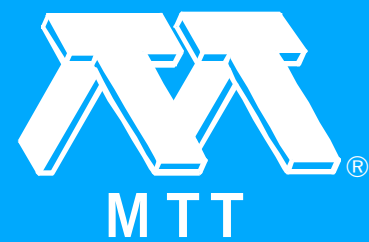
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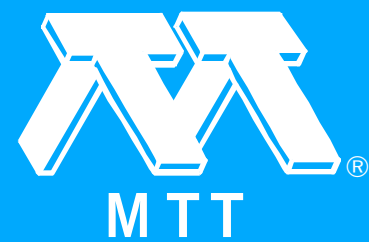
Microwave Processing and Diagnosis of Chemically Reacting Materials in a Single-Mode Cavity Applicator

J. Jow, M.C. Hawley, M. Finzel, J. Asmussen, Jr., H.-H. Lin and B. Manning. "Microwave Processing and Diagnosis of Chemically Reacting Materials in a Single-Mode Cavity Applicator." 1987 Transactions on Microwave Theory and Techniques 35.12 (Dec. 1987 [T-MTT] (1987 Symposium Issue)): 1435-1443.

On-line chemically reacting microwave processing and dielectric diagnosis of materials (epoxy/amine) have been successfully performed using a TM/sub 012/-mode cylindrical cavity at a frequency of 2.45 GHz in conjunction with fluoroptic temperature measurement. Complex permittivity measurements by this single-frequency technique are repeatable and consistent with those obtained by conventional swept frequency methods. 'The accuracy of complex permittivity measurements for both methods is within ± 5 percent for permittivity (epsilon') and ± 15 percent for loss (epsilon''). Both techniques are based on material-cavity perturbation theory. Perturbation equations for cylindrical shapes of the cavity and loaded material have been derived to account for volume variation of the sample due to thermal expansion. Complex permittivity of epoxy/amine as a function of the extent of cure and temperature was determined in order to monitor the chemical reaction progress during microwave processing.

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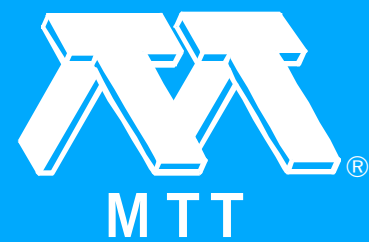
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Microwave Performance of an Optically Controlled AlGaAs/GaAs High Electron Mobility Transistor and GaAs MESFET (Dec. 1987 [T-MTT])

R.N. Simons. "Microwave Performance of an Optically Controlled AlGaAs/GaAs High Electron Mobility Transistor and GaAs MESFET (Dec. 1987 [T-MTT])." 1987 Transactions on Microwave Theory and Techniques 35.12 (Dec. 1987 [T-MTT] (1987 Symposium Issue)): 1444-1455.

This paper presents for the first time extensive experimental results which show the light-induced voltage, the increase in the drain current, the RF gain, and the change in the microwave scattering parameters of an AlGaAs/GaAs high electron mobility transistor (HEMT) under optical illumination of photon energy equal to or greater than the semiconductor band gap. From the de-embedded device scattering parameters, the change in the small-signal, lumped-element equivalent circuit model is computed. These results are compared and contrasted with those of a GaAs MESFET. Lastly, three potential applications of an optically controlled AlGaAs/GaAs HEMT are demonstrated: microwave amplifier gain control, detection, and mixing with an optically coupled local oscillator signal. Preliminary experiments on the optical control of a monolithic GaAs distributed amplifier are also presented. Measurements on a HEMT show that the light-induced voltage is 0.57 V and the increase in the drain current is 5 mA under 1.7 mW optical power at 0.83 μm . Further, the increase in magnitude of S_{21} with illumination ranges from 0.5 to 2.0 dB as V_{gs} takes discrete values between -0.5 and -0.95 V. However, the phase of S_{21} is insensitive to optical illumination. The HEMT as a photodetector has an external quantum efficiency greater than 500 percent and a dark noise current of 27 pA/sqrt(Hz). Lastly, computations show that the response speed of the HEMT to an intensity-modulated optical signal is on the order of 11 ps.





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Bias-Dependent Microwave Characteristics of Atomic Planar-Doped AlGaAs/InGaAs/GaAs Double Heterojunction MODFET's (Short Papers)

Y.K. Chen, G.W. Wang, D.C. Radulescu, A.N. Lepore, P.J. Tasker, L.F. Eastman and E. Strid. "Bias-Dependent Microwave Characteristics of Atomic Planar-Doped AlGaAs/InGaAs/GaAs Double Heterojunction MODFET's (Short Papers)." 1987 Transactions on Microwave Theory and Techniques 35.12 (Dec. 1987 [T-MTT] (1987 Symposium Issue)): 1456-1460.

Double heterojunction AlGaAs/InGaAs/GaAs modulation-doped field effect transistors (MODFET's) using lattice-strained AlGaAs/InGaAs/GaAs layer structure have been fabricated and evaluated at microwave frequencies for various bias conditions. MODFET's with a 1- μm gate length show a room-temperature peak extrinsic dc transconductance ($g_{\text{sub m}}$) of 400 mS/mm with a full channel current of 610 mA/mm. For 0.3- μm -gate MODFET's an extrinsic dc $g_{\text{sub m}}$ of 505 mS/mm and a full channel current of 720 mA/mm were obtained. Devices having a 1- μm gate length show a maximum available gain cutoff frequency ($f_{\text{sub max}}$) of 85 GHz and a current-gain cutoff frequency ($f_{\text{sub T}}$) of 22 GHz from S-parameter measurements. The 0.3- μm devices show an $f_{\text{sub T}}$ of 45 GHz and an $f_{\text{sub max}}$ of 120 GHz. Bias-dependent equivalent circuit models are also discussed.



Abstracts

Foreword (Dec. 1987 [T-MTT])

D. Hornbuckle. "Foreword (Dec. 1987 [T-MTT])." 1987 Transactions on Microwave Theory and Techniques 35.12 (Dec. 1987 [T-MTT] (1987 Symposium Issue)): 1461-1461.

The 1987 IEEE Microwave and Millimeter-Wave Monolithic Circuits Symposium was held on June 8-9, 1987, in conjunction with the IEEE MTT-S International Microwave Symposium. The Technical Program consisted of 32 papers, a growth of 50 percent relative to prior years, even though the paper acceptance ratio continued to be held below 50 percent. Attendance also reflected the rising interest in monolithic circuits, increasing over 25 percent to 950.



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Heterojunction Bipolar Transistors for Microwave and Millimeter-Wave Integrated Circuits (Dec. 1987 [T-MTT])

P.M. Asbeck, M.F. Chang, K.-C. Wang, D.L. Miller, G.J. Sullivan, N.H. Sheng, E. Sovero and J.A. Higgins. "Heterojunction Bipolar Transistors for Microwave and Millimeter-Wave Integrated Circuits (Dec. 1987 [T-MTT])." 1987 Transactions on Microwave Theory and Techniques 35.12 (Dec. 1987 [T-MTT] (1987 Symposium Issue)): 1462-1470.

This paper reviews the present status of GaAlAs/GaAs HBT technology and projects the impact of these devices on microwave and millimeter-wave integrated circuits. Devices with f_{max} above 120 GHz are described. Differential amplifiers are shown to have offset voltages with standard deviation below 2 mV and voltage gain as high as 200 per stage. Breakdown voltages (BV_{CEO}) above 20 V are demonstrated. Frequency dividers operating above 20 GHz are described.



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An 8-15 GHz GaAs Monolithic Frequency Converter (Dec. 1987 [T-MTT])

R. Ramachandran, S.B. Moghe, G. Lizama, P. Ho and A.F. Podell. "An 8-15 GHz GaAs Monolithic Frequency Converter (Dec. 1987 [T-MTT])." 1987 Transactions on Microwave Theory and Techniques 35.12 (Dec. 1987 [T-MTT] (1987 Symposium Issue)): 1471-1476.

An MMIC frequency converter with an RF bandwidth of 8-15 GHz and an IF bandwidth of 1.5 GHz has been designed and built. The MMIC chip has 15 dB conversion gain and includes a two-stage RF amplifier, a two-stage LO buffer amplifier, a double-balanced mixer, and a three-stage IF amplifier. This high level of integration is realized on a small--48 x 96 mil--area, resulting in good RF yields. The circuit employs a push-pull configuration to eliminate the need for via holes (low-inductance grounds) and facilitate a compact layout.



GaAs MMIC's for Digital Radio Frequency Memory (DRFM) Subsystems

G.K. Lewis, I.J. Bahl, E.L. Griffin and E.R. Schineller. "GaAs MMIC's for Digital Radio Frequency Memory (DRFM) Subsystems." 1987 Transactions on Microwave Theory and Techniques 35.12 (Dec. 1987 [T-MTT] (1987 Symposium Issue)): 1477-1485.

A DRFM analog subsystem using ten GaAs MMIC chips (six limiting amplifiers, one quadrature down-converter, two IF amplifiers, and one quadrature up-converter) has been developed and integrated into a 0.72-cubic-inch module. The 2-6-GHz limiting amplifier provides 12 dBm constant output power, the quadrature IF mixer down-converts a 2-6-GHz input signal into two 1 MHz to 1 GHz quadrature IF signals, the IF amplifier provides the required gain, and a quadrature up-converter converts the IF signals to a 6-8-GHz output band. The input signal dynamic range is 50 dB. The amplitude and phase tracking performance of the two IF channels is ± 0.5 dB and $\pm 5^\circ$, respectively. The output signal is a single-sideband suppressed carrier signal. The sideband rejection is 20 dB and the LO to RF isolation is 27 dB.



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DC-40 GHz and 20-40 GHz MMIC SPDT Switches (Dec. 1987 [T-MTT])

M.J. Schindler and A. Morris. "DC-40 GHz and 20-40 GHz MMIC SPDT Switches (Dec. 1987 [T-MTT])." 1987 Transactions on Microwave Theory and Techniques 35.12 (Dec. 1987 [T-MTT] (1987 Symposium Issue)): 1486-1493.

DC to 40 GHz and 20 to 40 GHz monolithic GaAs SPDT switches have been demonstrated. Both the measured and the modeled small-signal performance are presented. Measured power handling performance and switching speed data are also presented. The 20-40 GHz switch uses a combination of shunt FET's and quarter-wave transformers. Better than 2 dB insertion loss and 25 dB isolation have been achieved. The dc-40 GHz switch uses a combination of series and shunt FET's. Better than 3 dB insertion loss and 23 dB isolation have been achieved. A simplified switchhg FET model is used to adequately model switch performance. It is demonstrated that parasitic "off" state resistance is an important FET characteristic for broad-band switch design. The switches use MESFET's with the same characteristics as an existing millimeter-wave amplifier to allow for ease of future integration.

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A 2-20 GHz High-Gain Monolithic HEMT Distributed Amplifier (Dec. 1987 [T-MTT])

S.G. Bandy, C.K. Nishimoto, C. Yuen, R.A. LaRue, M. Day, J. Eckstein, Z.C.H. Tan, C. Webb and G.A. Zdasiuk. "A 2-20 GHz High-Gain Monolithic HEMT Distributed Amplifier (Dec. 1987 [T-MTT])." 1987 Transactions on Microwave Theory and Techniques 35.12 (Dec. 1987 [T-MTT] (1987 Symposium Issue)): 1494-1500.

A low-noise 2-21 GHz monolithic distributed amplifier utilizing 0.35-micrometer-gate-length HEMT devices has achieved 12 ± 0.5 dB of gain. This represents the highest gain reported for a distributed amplifier using single FET gain cells. A record low noise figure of 3 dB was achieved midband (4-12 GHz). The circuit design utilizes five HEMT transistors of varying width with gates fabricated by E-beam lithography. The same amplifier fabricated with 0.35- μ m-gate-length MESFET's in place of the HEMT devices resulted in 9.5 ± 0.5 dB of gain across the 2-20 GHz band. This record performance level, for a MESFET distributed amplifier is used to determine that the use of HEMT devices rather than the small gate lengths is primarily responsible for the HEMT amplifier performance.

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State-of-the-Art Ion-Implanted Low-Noise GaAs MESFET's and High-Performance Monolithic Amplifiers

K.-G. Wang and S.-K. Wang. "State-of-the-Art Ion-Implanted Low-Noise GaAs MESFET's and High-Performance Monolithic Amplifiers." 1987 Transactions on Microwave Theory and Techniques 35.12 (Dec. 1987 [T-MTT] (1987 Symposium Issue)): 1501-1506.

State-of-the-art GaAs low-noise MESFET's and high-performance monolithic amplifiers have been fabricated using a high-yield, planar ion-implantation process. A 0.5- μm -gate FET has achieved a 1.2-dB noise figure with 8.8 dB associated gain at 12 GHz and a 1.7-dB noise figure with 6.6 dB associated gain at 18 GHz. A 0.25 x 60 μm FET has achieved 1.7 dB and 2.5 dB noise figures with 6.3 dB and 5.0 dB associated gains at 22 GHz and 35 GHz, respectively. A two-stage monolithic amplifier using the 0.5- μm FET process has achieved a 1.8-dB noise figure with 23.6 dB associated gain at 9.5 GHz. The dc yield of the amplifier chips is better than 40 percent. These results have demonstrated that direct ion implantation is capable of producing low-cost, high-performance low-noise monolithic microwave integrated circuits (MMIC's).

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Abstracts

Successful Alloy Attachment of GaAs MMIC's

J.S. Pavio. "Successful Alloy Attachment of GaAs MMIC's." 1987 Transactions on Microwave Theory and Techniques 35.12 (Dec. 1987 [T-MTT] (1987 Symposium Issue)): 1507-1511.

Alloy attachment of GaAs monolithic circuits was examined after initial reflow, after environmental bake, and after a stepped series of thermal cycles from 200 to 1000 cycles (-55 to + 125°C). The variety of solders tested included both pastes and preforms. Monolithic assemblies alloyed with these solders were evaluated for changes in physical properties as well as for changes in electrical performance. It was noted during the study that via fractures due to thermal expansion differences between the alloy and the GaAs monolithic device were a common occurrence and could become an inherent reliability risk. Based on this evidence, an investigation relating the frequency of fracturing to the size and the shape of the vias was undertaken. Results led to the development of processing parameters which could minimize and control fracture occurrence.



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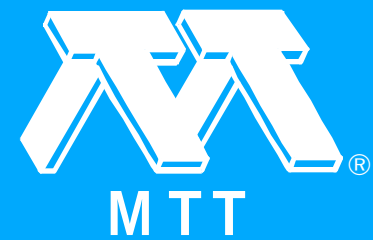
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Call for Papers - Quasi-Planar Millimeter-Wave Components and Subsystems (Dec. 1987 [T-MTT])

"Call for Papers - Quasi-Planar Millimeter-Wave Components and Subsystems (Dec. 1987 [T-MTT])." 1987 Transactions on Microwave Theory and Techniques 35.12 (Dec. 1987 [T-MTT] (1987 Symposium Issue)): 1517-1517.



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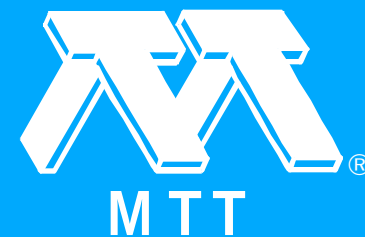
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Index, IEEE [T-MTT] 1987, Volume 35, and MTT-S Sponsored Conferences

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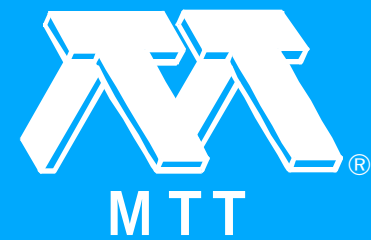
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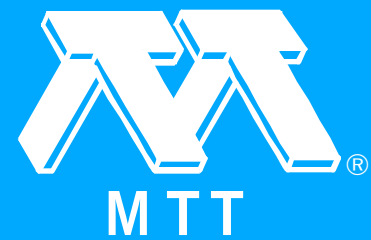
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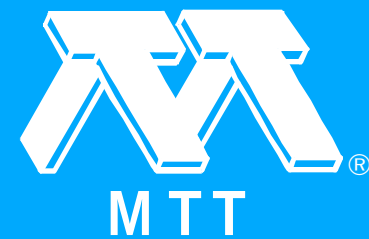
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Abstracts

Welcome to the 1986 International Symposium (1986 [MWSYM])

E. Niehenke. "Welcome to the 1986 International Symposium (1986 [MWSYM])." 1986 MTT-S International Microwave Symposium Digest 86.1 (1986 [MWSYM]): iii-iii.

On behalf of the Steering Committee it gives me great pleasure to welcome you to the 1986 MTT-S International Microwave Symposium. The Symposium Steering Committee, some 38 strong, have been hard at work adding its personal touches and innovations to make your stay in "The Land of Pleasant Living" on the Baltimore Inner Harbor technically stimulating, exciting, and very enjoyable.



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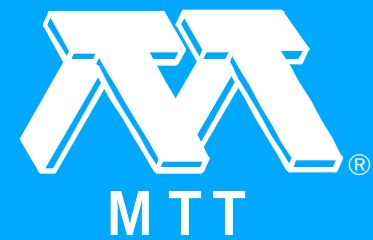
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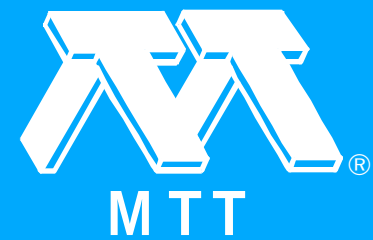
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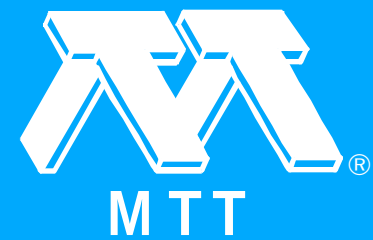
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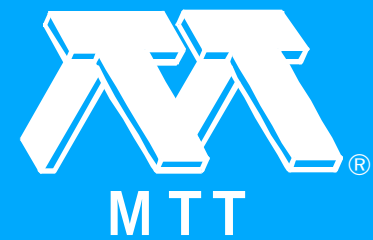
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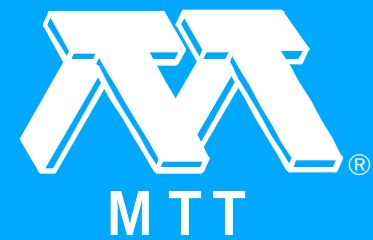
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Session B -- Guided Wave Structures I

"Session B -- Guided Wave Structures I." 1986 MTT-S International Microwave Symposium Digest 86.1 (1986 [MWSYM]): 55-55.



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Abstracts

The Nature of the Leakage from Higher Modes on Microstrip Line

A.A. Oliner and K.S. Lee. "The Nature of the Leakage from Higher Modes on Microstrip Line." 1986 MTT-S International Microwave Symposium Digest 86.1 (1986 [MWSYM]): 57-60.

Some confusion in the literature is clarified regarding the properties of microstrip line higher modes in the neighborhood of cutoff. It is shown that those modes become leaky in that range, and that the leakage occurs in two forms, a surface wave and a space wave. Numerical values obtained from an accurate analysis are presented that illustrate the nature of the leakage for microstrip lines with either open or covered tops.



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Abstracts

Uniaxial and Biaxial Substrate Effects on Uniform Finlines and Finline Step Discontinuities

H.-Y. Yang and N.G. Alexopoulos. "Uniaxial and Biaxial Substrate Effects on Uniform Finlines and Finline Step Discontinuities." 1986 MTT-S International Microwave Symposium Digest 86.1 (1986 [MWSYM]): 61-63.

Substrate materials exhibit inherent anisotropy which affects the dispersive characteristics of uniform finlines and finline discontinuities with increasing frequency. An accurate model is presented which accounts for uniaxial or biaxial anisotropy. The error involved in neglecting such substrate properties is discussed. In addition, the effect of anisotropy on the step discontinuity is analyzed and a comparison of the accuracy of the transverse resonance method and the mode matching technique is provided.



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Slow-Wave Characteristics of Ferromagnetic Semiconductor Microstrip Line (1986 [MWSYM])

H. Ogawa and T. Itoh. "Slow-Wave Characteristics of Ferromagnetic Semiconductor Microstrip Line (1986 [MWSYM])." 1986 MTT-S International Microwave Symposium Digest 86.1 (1986 [MWSYM]): 65-68.

A new slow-wave microstrip line made of a ferromagnetic semiconductor (FMS) substrate is proposed and its characteristics discussed. It is shown that this structure has more desirable and flexible guided wave properties than the conventional metal-insulator-semiconductor (MIS) microstrip line.

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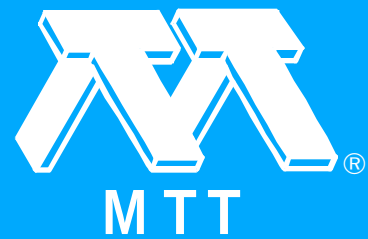


Abstracts

Effects of Transition Waveguide on Dielectric Waveguide Directional Couplers

S.T. Xu and S.J. Peng. "Effects of Transition Waveguide on Dielectric Waveguide Directional Couplers." 1986 MTT-S International Microwave Symposium Digest 86.1 (1986 [MWSYM]).

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Mutual Interference Between the Guided Wave and the Leaky Wave Regions and its Effects on the Performance of Dielectric Grating Filters

M. Tsuji and H. Shigesawa. "Mutual Interference Between the Guided Wave and the Leaky Wave Regions and its Effects on the Performance of Dielectric Grating Filters." 1986 MTT-S International Microwave Symposium Digest 86.1 (1986 [MWSYM]): 69-72.

In an open periodic structure with finite length, a new interaction between the guided-wave and the leaky-wave regions in the ω - β diagram does occur. The effect of such an interaction on the characteristics is investigated rigorously by using our network approach already proposed. Numerical calculations show that the finite length of periodic structures significantly affects the stopband characteristics of the first Bragg reflection region, especially in producing a complicated behavior of the return loss due to radiation. This paper also shows that such a return loss behavior can be easily estimated from the radiation characteristics of only the first step discontinuity of the periodic structure.

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Abstracts

Session C -- Low Noise Techniques

"Session C -- Low Noise Techniques." 1986 MTT-S International Microwave Symposium Digest 86.1 (1986 [MWSYM]): 73-73.



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20 GHz-Band Low-Noise HEMT Amplifier

K. Shibata, K. Nakayama, M. Ohtsubo, H. Kawasaki, S. Hori and K. Kamei. "20 GHz-Band Low-Noise HEMT Amplifier." 1986 MTT-S International Microwave Symposium Digest 86.1 (1986 [MWSYM]): 75-78.

A 20 GHz-band low-noise amplifier has been developed by using newly developed 0.25- μm gate HEMTs. The amplifier has been fabricated by cascading six single-ended unit amplifiers without any isolators at the interstages. The HEMT amplifier exhibits a noise temperature of 170 K (NF = 2.0 dB) and a gain of 47 dB over 17.5 to 19.5 GHz in an uncooled operation. Noise temperatures of 130 K (NF = 1.6 dB) and 110 K (NF = 1.4 dB) have been obtained at -20°C and -50°C, respectively.





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Low Frequency Noise Measurements of GaAs FETs

A.N. Riddle and R.J. Trew. "Low Frequency Noise Measurements of GaAs FETs." 1986 MTT-S International Microwave Symposium Digest 86.1 (1986 [MWSYM]): 79-82.

A knowledge of low frequency noise in FETs is essential in designing oscillators, multipliers, and broadband amplifiers for fiber optics. Measurements on commercial and research GaAs FETs are presented which show up to 25 db differences in the $1/f$ noise of similarly sized devices. The presence of discrete traps creates even larger differences. The importance of material quality over FET size is demonstrated. Simple equations are presented which describe the noise sources and noise figure of an FET at all frequencies.

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Highly Stabilized, Ultra-Low Noise FET Oscillator with Dielectric Resonator

G. Lan, D. Kalokitis, E. Mykiety, E. Hoffman and F. Sechi. "Highly Stabilized, Ultra-Low Noise FET Oscillator with Dielectric Resonator." 1986 MTT-S International Microwave Symposium Digest 86.1 (1986 [MWSYM]): 83-86.

A highly stabilized ultra-low noise GaAs FET oscillator, using a temperature stabilized dielectric resonator in the feedback circuit, has been developed. A key factor for achieving high stability and low noise is a very high loaded Q (8000). The oscillator operates at 4 GHz with a power output of 11.5 dBm, a frequency temperature coefficient of ± 0.02 ppm/ $^{\circ}$ C, and a SSB N/C ratio of -130 dBc/Hz and -146 dBc/Hz at 10 KHz and 100 KHz off carrier, respectively. The oscillator is varactor tunable over a 1500 KHz bandwidth.

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Dielectric Resonator Oscillators at 4, 6, and 11 GHz

K.R. Varian. "Dielectric Resonator Oscillators at 4, 6, and 11 GHz." 1986 MTT-S International Microwave Symposium Digest 86.1 (1986 [MWSYM]): 87-90.

The microwave circuit used in this paper permits the use of the same power transistor at 4, 6, and 11 GHz. The phase noise of these units at 10 kHz from the carrier in a 1-Hz bandwidth is -116 dBc/Hz at 4 GHz, -113 dBc/Hz at 6 GHz, and -100 dBc/Hz at 11 GHz.

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Abstracts

Bipolar Transistor Ku-Band Oscillators with Low Phase-Noise

C. Ansorge. "Bipolar Transistor Ku-Band Oscillators with Low Phase-Noise." 1986 MTT-S International Microwave Symposium Digest 86.1 (1986 [MWSYM]): 91-94.

The frequency range of low cost silicon bipolar transistors can be extended using finline technique. Oscillators built up this way show high efficiency and output power up to Ku-band. The biggest advantage over the GsAs-FET is the very low phase-noise near the carrier of the bipolar oscillator.



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Dielectric Resonator Oscillators Using GaAs/(Ga,Al)As Heterojunction Bipolar Transistors

K.K. Agarwal. "Dielectric Resonator Oscillators Using GaAs/(Ga,Al)As Heterojunction Bipolar Transistors." 1986 MTT-S International Microwave Symposium Digest 86.1 (1986 [MWSYM]): 95-98.

This paper reports the first application of heterojunction bipolar transistors (HBTs) in microwave oscillators. A dielectric resonator (DR) is used to stabilize a 4-GHz shunt feedback oscillator. Using an npn grounded emitter GaAs HBT with 1.2- to 1.5- μm emitter width, microwave oscillator power in excess of 10 dBm with 30% efficiency was achieved. The oscillator frequency stability of 3 ppm/ $^{\circ}\text{C}$ over -30° to $+70^{\circ}\text{C}$, and FM noise of -73 dBc/Hz at 1-kHz off-carrier was measured. With further design optimization, improved performance is expected. The HBT phase-noise performance is comparable to silicon-bipolar and is superior to GaAs FET. A mechanical tuning using metal screw gives a 9% tuning for 1-dB change in output power as compared to about 3% for dielectric tuning ($\epsilon/\text{sub } r/ = 38$). The dielectric tuning as implemented provides a controlled tuning slope but is found to be susceptible to mode jumping beyond 3% range.

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Abstracts

Session D -- IMPATTs

"Session D -- IMPATTs." 1986 MTT-S International Microwave Symposium Digest 86.1 (1986 [MWSYM]): 99-99.



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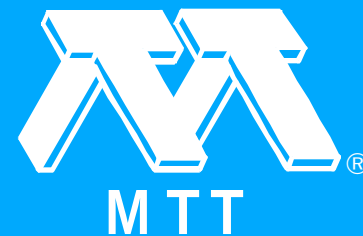


Abstracts

Low-Cost Modular 100-Watt Peak 10% Bandwidth Microstrip IMPATT Amplifier

J.F. Cushman and M.E. Hines. "Low-Cost Modular 100-Watt Peak 10% Bandwidth Microstrip IMPATT Amplifier." 1986 MTT-S International Microwave Symposium Digest 86.1 (1986 [MWSYM]): 101-103.

A New IMPATT diode amplifier circuit is described which uses planar microstrip circuitry. A single-diode stage serves as a driver for a four-diode combiner stage. The combiner uses a tree of three hybrids of the Wilkinson-Gysel type. GaAs double-drift IMPATT diodes are used. The device provides a minimum of 12 dB gain over a band from 9.4 to 10.6 GHz with a peak pulsed output between 105 and 120 watts over the band.



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Abstracts

Development of a Pulsed IMPATT Diode Amplifier

B.E. Sigmon and T.W. Van Alstyne. "Development of a Pulsed IMPATT Diode Amplifier." 1986 MTT-S International Microwave Symposium Digest 86.1 (1986 [MWSYM]): 105-108.

The impedance transformation properties of parallel coupled lines have been used to develop broadband reflection amplifiers operating in X-band. These amplifiers have demonstrated peak powers of 40 watts (single IMPATT diode), 63 watts (two diode combiner), and 110 watts (four diode combiner). 3 dB bandwidths of 1.4 to 3 GHz (14 to 30%) have been attained.



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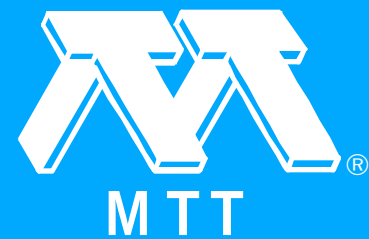
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Indirect Sub-Harmonic Optical Injection Locking of a Millimeter Wave IMPATT Oscillator (1986 [MWSYM])

A.S. Daryoush, P.R. Herczfeld, A. Rosen, A.K. Sharma and V.M. Contarino. "Indirect Sub-Harmonic Optical Injection Locking of a Millimeter Wave IMPATT Oscillator (1986 [MWSYM])." 1986 MTT-S International Microwave Symposium Digest 86.1 (1986 [MWSYM]): 109-112.

This paper presents results of indirect optical injection locking of a free-running 38GHz (Ka-band) IMPATT oscillator over the locking range of 2 to 132MHz, depending on the injected power level (amplifier gain). In this experiment, The nonlinearity of the both laser diode and the IMPATT, are exploited to achieve twelfth sub-harmonic injection locking. Methods by which optical links may be extended into 60 and 90GHz are demonstrated.

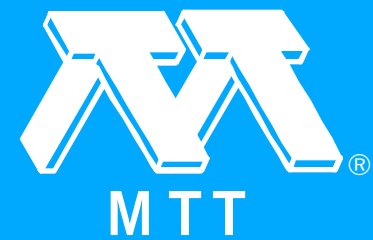
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Session E -- Guided Wave Structures II

"Session E -- Guided Wave Structures II." 1986 MTT-S International Microwave Symposium Digest 86.1 (1986 [MWSYM]): 113-113.



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Analysis and Measurements of Nonradiative Dielectric Waveguide Bends (1986 [MWSYM])

T. Yoneyama, H. Tamaki and S. Nishida. "Analysis and Measurements of Nonradiative Dielectric Waveguide Bends (1986 [MWSYM])." 1986 MTT-S International Microwave Symposium Digest 86.1 (1986 [MWSYM]): 115-117.

The coupling theory is applied to analyze bending loss characteristics of the nonradiative dielectric waveguide. As an application of the theory, a low loss 180° bend with a curvature radius of 5 mm was fabricated and successfully tested at 50 GHz. The measured bending loss never exceeded 0.3 dB.



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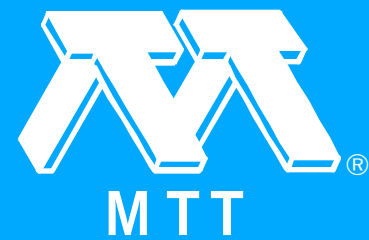


Abstracts

Effects of Air Gap and Finite Metal Plate Width on NRD Guide

H. Shigesawa, M. Tsuji and A.A. Oliner. "Effects of Air Gap and Finite Metal Plate Width on NRD Guide." 1986 MTT-S International Microwave Symposium Digest 86.1 (1986 [MWSYM]): 119-122.

A potentially serious problem that may arise with nonradiative dielectric (NRD) guide circuitry is described. First, a small unwanted air gap would generate a leaky hybrid mode that could produce cross talk between components of a circuit, and, second, if the plate width were also finite another type of leaky mode would be created similar to the well-known channel guide leaky mode. Under appropriate circumstances, this additional mode would couple to the leaky NRD guide mode and seriously complicate the performance characteristics of the NRD guide.



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Abstracts

Effect of Complex Modes on Finline Discontinuities

A.S. Omar, K. Schunemann and J. Piotrowski. "Effect of Complex Modes on Finline Discontinuities." 1986 MTT-S International Microwave Symposium Digest 86.1 (1986 [MWSYM]): 123-126.

The effect of ignoring complex modes on the solution of finline discontinuity problems is investigated. It is shown that the modal energy distribution at both sides of the discontinuity may be greatly affected by overlooking complex modes, even if they are not strongly excited. Comparison to measured data is also given to justify the validity of the numerical results.



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A Combined Experimental and Theoretical Characterisation of Discontinuities in Unilateral Finlines

A. Beyer, D. Kother and I. Wolff. "A Combined Experimental and Theoretical Characterisation of Discontinuities in Unilateral Finlines." 1986 MTT-S International Microwave Symposium Digest 86.1 (1986 [MWSYM]): 127-130.

An optimization procedure for characterizing finline discontinuities has been developed using the generalized scattering matrix formulation for steps in finline technique. The general waveguide representation of a two-taper finline section with a step is investigated first. The scattering matrix representation of the step is deduced from a combined measurement-numerical optimization procedure. Experimental results will verify the feasibility of the method.

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Finite Element Analysis of Slow-Wave Schottky Printed Line

C.-K. Tzuang, Q. Zhang and T. Itoh. "Finite Element Analysis of Slow-Wave Schottky Printed Line." 1986 MTT-S International Microwave Symposium Digest 86.1 (1986 [MWSYM]): 131-132.

The Schottky contacted slow-wave structure is analyzed for the first time without use of a layered model approximation for the localized depletion region. A general finite element code is developed for the analysis. Both microstrip and coplanar configurations are studied.

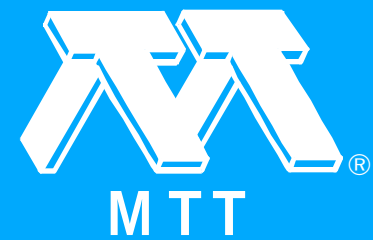
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Session F -- Passive Components

"Session F -- Passive Components." 1986 MTT-S International Microwave Symposium Digest 86.1 (1986 [MWSYM]): 133-133.



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Broadband Dielectric Waveguide 3-dB Couplers Using Asymmetrical Coupled Lines

P.K. Ikalainen, G.L. Matthaei and M.M. Monte. "Broadband Dielectric Waveguide 3-dB Couplers Using Asymmetrical Coupled Lines." 1986 MTT-S International Microwave Symposium Digest 86.1 (1986 [MWSYM]): 135-138.

It is shown how wideband 3-dB couplers can be designed by appropriately taking advantage of the dispersion and the frequency dependence of the coupling per unit length between two dielectric waveguides with asymmetrical cross sections. Theoretical methods for computing frequency responses of dielectric waveguide couplers composed of asymmetrical coupled guides are discussed. Experimental verifications of theoretical results are presented.

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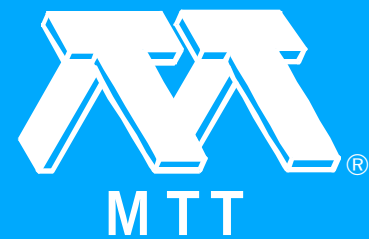
A Printed Circuit Hybrid-Ring Directional Coupler for Arbitrary Power Divisions

A.K. Agrawal and G.F. Mikucki. "A Printed Circuit Hybrid-Ring Directional Coupler for Arbitrary Power Divisions." 1986 MTT-S International Microwave Symposium Digest 86.1 (1986 [MWSYM]): 139-142.

A directional coupler in the form of a hybrid ring particularly suited for printed circuits is described. The maximum power-split ratio between the two output ports of a printed-circuit conventional hybrid ring coupler is limited by the highest impedance line that can be realized. The hybrid-ring directional coupler described in this paper allows a larger power-split ratio for the same impedance lines, and thereby increases the range of the power-split ratio that can be realized for printed circuits. A theoretical analysis was conducted using the scattering matrix, and experimental verification of the theoretical results was achieved in a stripline configuration at Ku-band.

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Design and Performance of a Wideband Multilayer Feed Network

M.D. Abouzahra. "Design and Performance of a Wideband Multilayer Feed Network." 1986 MTT-S International Microwave Symposium Digest 86.1 (1986 [MWSYM]): 143-146.

This paper describes the design and construction of a novel, high performance broadband, stripline, 8x8 port feed network. Hybrid ring couplers with improved performance are used as building blocks. The division of the circuit into two stackable even-mode and odd-mode subcircuits has greatly simplified the realization and the testing of the feed network. Experimental results for various phase modes are presented.

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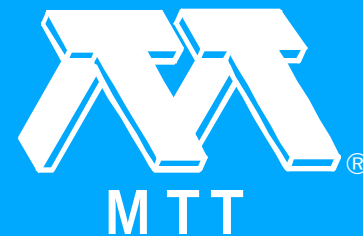


Abstracts

A New N-Way Broadband Planar Power Combiner/Divider

W. Yau, J.M. Schellenberg and Y.C. Shih. "A New N-Way Broadband Planar Power Combiner/Divider." 1986 MTT-S International Microwave Symposium Digest 86.1 (1986 [MWSYM]): 147-149.

A new N-way broadband planar power combiner/ divider was developed for ultra-broadband MMIC applications utilizing Dolph-Tchebycheff transmission line taper. The combiner/divider demonstrated a 5 to 18 GHz bandwidth with an insertion loss of less than 0.2 dB and an input VSWR of no more than 1.35.



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An Octave - Wide Matched Impedance Step and - Quarterwave Transformer

F.C. de Ronde. "An Octave - Wide Matched Impedance Step and - Quarterwave Transformer." 1986 MTT-S International Microwave Symposium Digest 86.1 (1986 [MWSYM]): 151-154.

An impedance step can now be matched - $\Gamma \leq 0.02$ - over a frequency band corresponding to at least an octave in wavelength by using a shunt inductor before and - capacitor behind, but almost a quarterwavelength apart. A shortened quarterwave impedance transformer could be matched with the shunt capacitor only. For high transformer ratios, part of a taper was used. Ultra-short X-band transformers and-transducers could be realized from rectangular w.g. to flat-square-, circular-, ridge w.g., finline and partly or fully dielectric-filled w.g. Although realized in X-band w.g., its principle is very general and can be applied to any dominant-mode transmission line.

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Abstracts

Matched, Dual Mode Square Waveguide Corner

P.K. Park, R.L. Eisenhart and S.E. Bradshaw. "Matched, Dual Mode Square Waveguide Corner." 1986 MTT-S International Microwave Symposium Digest 86.1 (1986 [MWSYM]): 155-156.

A design method for matching a square waveguide right angle corner for both E & H-plane (TE/sub 10/ and TE/sub 01/ modes) operation is presented. Results show VSWR <1.05 for 1.0 GHz bandwidth at X-Band with mode-to-mode isolation >30 dB.



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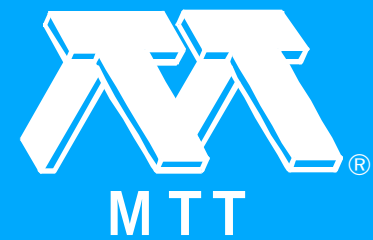
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Abstracts

Session G -- Oscillator Topics

"Session G -- Oscillator Topics." 1986 MTT-S International Microwave Symposium Digest 86.1 (1986 [MWSYM]): 157-157.



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Inter-Injection-Locked Oscillators with Applications to Spatial Power Combining and Phased Arrays

K.D. Stephan. "Inter-Injection-Locked Oscillators with Applications to Spatial Power Combining and Phased Arrays." 1986 MTT-S International Microwave Symposium Digest 86.1 (1986 [MWSYM]): 159-162.

Although the principle of injection locking has been applied to single- and multiple-device oscillators at microwave through millimeter wavelengths, the technique has not found many uses in hybrid or monolithic microwave integrated circuits. We present here a novel circuit topology which leads to the inter-injection-locking of a set of interconnected oscillators. Since each oscillator is coupled only to its two nearest neighbors, the scheme is very well adapted to integrated planar construction. Furthermore, phase control of only one injection power source can control the phases of all oscillators in the system in a manner suitable for driving a phased antenna array. A summary of the theory is followed by a description of results from an experimental VHF three-oscillator system. We conclude with a discussion of some proposed applications of inter-injection-locked systems.

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



A 10 GHz Space Power Combiner with Parasitic Injection Locking

R.J. Dinger, D.J. White and D. Bowling. "A 10 GHz Space Power Combiner with Parasitic Injection Locking." 1986 MTT-S International Microwave Symposium Digest 86.1 (1986 [MWSYM]): 163-166.

An array of three microstrip patch antennas, each connected by a matching network to an IMPATT diode, has been investigated. Coherent radiation from the array was obtained at 10.23 GHz by feeding only the center element with an injectionlocking signal, which then appeared at the input to the other two elements by free space mutual coupling. The three IMPATTs injection locked successfully in this manner. A beamwidth of 38 degrees and sidelobe level of -10 dB were achieved, values consistent with the theory for coherent radiation from an array of this configuration. An RF efficiency of 90% and a bandwidth of 30 MHz were measured.





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Planar Radial Resonator Oscillator

M. Dydyk. "Planar Radial Resonator Oscillator." 1986 MTT-S International Microwave Symposium Digest 86.1 (1986 [MWSYM]): 167-168.

The input and output coupling coefficients associated with planar radial resonator oscillator having two degrees of freedom are derived. It is shown, that (a) the input coupling coefficient can be controlled by the separation between the centers of the radial disk resonator and the active device and (b) the output coupling coefficient is controlled by the amount of overlap between the radial disk resonator and the inner conductor of the microstrip transmission media.

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



Abstracts

Frequency/Temperature Compensated Millimeter-Wave Oscillators and Broadband VCO's in Lumped-Element and Printed-Circuit Forms

L.D. Cohen and N. King, Jr.. "Frequency/Temperature Compensated Millimeter-Wave Oscillators and Broadband VCO's in Lumped-Element and Printed-Circuit Forms." 1986 MTT-S International Microwave Symposium Digest 86.1 (1986 [MWSYM]): 169-172.

Frequency/temperature compensation of millimeter-wave, lumped-element, Gunn oscillators and broadband VCO's by use of a simple capacitive compensating element has been demonstrated with performance that includes ± 1.5 ppm/ $^{\circ}\text{C}$ frequency stability at 30 GHz over a temperature range of -40° to $+71^{\circ}\text{C}$. A printed-circuit oscillator, in which the temperature compensating capacitor is printed in situ with the circuit elements, will also be described.



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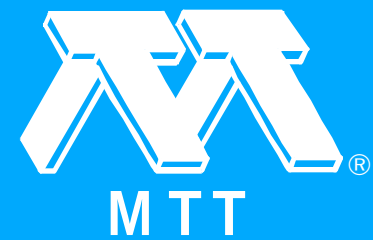
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Abstracts

Session H -- MM-Wave Oscillators

"Session H -- MM-Wave Oscillators." 1986 MTT-S International Microwave Symposium Digest 86.1 (1986 [MWSYM]): 173-173.



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Abstracts

A mm-Wave Microslab™ Oscillator

H.B. Sequeira and J.A. McClintock. "A mm-Wave Microslab™ Oscillator." 1986 MTT-S International Microwave Symposium Digest 86.1 (1986 [MWSYM]): 175-177.

We report, for the first time, a mm-wave GaAs Gunn device directly coupled to a novel planar transmission medium, Microslab./sup TM/ A monolithic-like structure was used to couple the GaAs device to a GaAs Microslab network to produce 0.25 mW at 141 GHz.



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Abstracts

A High Q Cavity Stabilized Gunn Oscillator at 94 GHz

H. Barth. "A High Q Cavity Stabilized Gunn Oscillator at 94 GHz." 1986 MTT-S International Microwave Symposium Digest 86.1 (1986 [MWSYM]): 179-182.

The set up and the performance of a 94 GHz second harmonic Gunn oscillator that is cavity stabilized at its fundamental frequency is described. The cavity has a quality factor of about 7000 and reduces the phase noise by nearly 40 dB. The oscillator generates an output power of 40 mW, sufficient to drive low noise balanced mixers, to synchronize Impatt oscillators or to operate as a reference source in coherent radar systems.



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Barium Ferrite Tuned-Indium Phosphide Gunn Millimeter Wave Oscillators

Y.S. Lau and D. Nicholson. "Barium Ferrite Tuned-Indium Phosphide Gunn Millimeter Wave Oscillators." 1986 MTT-S International Microwave Symposium Digest 86.1 (1986 [MWSYM]): 183-186.

Two barium ferrite (BaFe) sphere tuned InP Gunn diode oscillators are described. One oscillator's output power is 6-13 dBm from 40.5 GHz to 50 GHz while the second oscillator tunes from 42 GHz to 55 GHz with -5 dBm to 2 dBm output power. These results are compared to those obtained with a YIG sphere tuned InP Gunn diode oscillator which tunes from 34.5 GHz to 50 GHz. This work represents the first reported results for BaFe sphere tuned InP Gunn diode oscillators.

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Dual Output Stabilized Gunn Oscillator for Finlines

U. Goebel and K. Grimpe. "Dual Output Stabilized Gunn Oscillator for Finlines." 1986 MTT-S International Microwave Symposium Digest 86.1 (1986 [MWSYM]): 187-190.

A dual output Gunn oscillator for use in an integrated K-band network analyzer extender has been developed. It is stabilized using a dielectric resonator in a unique hybrid configuration with transmission type cavity behaviour. Both output ports offer 15 dBm power at 16 GHz.

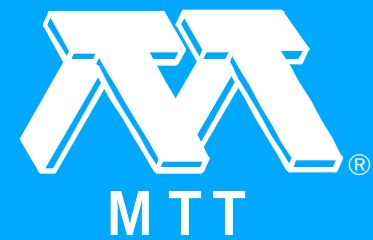
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Abstracts

Session I -- Special International Session

"Session I -- Special International Session." 1986 MTT-S International Microwave Symposium Digest 86.1 (1986 [MWSYM]): 191-191.



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Abstracts

Optoelectronic Technology and Devices in Europe

R. Baets. "Optoelectronic Technology and Devices in Europe." 1986 MTT-S International Microwave Symposium Digest 86.1 (1986 [MWSYM]): 193-196.

Over the past years exciting advances have been made in optoelectronic devices and circuits. The interaction of light with electronic systems is taking an ever increasing variety of forms. In this review we will focus primarily on optoelectronic devices for lightwave communication systems, although some related application areas will be touched. In the first section a rather general survey of advances in optoelectronic components will be given, with some emphasis on (but no limitation to) European achievements. In the second section a description will follow of European research programs related to optoelectronics, such as ESPRIT, RACE and EUREKA.



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Abstracts

Recent Progress in Computing Capabilities of Millimetre Wave Integrated Passive Components

J. Citerne. "Recent Progress in Computing Capabilities of Millimetre Wave Integrated Passive Components." 1986 MTT-S International Microwave Symposium Digest 86.1 (1986 [MWSYM]): 197-201.

In this paper, several computational schemes, applicable to passive components to be used in millimetre wave circuitry, are discussed. These schemes lie on concepts and techniques which are in most-cases, well known but rarely experimented on integrated components due to the importance of the numerical effort to produce.



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Abstracts

Microstrip Computer-Aided Design in Europe (1986 [MWSYM])

F.E. Gardiol. "Microstrip Computer-Aided Design in Europe (1986 [MWSYM])." 1986 MTT-S International Microwave Symposium Digest 86.1 (1986 [MWSYM]): 203-206.

The purpose of this survey is to provide a general idea about present microstrip research in Europe, emphasizing computer-aided design. Attention is drawn to the particularities of microstrip, which make it a particularly difficult field. The survey covers the description of microstrip lines, discontinuities and patch antennas, applications to circuit layout, followed by a brief description of MIC and nonlinear CAD.



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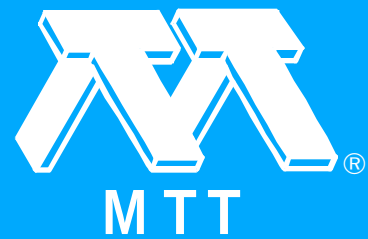


Abstracts

Millimetre Wave Devices and System Work in Europe

J. Forrest. "Millimetre Wave Devices and System Work in Europe." 1986 MTT-S International Microwave Symposium Digest 86.1 (1986 [MWSYM]).

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Abstracts

Microwave Research in China

W. Lin. "Microwave Research in China." 1986 MTT-S International Microwave Symposium Digest 86.1 (1986 [MWSYM]): 207-210.

China needs microwave research to realize its grand goal of four modernizations. Microelectronics, bioengineering, new materials, new sources of energy, oceanographic engineering and astronavigation have shown their importance and will boost our productive forces in the future. Microwave research in China plays an active role in all these fields, is an area where talented people temper themselves through new experience and enjoys good prospects.



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Abstracts

Session J -- Open Forum I (1986 [MWSYM])

"Session J -- Open Forum I (1986 [MWSYM])." 1986 MTT-S International Microwave Symposium Digest 86.1 (1986 [MWSYM]): 211-211.



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Abstracts

Efficient Analysis of Finline with Finite Metallization Thickness

J.K. Piotrowski. "Efficient Analysis of Finline with Finite Metallization Thickness." 1986 MTT-S International Microwave Symposium Digest 86.1 (1986 [MWSYM]): 213-216.

The transverse resonance method is used for deriving dispersion characteristics of fundamental and higher order modes in finline with arbitrary slot widths and locations with regard to the finite thickness of metallization. In addition to the propagation constant, the characteristic impedance is calculated on the basis of the power-voltage definition.



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Asymmetrical Structure Fin-line: An Alternative for Satellite Applications

J.M. Goutoule, P. Espes, P. Fraise and P. Combes. "Asymmetrical Structure Fin-line: An Alternative for Satellite Applications." 1986 MTT-S International Microwave Symposium Digest 86.1 (1986 [MWSYM]): 217-220.

A new kind of fin-line has been developed, compatible with classical M.I.C. technology: the dielectric substrate is soldered in an asymmetrical wave-guide. We first expose the reasons which, in space applications, lead to this structure. Then we present a theoretical model, based on spectral domain analysis, and we compare the Electromagnetic Field distribution of the new line and of classical line. At last a 4/20 GHz Up converter is presented, using the Asymmetrical Structure Fin-Line (ASFL).

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



Abstracts

Analysis of the Coupling Coefficient Between a Cylindrical Dielectric Resonator and a Fin-Line

F. Hernandez-Gil and J. Perez. "Analysis of the Coupling Coefficient Between a Cylindrical Dielectric Resonator and a Fin-Line." 1986 MTT-S International Microwave Symposium Digest 86.1 (1986 [MWSYM]): 221-224.

The external quality factor of a cylindrical dielectric resonator coupled to a finline is evaluated using the finite element method to analyse the transmission line and the resonator. The effects of varying the location of the resonator on the coupling are studied. Experimental results compared with the theoretical ones are presented.



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Abstracts

Modeling of the Apparent Characteristic Impedance Finned-Waveguide and Finlines

P. Pramanick and P. Bhartia. "Modeling of the Apparent Characteristic Impedance Finned-Waveguide and Finlines." 1986 MTT-S International Microwave Symposium Digest 86.1 (1986 [MWSYM]): 225-228.

This paper models the apparent characteristic impedance of finned-waveguide and finline from the standpoint of per unit length capacitance obtained from conformal-mapping and the cutoff wavelength, without going into the controversy of definition. The model strongly supports the power/voltage definition. Closed-form synthesis equations have also been derived.



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Abstracts

Analysis of Finline Discontinuities

Y.-Y. Chen and S.-F. Li. "Analysis of Finline Discontinuities." 1986 MTT-S International Microwave Symposium Digest 86.1 (1986 [MWSYM]): 229-232.

Finline discontinuities are analyzed by means of mode matching technique and spectral domain technique. Numerical results are given.



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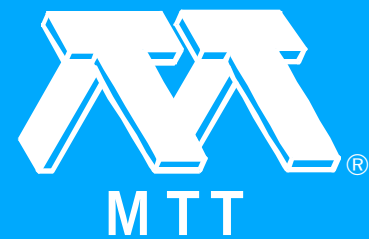
Millimeter-Wave QPSK Modulator in Fin Line

G.B. Gajda and C.J. Verver. "Millimeter-Wave QPSK Modulator in Fin Line." 1986 MTT-S International Microwave Symposium Digest 86.1 (1986 [MWSYM]): 233-236.

A PIN diode QPSK modulator in unilateral fin line is described for use at millimeter-wave frequencies. A parallel configuration, consisting of two 180-degree bi-phase modulators and quadrature and in-phase hybrids, is used in order to accommodate pre-filtered data. All circuitry was implemented using unilateral fin line printed on a single side of the substrate. No stringent dimensional tolerances for either the circuit or the housing were required. Experimental results gave an overall insertion loss of 6.5 dB, and maximum phase error of 5 degrees at the design frequency (28.4 GHz). This approach for implementing a QPSK modulator lends itself to low-cost manufacturing.

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Broadband Dielectric Waveguide Coupler and Six-Port Network

F. Zheng-he. "Broadband Dielectric Waveguide Coupler and Six-Port Network." 1986 MTT-S International Microwave Symposium Digest 86.1 (1986 [MWSYM]): 237-240.

A new structure of dielectric waveguide coupler and power divider has been described which has merits such as simple construction, flat frequency response, good repeatability and stability. The theoretical and measurement data are given in the paper. The six-port network in which the same technique is used has been developed. The design and performance data are also presented.

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Design Charts for Shielded Dielectric Rod and Ring Resonators

Y. Kobayashi and S. Nakayama. "Design Charts for Shielded Dielectric Rod and Ring Resonators." 1986 MTT-S International Microwave Symposium Digest 86.1 (1986 [MWSYM]): 241-244.

Some useful charts are presented to design precisely dielectric rod and ring resonators placed symmetrically in conductor cavities. When a resonant frequency of the TE/sub 01delta/ mode and necessary material constants are given, the optimum dimensions for offering the best separation from other resonances, the frequency-temperature coefficient, and the unloaded Q can be determined from these charts.

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Coupling of Dielectric Resonators to Rectangular Waveguides

K.A. Zaki and C. Chen. "Coupling of Dielectric Resonators to Rectangular Waveguides." 1986 MTT-S International Microwave Symposium Digest 86.1 (1986 [MWSYM]): 245-248.

A method for calculation of the coupling of a dielectric loaded resonator to a rectangular waveguide by means of a long thin slot is presented. Experimental measurements performed on several cases are compared to the calculations. Effect of the resonator's field variation on the coupling calculations are discussed. It is shown that the small aperture theory fails to predict the coupling coefficient variation as a function of the slot length. The actual (measured) variation is predicted properly by taking into account the field distribution in the resonator.

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Abstracts

Computer-Aided Tuning of Microwave Filters

L. Accatino. "Computer-Aided Tuning of Microwave Filters." 1986 MTT-S International Microwave Symposium Digest 86.1 (1986 [MWSYM]): 249-252.

LCX synthesis and pattern search optimisation techniques are used to construct a very effective algorithm for computer aided tuning of microwave filters. Intercavity couplings and resonator detunings of the short-circuited network under test are worked out from the measurement of the phase of the reflection coefficient. The technique proves to be successful in tuning a 6-pole filter having both elliptic attenuation peaks and group delay equalisation and looks very promising for properly aligning channel filters of manifold multiplexers.



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Abstracts

Realization of Dual-Mode Longitudinal Filters with Arbitrary Polarization of Input and Output Ports

J. Frenna. "Realization of Dual-Mode Longitudinal Filters with Arbitrary Polarization of Input and Output Ports." 1986 MTT-S International Microwave Symposium Digest 86.1 (1986 [MWSYM]): 253-256.

This paper describes the synthesis techniques and experimental verification for the realization of dual-mode longitudinal filters with arbitrary polarization of input and output ports. This represents a generalization of the synthesis procedure and offers the possibility of different physical form factors in the implementation of filters and multiplexing networks for satellite systems.



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Abstracts

Dynamic Analysis of Microstrip Lines on Anisotropic Substrates

M.R.G. Maia and A.G. D'Assuncao. "Dynamic Analysis of Microstrip Lines on Anisotropic Substrates." 1986 MTT-S International Microwave Symposium Digest 86.1 (1986 [MWSYM]).

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Analysis of E-Plane Circulators by Eigenvalue Measurements

U. Goebel and C. Schieblich. "Analysis of E-Plane Circulators by Eigenvalue Measurements." 1986 MTT-S International Microwave Symposium Digest 86.1 (1986 [MWSYM]): 257-260.

The operation of E-plane waveguide circulators is explained and verified by eigenvalue measurements. Besides the reverse type circulator, which is usually realized but has inherently small bandwidth, a forward type operation has been found with good potentials for broad-band performance. A model at 10 GHz showed 20 % bandwidth at 20 dB isolation without using external transformers.

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Abstracts

Analysis Method for Generalized Suspended Strip Lines

E. Yamashita, M. Nakajima and K. Atsuki. "Analysis Method for Generalized Suspended Strip Lines." 1986 MTT-S International Microwave Symposium Digest 86.1 (1986 [MWSYM]): 261-264.

This paper describes an effective analysis method suited to planar transmission lines having multiple conductor sheets, multiple substrates, and multiple grooves or pedestals. A coupled strip line structure is analyzed based on this method. Some experimental results are shown.



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New Types of 3-dB Directional Couplers of Microstrip Transmission Lines

L. Dongtien. "New Types of 3-dB Directional Couplers of Microstrip Transmission Lines." 1986 MTT-S International Microwave Symposium Digest 86.1 (1986 [MWSYM]): 265-266.

In this paper the author has brought forward three new types of 3-dB directional couplers suitable to microstrip circuit. The originality of these couplers is that by using these couplers extraordinary close coupling which is less than $1-d/\sup B/$ can easily be achieved. An analysis is given to the electric field distribution and the characteristic impedance of the coupling circuit. The designing curves and the design of the 3-dB coupler with experimental data are provided in the paper.

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Abstracts

Accurate Characterisation and Modelling of Transmission Lines for GaAs MMICs

H.J. Finlay, R.H. Jansen, J.A. Jenkins and I.G. Eddison. "Accurate Characterisation and Modelling of Transmission Lines for GaAs MMICs." 1986 MTT-S International Microwave Symposium Digest 86.1 (1986 [MWSYM]): 267-270.

The benefits of the spectral domain hybrid mode approach in the design of multi dielectric media transmission lines is described. Using GaAs ring resonator techniques covering 2 to 24 GHz, accuracies in effective dielectric constant and loss of 1% and 15% respectively are presented. By combining theoretical and experimental techniques a generalised MMIC microstrip design data base is outlined.



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Abstracts

An Analysis of EM Wave Circuit Problems by Network-Boundary Element Method

F. Zheng-he. "An Analysis of EM Wave Circuit Problems by Network-Boundary Element Method." 1986 MTT-S International Microwave Symposium Digest 86.1 (1986 [MWSYM]): 271-273.

The paper describes a new method which combines Boundary Element Method (BEM) with network method and is called "Network-Boundary Element Method". This hybrid method needs small amount of nodes, can get network parameter directly. It can be used to solve planar circuit problems and discontinuous problems of transmission lines. Some examples are given in the paper.



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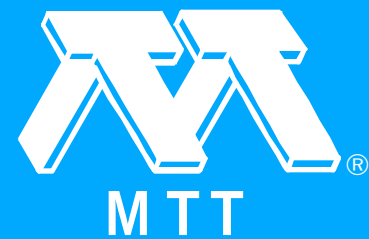
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Symmetric Test Fixture Calibration

E.R. Ehlers. "Symmetric Test Fixture Calibration." 1986 MTT-S International Microwave Symposium Digest 86.1 (1986 [MWSYM]): 275-278.

A symmetric test fixture can be calibrated for error-corrected measurements with two standards. Equations are presented for calibrating with either of two special sets of standards: 1) a thru of zero length and a matched load and 2) a thru of zero length and a matched 2-Port with unknown transmission characteristics. A measurement example is described for a fin-line test fixture.

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Microwave Transmission Line Frequency Discriminators

H.G. Cho and C.W. Lee. "Microwave Transmission Line Frequency Discriminators." 1986 MTT-S International Microwave Symposium Digest 86.1 (1986 [MWSYM]): 279-282.

New types of microwave frequency discriminators are proposed for the narrow band as well as wide-band applications. An example of branch-line hybrid type with 5% operation bandwidth is presented at 4.94 GHz. A bridge type wide-band frequency discriminator is realized using microstrip lines and slot-lines. An experimental discriminator has 50% band-width, which shows good agreement with the theory.

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Abstracts

Multilayer Planar Structures for High Directivity Directional Coupler Design (1986 [MWSYM])

M. Horno and F. Medina. "Multilayer Planar Structures for High Directivity Directional Coupler Design (1986 [MWSYM])." 1986 MTT-S International Microwave Symposium Digest 86.1 (1986 [MWSYM]): 283-286.

One of the problems that appear in the directional couplers designed with coupled transmission lines embedded in nonhomogeneous medium is their poor directivity. In this work several multilayer configurations for high directivity coupler design are studied by means of a variational technique in the spectral domain, and a set of curves for an optimum design are included.



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Abstracts

A FET Amplifier in Fin-Line Technique

J. L'Ecuyer, G.B. Gajda and W.J.R. Hoefer. "A FET Amplifier in Fin-Line Technique." 1986 MTT-S International Microwave Symposium Digest 86.1 (1986 [MWSYM]): 287-290.

This paper describes the successful demonstration of a stable FET amplifier using fin-line technique. The circuit has been realized in integrated E-plane technology, utilizing two main fin-line ports and a microstrip/coplanar bias circuit. The amplifier was designed for 17 GHz operation using a NE67300 FET and achieved a gain of 6 dB over a bandwidth of 1 GHz.



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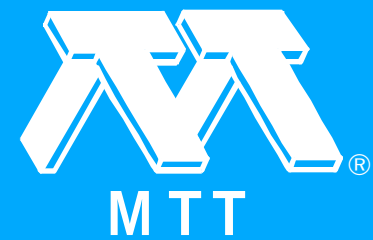
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Abstracts

Session K -- Solid State Topics

"Session K -- Solid State Topics." 1986 MTT-S International Microwave Symposium Digest 86.1 (1986 [MWSYM]): 291-291.



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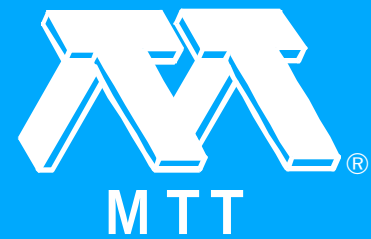


Abstracts

Subharmonically and Fundamentally Pumped Slotline Quasioptical Mixer

C.M. Jackson and C. Sun. "Subharmonically and Fundamentally Pumped Slotline Quasioptical Mixer." 1986 MTT-S International Microwave Symposium Digest 86.1 (1986 [MWSYM]): 293-295.

A slotline dipole quasioptical mixer has been designed, tested at 35 GHz. This quasioptical mixer has circuit elements that can act as inefficient antennas without adversely affecting mixer performance, showing another reason why the isotropic conversion loss is important for the characterization of quasioptical mixers.



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Abstracts

50 Watt/CW Diode Tuned UHF Filter

G.C. DiPiazza and P. Onno. "50 Watt/CW Diode Tuned UHF Filter." 1986 MTT-S International Microwave Symposium Digest 86.1 (1986 [MWSYM]): 297-300.

A novel diode tunable filter is described using quarter wavelength tapped stub resonator sections and digital microprocessor control. Fine resolution electronic tuning in 25KHz steps of a 2MHz-3dB transmission bandwidth from 270-400MHz was achieved with 50 watts CW RF power, 10dB average insertion loss and 42dB minimum rejection skirts, 6MHz from the center frequency.



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Abstracts

High Dynamic Range Video Detector

R.W. Shillady. "High Dynamic Range Video Detector." 1986 MTT-S International Microwave Symposium Digest 86.1 (1986 [MWSYM]): 301-304.

A design technique yielding high dynamic range video, detectors is described. Increased power handling capability is gained by combining multiple detector diodes utilizing a distributed element design approach for the impedance matching structure. Bandwidth ratios greater than 10:1 with upper passband extremes to 40GHz are realizable. VSWR of less than, 2:1 has been realized covering the entire dynamic range of the detector which extends to in excess of +10dBm incident power level. The video detector is comprised of an artificial transmission line wherein the shunt capacitive elements are spaced semiconductor detector diodes and the interconnecting bonds form the series elements.



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Abstracts

Varactor Frequency Halvers with Enhanced Bandwidth and Dynamic Range

R.G. Harrison and W.D. Cornish. "Varactor Frequency Halvers with Enhanced Bandwidth and Dynamic Range." 1986 MTT-S International Microwave Symposium Digest 86.1 (1986 [MWSYM]): 305-308.

A one-and-one-third-octave frequency halver has been developed to accommodate the 7-18 GHz input band, the widest bandwidth yet reported. Dynamic range capabilities of varactor halvers can be increased from 7 dB to about 20 dB by means of a novel "sliding bias" circuit.



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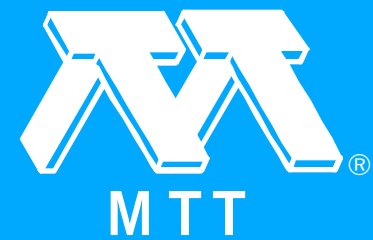
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Abstracts

Session L -- Microwave Systems I

"Session L -- Microwave Systems I." 1986 MTT-S International Microwave Symposium Digest 86.1 (1986 [MWSYM]): 309-309.



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Abstracts

Millimeter-Wave Imaging Sensor (1986 [MWSYM])

W.J. Wilson, R.J. Howard, A.C. Ibbott, G.S. Parks and W.B. Ricketts. "Millimeter-Wave Imaging Sensor (1986 [MWSYM])." 1986 MTT-S International Microwave Symposium Digest 86.1 (1986 [MWSYM]): 311-313.

A scanning 3-mm radiometer system has been built and used on a helicopter to produce moderate resolution (0.5°) images of the ground. This mm-wave sensor can be used for a variety of remote sensing applications, and produces images through clouds, smoke, and dust when visual and IR sensors are not usable. The system is described, and imaging results are presented.



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Abstracts

A Distributed Array Antenna System

R. Shaw and J. Kovitz. "A Distributed Array Antenna System." 1986 MTT-S International Microwave Symposium Digest 86.1 (1986 [MWSYM]): 315-318.

The Space Station communication system will use microwave frequency radio links to carry digitized information from sender to receiver. The ability of the antenna system to meet stringent requirements on coverage zones, multiple users, and reliability will play an important part in the overall multiple access communication system. This paper will describe the configuration of a multibeam conformal phased array antenna and the individual microwave integrated components incorporated into this antenna system.



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Abstracts

High Efficiency 4 GHz SSPA for Space Application

G. Gatti, G. Turgeon, L. Duque, J. Zaichkowsky and M. de Payrebrune. "High Efficiency 4 GHz SSPA for Space Application." 1986 MTT-S International Microwave Symposium Digest 86.1 (1986 [MWSYM]): 319-322.

A high efficiency 4 GHz SSPA has been developed for on-board satellite application. The amplifier utilizes state-of-the-art internally matched devices that allow good performances and reduced alignment time. The obtained results make the substitution of the traditional TWTA highly convenient, in terms of reduced weight, increased reliability and improved RF performance.



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Abstracts

A Compact 4GHz Linearizer for Space Use (1986 [MWSYM])

R. Inada, H. Ogawa, S. Kitazume and P. Desantis. "A Compact 4GHz Linearizer for Space Use (1986 [MWSYM])." 1986 MTT-S International Microwave Symposium Digest 86.1 (1986 [MWSYM]): 323-326.

A compact and lightweight 4GHz linearizer for satellite TWTA has been developed by using MIC packages with chip devices. It consists of preamplifier, predistortion linearizer and limiting amplifier. It improves the noise power ratio for FM system by 3dB and required C/N for INTELSAT TDMA system by 4.5dB. The space environmental test and aging test are successfully performed.



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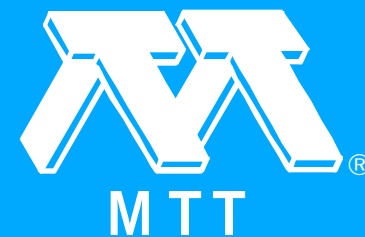
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Abstracts

Session M -- Distributed FET Amplifiers and Circuits

"Session M -- Distributed FET Amplifiers and Circuits." 1986 MTT-S International Microwave Symposium Digest 86.1 (1986 [MWSYM]): 327-327.



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Abstracts

A Distributed 1-12 GHz Dual-Gate FET Mixer

T.S. Howard and A.M. Pavio. "A Distributed 1-12 GHz Dual-Gate FET Mixer." 1986 MTT-S International Microwave Symposium Digest 86.1 (1986 [MWSYM]): 329-332.

A novel broadband mixer topology, which can be implemented using either monolithic or discrete microwave integrated circuit methods, has been developed using distributed design techniques. The mixer exhibits excellent conversion gain and frequency response characteristics with signal handling capabilities and LO drive requirements similar to conventional diode double-balanced mixers.



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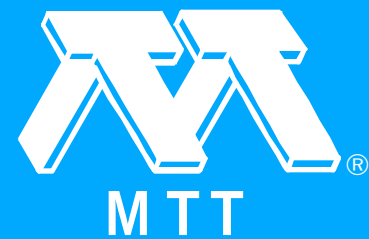
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Internal Microwave Propagation and Distortion Characteristics of Travelling-Wave Amplifiers Studied by Electro-Optic Sampling

M.J.W. Rodwell, M. Riazat, K.J. Weingarten and D.M. Bloom. "Internal Microwave Propagation and Distortion Characteristics of Travelling-Wave Amplifiers Studied by Electro-Optic Sampling." 1986 MTT-S International Microwave Symposium Digest 86.1 (1986 [MWSYM]): 333-336.

The internal signal propagation and saturation characteristics of two monolithic microwave travelling-wave amplifiers (TWA) are measured by electro-optic sampling. Gate and drainline responses are compared with theory and simulation, leading to revisions in the FET models. Drain voltage frequency dependence and harmonic current propagation together lead to more complex saturation behavior than is discussed in the literature.

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Abstracts

Coplanar Waveguides Used in 2-18 GHz Distributed Amplifier

M. Riazat, I. Zubeck, S. Bandy and G. Zdasiuk. "Coplanar Waveguides Used in 2-18 GHz Distributed Amplifier." 1986 MTT-S International Microwave Symposium Digest 86.1 (1986 [MWSYM]): 337-338.

This paper describes the use of coplanar waveguide as an alternative transmission medium in a monolithic distributed amplifier. The coplanar waveguide layout substantially reduces coupling effects between adjacent lines, and eliminates the need for via holes and substrate thinning, leading to higher fabrication yields. The resulting device reported here is a compact (1.3 x 1.5mm) low noise distributed amplifier on a thick GaAs substrate (15 mil), with a gain of $6.0 \pm 0.5\text{dB}$ over the frequency range of 2 - 18GHz.



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Full Characterization of GaAs Power MESFET and Accurate Load-Pull Contours Prediction

M. Lajugie, F. Grossier, A. Silbermann and Y. Bender. "Full Characterization of GaAs Power MESFET and Accurate Load-Pull Contours Prediction." 1986 MTT-S International Microwave Symposium Digest 86.1 (1986 [MWSYM]): 339-342.

A novel large-signal model implemented on the nonlinear time-domain program CIRCEC leads to accurate prediction of all the GaAs MESFET characteristics, needed for the design of a power amplifier. The good agreement between measured and modeled load-pull contours validates the chosen trends.



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Abstracts

A Complete Small Size 2 to 30 GHz Hybrid Distributed Amplifier Using a Novel Design Technique

P. Gamand. "A Complete Small Size 2 to 30 GHz Hybrid Distributed Amplifier Using a Novel Design Technique." 1986 MTT-S International Microwave Symposium Digest 86.1 (1986 [MWSYM]): 343-346.

A 2-30 GHz hybrid distributed amplifier has been designed using a novel design technique. It includes the bias circuitries and exhibits $4.8 \text{ dB} \pm 0.4 \text{ dB}$ up to 30 GHz. The design approach is based on a detailed analysis of the impedances and the cut-off frequency of the transmission lines to reduce the ripple and to increase the bandwidth. This novel approach can be applied in order to improve more generally the performance of distributed amplifiers. This is the first hybrid amplifier ever reported to cover such a wide frequency range using $0.5 \text{ }\mu\text{m}$ GaAs FETs and including the bias circuitries.



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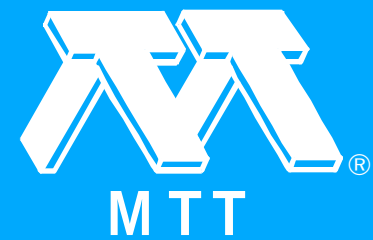
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Abstracts

Session N -- Filters for Satellite Applications

"Session N -- Filters for Satellite Applications." 1986 MTT-S International Microwave Symposium Digest 86.1 (1986 [MWSYM]): 347-347.



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An 8-Pole Quazi-Eilptic Function Filter Realized in 3 Dielectric Resonator Cavities

W.C. Tang. "An 8-Pole Quazi-Eilptic Function Filter Realized in 3 Dielectric Resonator Cavities." 1986 MTT-S International Microwave Symposium Digest 86.1 (1986 [MWSYM]): 349-351.

An eight-pole quazi-elliptic function filter with two pairs of transmission zeros (8-4) has been synthesized and experimentally realized in two triple-mode and one dual-mode dielectric resonator cavities. This was done by carefully selecting the optimum coupling topology. Subsequently the coupling matrix is generated using computer optimization program without using matrix rotation.

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Abstracts

Elliptic Bandpass Filters Using Four TM/sub 010/ Dielectric Rod Resonators

Y. Kobayashi and H. Furukawa. "Elliptic Bandpass Filters Using Four TM/sub 010/ Dielectric Rod Resonators." 1986 MTT-S International Microwave Symposium Digest 86.1 (1986 [MWSYM]): 353-356.

Compact elliptic bandpass filters of three types are constructed by using four TM/sub 010/ dielectric rod resonators. Filters designed to have center frequencies of 3 to 5 GHz, relative bandwidths of 2 to 13 percent, insertion losses of 0.3 to 1.6 dB, and minimum stopband attenuations of 40 to 52 dB.



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Realization of an Exact 5-Pole Elliptic Function Filter Employing Dielectric Loaded Triple-Dual-Mode Cavity Structure

D. Siu. "Realization of an Exact 5-Pole Elliptic Function Filter Employing Dielectric Loaded Triple-Dual-Mode Cavity Structure." 1986 MTT-S International Microwave Symposium Digest 86.1 (1986 [MWSYM]): 357-359.

A novel 5-pole symmetrical elliptic (with four transmission zeros) dielectric resonator filter has been built, using a cascade of a triple-mode and a dual-mode cavity and an unconventional resonant cross-coupling screw structure. Such a structure offers performance improvement over existing designs and makes it an attractive candidate for output multiplexer applications for future C-band satellite systems.

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



Abstracts

Analysis of Antipodal Ridge Waveguide Structure and Application on Extremely Wide Stopband Lowpass Filter

A.M.K. Saad, J.D. Miller, A. Mitha and R. Brown. "Analysis of Antipodal Ridge Waveguide Structure and Application on Extremely Wide Stopband Lowpass Filter." 1986 MTT-S International Microwave Symposium Digest 86.1 (1986 [MWSYM]): 361-363.

This paper presents an accurate analysis of antipodal ridge W/G structure. Design parameters like the cut-off frequencies of TE/sub 10/ and TE/sub 20/ modes, characteristic impedance and gap impedance have been calculated. Comparison with exact analysis of such structure reported in Literature, shows very good agreement. Using the fact that antipodal ridge structures provide very large bandwidth (about twice that of double ridge W/G structures), a lowpass filter with extremely wide stopband using evanescent mode-antipodal ridge W/G techniques has been developed and tested. Spurious free response up to at least the sixth harmonic has been achieved.



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Abstracts

Session O -- Microwave Systems II

"Session O -- Microwave Systems II." 1986 MTT-S International Microwave Symposium Digest 86.1 (1986 [MWSYM]): 364-364.



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Abstracts

A mm-Wave Miniaturized Phase-Lock Source for Low Noise Receiver Applications

L. Bui, R. Hennegan and N. Ton. "A mm-Wave Miniaturized Phase-Lock Source for Low Noise Receiver Applications." 1986 MTT-S International Microwave Symposium Digest 86.1 (1986 [MWSYM]): 367-370.

A mm-wave miniaturized phase-locked source has been developed using a modular concept. The mm-wave hardware is integrated into a single module, and the total phase-locked electronics is reduced to a 2 x 2 inch, 3-layer PC board using SMD (surface-mounted devices). The total phase-locked system with stable internal reference occupies less than 12 cubic inches. The system delivers 50 milliwatts at 84.1 GHz with crystal stability.



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Gigahertz Bandwidth Multibit Phase Sampling and Reconstruction of Microwave Signals

G.B. Wordsworth and D.G.D. Clark. "Gigahertz Bandwidth Multibit Phase Sampling and Reconstruction of Microwave Signals." 1986 MTT-S International Microwave Symposium Digest 86.1 (1986 [MWSYM]): 371-374.

This paper presents novel techniques for digitally sampling and reconstructing the phase of microwave signals. A practical implementation giving two bits of phase resolution and a one gigahertz bandwidth using silicon ECL and GaAs CDFL devices is described, outlining the constructional techniques developed to implement this high speed logic design. The performance observed is shown to be in agreement with computer simulations and future extensions to wider bandwidth and better phase resolution are discussed.

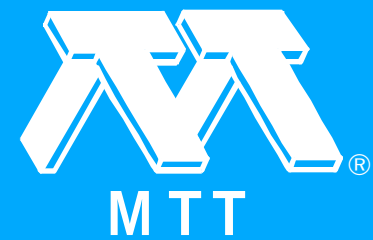
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Abstracts

Session P -- FET Modelling

"Session P -- FET Modelling." 1986 MTT-S International Microwave Symposium Digest 86.1 (1986 [MWSYM]): 375-375.



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An Accurate FET Modelling from Measured S-Parameters

H. Kondoh. "An Accurate FET Modelling from Measured S-Parameters." 1986 MTT-S International Microwave Symposium Digest 86.1 (1986 [MWSYM]): 377-380.

A new modelling algorithm has been developed which extracts a small-signal microwave equivalent circuit of an FET from measured S-parameters. The combinations of properly selected circuit elements with an S-parameter to be least-squares fitted greatly improve the accuracy and consistency of modelling. The absolute accuracy of determining element values was estimated to be better than 3 %.

Click on title for a complete paper.



Abstracts

RF Nonlinear Device Characterization Yields Improved Modeling Accuracy

M.A. Smith, T.S. Howard, K.J. Anderson and A.M. Pavio. "RF Nonlinear Device Characterization Yields Improved Modeling Accuracy." 1986 MTT-S International Microwave Symposium Digest 86.1 (1986 [MWSYM]): 381-384.

A new method for measuring the nonlinear characteristics of microwave GaAs field-effect transistors (FETs) has been developed and evaluated. The technique, which involves RF rather than DC FET measurement, has yielded significant improvement in circuit compression point and harmonic content modeling accuracy.



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Abstracts

Model-Extrapolated S-Parameter Design of MM-Wave GaAs FET Amplifiers

L. Dearden, G. Miner and M. Sayed. "Model-Extrapolated S-Parameter Design of MM-Wave GaAs FET Amplifiers." 1986 MTT-S International Microwave Symposium Digest 86.1 (1986 [MWSYM]): 385-388.

Broadband millimeter-wave GaAs MESFET amplifiers have been designed from model-extrapolated S-parameters. An equivalent circuit MESFET model valid to 40 GHz is given. Amplifier performance from 15-50 GHz is shown and compared with the equivalent circuit model.



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Characterization and Design of GaAs MESFETs for Broadband Control Applications

R.J. Gutmann, D. Fryklund and D. Menzer. "Characterization and Design of GaAs MESFETs for Broadband Control Applications." 1986 MTT-S International Microwave Symposium Digest 86.1 (1986 [MWSYM]): 389-392.

A variety of discrete and monolithically integrated GaAs MESFETs have been characterized for microwave switching figure-of-merit and power handling capability. Design principles for GaAs FETs in broadband switching applications are presented with an emphasis on tradeoffs between conducting-state resistance, non-conducting state capacitance and power handling. Switching frequency figure-of-merit values between 200 and 400 GHz have been achieved with 1 watt power handling capability.

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Large-Signal Narrow Band Quasi-Black-Box Modelling of Microwave Transistors

F. Filicori, A. Mambrioni and V.A. Monaco. "Large-Signal Narrow Band Quasi-Black-Box Modelling of Microwave Transistors." 1986 MTT-S International Microwave Symposium Digest 86.1 (1986 [MWSYM]): 393-396.

A method is proposed for the large-signal narrow-band characterization of microwave active devices. It does not require a detailed knowledge of the device internal structure, but only some measurements of small signal S parameters effected under different bias conditions and some other simple large-signal measurements to be effected by a standard network analyzer.

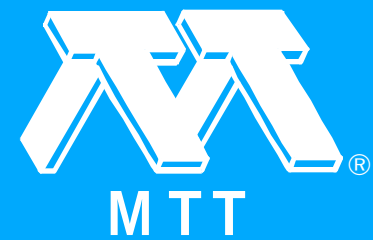
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Abstracts

Session Q -- Dielectric Resonators and Filters

"Session Q -- Dielectric Resonators and Filters." 1986 MTT-S International Microwave Symposium Digest 86.1 (1986 [MWSYM]): 397-397.



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Abstracts

A Simple Experimental Technique for Determining Coupling Between Dielectric Resonators

J.C. Brand. "A Simple Experimental Technique for Determining Coupling Between Dielectric Resonators." 1986 MTT-S International Microwave Symposium Digest 86.1 (1986 [MWSYM]): 399-401.

A method for determining the coupling coefficients between dielectric resonators (DR) is presented. Experimentally measured S-parameters are used to characterize a circuit model of the DR. The DR's resonant frequency is systematically altered with a sliding short in the desired filter configuration and measured. This data is combined with the DR model utilizing equivalent circuit techniques to determine the coupling coefficient.



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Abstracts

800 MHz Band Face-Bonding Filter Using Dielectric B. D. I. S.

T. Nishikawa, K. Wakino, J. Hattori and Y. Ishikawa. "800 MHz Band Face-Bonding Filter Using Dielectric B. D. I. S." 1986 MTT-S International Microwave Symposium Digest 86.1 (1986 [MWSYM]): 403-406.

A 800MHz band face-bonding bandpass filter using high K dielectric "Balanced Double Layered Stripline (B. D. L. S.)" construction was developed. This construction suppressed RF leakage almost completely. And excellent temperature stability as high as the dielectric material was obtained. The insertion loss was improved over 20% compared with the conventional microstripline filter. Outer dimensions of the 5-pole filter were 27x11x5mm.



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Two Path Cutoff Waveguide Resonator Filters with Attenuation Poles

H. Shigesawa, M. Tsuji and K. Takiyama. "Two Path Cutoff Waveguide Resonator Filters with Attenuation Poles." 1986 MTT-S International Microwave Symposium Digest 86.1 (1986 [MWSYM]): 407-410.

We propose here a new idea to design filters which consist of low permittivity dielectric resonators placed in the two paths which are realized by a partial H-plane bifurcation in a rectangular waveguide. This type of filters is regarded as the parallel connection of two evanescent - mode waveguide filters. This paper will try to design such a filter with the Chebyshev's passband response and also with the stopband response with attenuation poles at desired frequencies, and practical performance aspects of this type of filters will be discussed from the view points of both analytical methods and experiments in the X-band.

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Abstracts

Varactor Tuned Bandpass Filters Using Microstrip-Line Ring Resonators

M. Makimoto and M. Sagawa. "Varactor Tuned Bandpass Filters Using Microstrip-Line Ring Resonators." 1986 MTT-S International Microwave Symposium Digest 86.1 (1986 [MWSYM]): 411-414.

This paper describes the fundamental characteristics and experimental results of newly developed tunable bandpass filters using microstrip-line ring resonators. The experimental filter has a steeper attenuation slope and less circuit instability than conventional filters, and it seems to be a suitable filter for MICs or MMICs.



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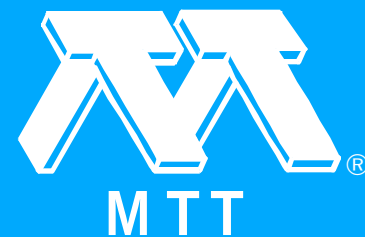


Abstracts

A Bandstop Filter Constructed in Non-Radiative Dielectric Waveguide

J.C. Olivier and J.A.G. Malherbe. "A Bandstop Filter Constructed in Non-Radiative Dielectric Waveguide." 1986 MTT-S International Microwave Symposium Digest 86.1 (1986 [MWSYM]): 415-416.

The exact design of a bandstop filter in Non-Radiative Dielectric Waveguide is described. The filter makes use of side-coupled guides to realize an equivalent of a shunt capacitor and transmission line section. Theoretical and practical results of the coupled lines as well as the filter performance is presented.



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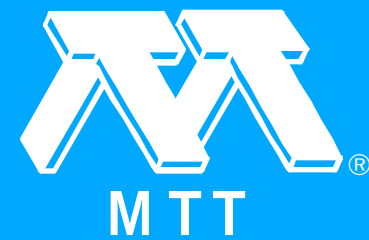
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Abstracts

Session R -- Focused Session -- Low Cost Component Manufacturing

"Session R -- Focused Session -- Low Cost Component Manufacturing." 1986 MTT-S International Microwave Symposium Digest 86.1 (1986 [MWSYM]): 417-417.



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Abstracts

Cost Reduction in Manufacturing Microwave Components

R.M. Malbon. "Cost Reduction in Manufacturing Microwave Components." 1986 MTT-S International Microwave Symposium Digest 86.1 (1986 [MWSYM]): 419-422.

With the rapid infusion of solid state microwave components in both commercial and military systems, cost reduction in component manufacturing has become key to affordability. Some specific areas that have had a significant impact on reducing overall component cost are: 1) device cost, 2) piece count, 3) assembly cost and 4) package cost. In the areas of device cost and piece count, the advent of manufacturable Monolithic Microwave Integrated Circuits (MMIC's) are having a dramatic effect. In the areas of assembly and packaging, automation has been the prime cost reducing factor.



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Automated Interconnect on GaAs Integrated Circuits

J.S. Pavo and D. Bretzke. "Automated Interconnect on GaAs Integrated Circuits." 1986 MTT-S International Microwave Symposium Digest 86.1 (1986 [MWSYM]): 423-426.

Although GaAs integrated circuits provide significant advantage over silicon in both digital, microwave applications, automated assembly of this brittle material presents a considerable technical challenge. As volume and cost effective demands increase, automated interconnect becomes a key requirement. This paper discusses how automation can be achieved with consistent reliability in ball bonding on GaAs.

Click on title for a complete paper.



Abstracts

Advances in Low-Cost Manufacturing - Quasi Thin Film Technology Produces Low-Loss MIC-Components

M. Leitner and R. Vahldieck. "Advances in Low-Cost Manufacturing - Quasi Thin Film Technology Produces Low-Loss MIC-Components." 1986 MTT-S International Microwave Symposium Digest 86.1 (1986 [MWSYM]): 427-430.

A unique method of quasi thin film (QTF) MIC fabrication on soft substrate has been developed. The new technology provides finer lines and interspaces narrower than 1.mil with tolerances of typically + 2.microns. The manufacturing process is especially promising for millimeter-wave circuits since transmission line losses and manufacturing tolerances can be reduced significantly.



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Abstracts

A Comparison of Thin Film and Thick Film Ku-Band Amplifiers

A.M. Pavio and L.L. Cook. "A Comparison of Thin Film and Thick Film Ku-Band Amplifiers." 1986 MTT-S International Microwave Symposium Digest 86.1 (1986 [MWSYM]): 431-432.

The use of thick film fabrication methods, to achieve a low cost microwave design media, will be discussed. A variety of common components, transmission lines were assembled, evaluated in order to assess the performance differences between these circuits, their thin film counterparts. One of the key components evaluated, which exhibited excellent performance, was a Ku-Band GaAs FET amplifier.



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Abstracts

Advances in Low-Cost Component Manufacturing: Avantek's Die Manufacturing Facility in Newark, California

K. Crowley. "Advances in Low-Cost Component Manufacturing: Avantek's Die Manufacturing Facility in Newark, California." 1986 MTT-S International Microwave Symposium Digest 86.1 (1986 [MWSYM]): 433-435.

The microwave semiconductor industry is changing. Unit demand is rising and pressure to reduce price per function follows. If the industry is to meet these challenges, it must evolve rapidly. Analysis of the digital silicon industry may provide clues as to how to proceed.

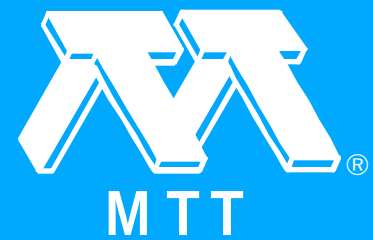


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Low Cost to Packages for High Speed/Microwave Applications

D.A. Larson, D.E. Heckaman, J.A. Frisco and D.A. Haskins. "Low Cost to Packages for High Speed/Microwave Applications." 1986 MTT-S International Microwave Symposium Digest 86.1 (1986 [MWSYM]): 437-440.

A set of low cost, microwave quality packages has been developed for use with both monolithic and hybrid integrated circuits. The packages are modeled after the common TO-style packages, thus allowing the use of an established, cost effective manufacturing base. They are plug-in packages, with pins on 0.100 inch spacings for easy insertion at higher levels. Test results of the TO-8 style package show better than 20 dB return loss through 15 GHz. Isolation between adjacent ports is greater than 50 dB. With package size varying from the small 0.300 inch diameter TO-5 can to the 1.000 inch diameter TO-3 can, applications requiring one GaAs chip, several cascaded chips, or an entire hybrid substrate can be accommodated. The low cost, high performance attributes of these packages make them ideal for high speed, high frequency subsystems.

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Plug-In 11-GHz LNA Module with Ground Plane Tuner

B.R. Hanford. "Plug-In 11-GHz LNA Module with Ground Plane Tuner." 1986 MTT-S International Microwave Symposium Digest 86.1 (1986 [MWSYM]): 441-444.

A tunable single-stage MESFET LNA plug-in module with a 2-dB noise figure and 10-dB gain becomes the front-end stage of mass produced low noise down-converters for the 10.7- to 11.7-GHz Digital Communication Systems. The LNA modules are tuned in a test receiver and then randomly inserted into down-converters to speed up production testing. Space feedback is used to enhance the LNA noise figure and gain.

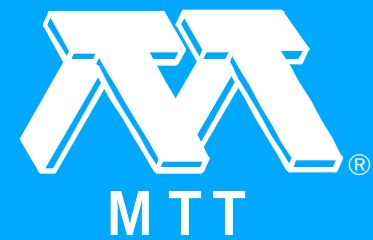
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Abstracts

Session S -- GaAs FET Amplifiers

"Session S -- GaAs FET Amplifiers." 1986 MTT-S International Microwave Symposium Digest 86.1 (1986 [MWSYM]): 445-445.



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Abstracts

5-GHz 20-Watt GaAs FET Amplifier for MLS

K. Hirai, H. Takamatsu, S. Morikawa and N. Tomita. "5-GHz 20-Watt GaAs FET Amplifier for MLS." 1986 MTT-S International Microwave Symposium Digest 86.1 (1986 [MWSYM]): 447-450.

5-GHz 20-watt GaAs FET amplifier using two state-of-the-art high power FETs in the final stage was developed for MLS applications. GaAs FET limiter with unique input/output characteristics and efficient operation of the final FETs were studied for this purpose. Stabilization of output power within 1dB peak-to-peak by means of open loop control was achieved of PIN diode attenuator.



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High Efficiency One, Two, and Four Watt Class B FET Power Amplifiers

J.R. Lane, R.G. Freitag, J.E. Degenford and M. Cohn. "High Efficiency One, Two, and Four Watt Class B FET Power Amplifiers." 1986 MTT-S International Microwave Symposium Digest 86.1 (1986 [MWSYM]): 451-454.

A family of X-band amplifier utilizing the higher efficiency of class B operation has been designed and fabricated. This paper describes the circuitry and performance of 1 watt single-ended, 2 watt push-pull, and 4 watt dual push-pull amplifiers having typical power-added efficiencies of 45%, 40%, and 35%, respectively, in a 1 GHz bandwidth, with associated gains of 5.8 dB, 5.4 dB, and 5.0 dB. Additional data is given for fifteen each of the 1 watt and 2 watt units to show the consistency of their performance.

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2.5-Watt and 5-Watt Internally Matched GaAs FETs for 10.7-11.7 and 14-14.5 GHz Bands

M. Avasarala and D.-Y.S. Day. "2.5-Watt and 5-Watt Internally Matched GaAs FETs for 10.7-11.7 and 14-14.5 GHz Bands." 1986 MTT-S International Microwave Symposium Digest 86.1 (1986 [MWSYM]): 455-458.

A new 7.2mm GaAs FET chip with high gain, power, efficiency and low thermal resistance has been developed. Internally matched packaged devices using one and two such FETs have been developed for the 10.7-11.7 and 14-14.5GHz bands. At 11.7GHz the 7.2mm and 14.4mm devices have achieved power gain, and power-added-efficiency of 35.3dBm, 8dB, 33% and 37.8dBm, 8.0dB and 31.5% respectively at the 1dB gain compression point. At 14.5GHz the results are 34dBm, 7dB, 25% and 37.0dBm, 6dB and 18.5% respectively at the 1dB gain compression point.

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A Low Phase Noise MMIC/Hybrid 3.0W Amplifier at X-Band

T. Dao, S. Huettner and A. Platzker. "A Low Phase Noise MMIC/Hybrid 3.0W Amplifier at X-Band." 1986 MTT-S International Microwave Symposium Digest 86.1 (1986 [MWSYM]): 459-462.

A power amplifier characterized by low phase modulation of the signal is important for Doppler radar systems in signal detection. Phase noise performance of -145 dBc/Hz measured at 10 kHz away from the carrier has been achieved with a MMIC/ hybrid FET 3.0W X-Band amplifier. A comparison with other power amplifiers such as IMPATTs, TWTs, and magnetrons shows that the MMIC/hybrid power amplifier has a lower phase noise level. It was found experimentally that the non-linearity operation of an amplifier and the instabilities of DC regulators are the primary sources of phase noise corruption. Circuit descriptions, performances and discussion of the phase noise behavior of individual stages and of the integrated amplifier module are presented.

Click on title for a complete paper.



Abstracts

60 and 70 GHz (HEMT) Amplifiers

M. Sholley and A. Nichols. "60 and 70 GHz (HEMT) Amplifiers." 1986 MTT-S International Microwave Symposium Digest 86.1 (1986 [MWSYM]): 463-465.

This paper describes the design and development of 60 and 70 GHz High Electron Mobility Transistor (HEMT) amplifiers. The 60 GHz amplifier exhibited a gain of 4.5 to 6.5 dB across the frequency band 56 to 62 GHz and had an associated noise figure of 6.0 dB measured at 57.5 GHz. The 72 GHz amplifier achieved a gain of 4 to 5 dB with a bandwidth of 2.5 GHz, with an associated noise figure of 7.8 measured at 71.0 GHz.



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Abstracts

Session T -- Open Forum II

"Session T -- Open Forum II." 1986 MTT-S International Microwave Symposium Digest 86.1 (1986 [MWSYM]): 466-466.



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Magnetostatic-Wave Propagation in a Finite YIG-Loaded Rectangular Waveguide

M. Radmanesh, C.M. Chu and G.I. Haddad. "Magnetostatic-Wave Propagation in a Finite YIG-Loaded Rectangular Waveguide." 1986 MTT-S International Microwave Symposium Digest 86.1 (1986 [MWSYM]): 469-472.

The propagation of magnetostatic waves (MSW) in a waveguide partially loaded with a low-loss YIG slab is investigated theoretically. Using the integral equation method, the dispersion relation is found to be an infinitely large determinant equal to zero. Proper truncation of this determinant and numerical analysis to find its roots are carried out in this work. It is noticed that there exists a trade off between the time delay and the device bandwidth and maximization of one property leads to a poor value in the other. Thus some design compromises should be made. It is also observed that the frequency range of operation of the device can be adjusted by an external magnetic bias field. This flexibility in tuning the device to operate in any frequency range adds an extra dimension of flexibility to the operation and also design of these devices.

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Magnetostatic Forward Volume Wave Straight Edge Resonators

K.-W. Chang and W.S. Ishak. "Magnetostatic Forward Volume Wave Straight Edge Resonators." 1986 MTT-S International Microwave Symposium Digest 86.1 (1986 [MWSYM]): 473-475.

The performance of Magnetostatic Forward Volume Wave Straight Edge Resonators (MSFVW-SER) is presented. The resonator uses a rectangular YIG film to propagate Magnetostatic forward volume waves where the straight edges serve as reflectors. The interference of width mode resonances with the main resonance reported in the MSSW-SER is not observed in the MSFVW-SER. As a result, high-Q tunable microwave resonators with a tuning range from 1-20 GHz, insertion loss less than 8 dB and spurious rejection better than 10 dB have been designed and fabricated.

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



Abstracts

A Ku Band MSW Delay Line

D.A. Willems and J.M. Owens. "A Ku Band MSW Delay Line." 1986 MTT-S International Microwave Symposium Digest 86.1 (1986 [MWSYM]): 477-480.

A MSW delay line operating at 14.4 GHz has been developed. The delay line has a minimum insertion loss of 15 dB and a VSWR of less than 2.0:1 across a 600 MHz bandwidth. This unit, including the biasing magnet, occupies a volume of four cubic inches and weighs less than one pound. A comparable coaxial delay line is 15 meters long, occupies 200 cubic inches and weighs 60 ounces. This paper presents the design techniques and data.



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Compact Magnetostatic Wave Channelizer

M.R. Daniel and J.D. Adam. "Compact Magnetostatic Wave Channelizer." 1986 MTT-S International Microwave Symposium Digest 86.1 (1986 [MWSYM]): 481-482.

A compact 5 channel filter bank is described which uses the new technology of magnetostatic forward volume waves propagating in narrow epitaxial yttrium iron garnet strips. Results are presented showing S-band performance where a -55 dB out-of-band level is achieved and a 2 tone intermodulation level rejection of 50 dB at 25 MHz from the mid-band frequency.

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Abstracts

Frequency Conversion in General Nonlinear Multiport Devices

V. Rizzoli, C. Cecchetti and A. Lipparini. "Frequency Conversion in General Nonlinear Multiport Devices." 1986 MTT-S International Microwave Symposium Digest 86.1 (1986 [MWSYM]): 483-486.

The conversion matrix of an arbitrary nonlinear multiport, operated in steady-state periodic regime, is defined and computed by a general straightforward approach. The results can be used to analyze the steady state for stability and generation of spurious, and to give a systematic solution to the generalized mixer problem. Some typical examples of application are presented and discussed.



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Prediction of Wideband Power Performance of MESFET Devices Using the Volterra Series Representation

C.L. Law and C.S. Aitchison. "Prediction of Wideband Power Performance of MESFET Devices Using the Volterra Series Representation." 1986 MTT-S International Microwave Symposium Digest 86.1 (1986 [MWSYM]): 487-489.

Power performance of a medium power GaAs MESFET is predicted over the frequency range from 2GHz to 16GHz using a non-linear model where the non-linearities represented by power series up to the third order are derived from D.C. and low-frequency measurements. The analysis employs the Volterra series representation up to the third order. Experimental verification is made on a NE9000 medium power MESFET device. The agreement between predicted and measured output power at one dB. gain compression is within ± 0.5 dB across the 2-16GHz band.

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Abstracts

Microwave Device Modelling Using Efficient l_1 Optimization: A Novel Approach (1986 [MWSYM])

J.W. Bandler, S.H. Chen and S. Daijavad. "Microwave Device Modelling Using Efficient l_1 Optimization: A Novel Approach (1986 [MWSYM])." 1986 MTT-S International Microwave Symposium Digest 86.1 (1986 [MWSYM]): 491-494.

A powerful modelling technique which exploits the unique properties of the l_1 norm is presented. Self-consistent models for passive and active devices are achieved by an approach that automatically checks the validity of model parameters obtained from optimization. Practical use of an efficient l_1 algorithm in complicated problems for which gradient evaluation may not be feasible, is discussed, Examples in modelling of multi-coupled cavity filters and GaAs FET's are presented.



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Abstracts

Thermal Characterization of Microwave Power FETs Using Nematic Liquid Crystals

M.N. Minot. "Thermal Characterization of Microwave Power FETs Using Nematic Liquid Crystals." 1986 MTT-S International Microwave Symposium Digest 86.1 (1986 [MWSYM]): 495-498.

A method of measuring the thermal characteristics of microwave power FETs using temperature sensitive nematic liquid crystals is described. Measurements performed using this technique show thermal resistance not to be invariant, as often assumed.



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Abstracts

Determination of the Transfer Function of a Nonlinear Circuit for Prediction of Intermodulation Characteristics

J.R. Fayos and S.J. Nightingale. "Determination of the Transfer Function of a Nonlinear Circuit for Prediction of Intermodulation Characteristics." 1986 MTT-S International Microwave Symposium Digest 86.1 (1986 [MWSYM]): 499-502.

This paper describes a frequency domain analysis technique developed to determine the transfer function of a nonlinear circuit from the harmonic outputs generated when the circuit is driven at specific frequencies by a single, large-signal sinusoid. The technique can be used to analyze power amplifiers and mixers for gain compression, intermodulation distortion, AM to PM conversion, etc. Examples are provided to illustrate the validity and accuracy of this technique.



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A 2 - 18 GHz Travelling Wave Lossless Two-Port Combiner

D. Levy, A. Noblet and Y. Bender. "A 2 - 18 GHz Travelling Wave Lossless Two-Port Combiner." 1986 MTT-S International Microwave Symposium Digest 86.1 (1986 [MWSYM]): 503-506.

An extension of traveling wave amplifiers is applied to a lossless 2 - 18 GHz two-port combiner, realized in hybrid microstrip technology. Its amplitude weighting capability allows its use in vector phase shifters for phased array applications; it enables also to realize a lossless n-port combiner by cascading several identical modules.

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Abstracts

A Microwaver Powered, Long Duration, High Altitude Platform

W.C. Brown. "A Microwaver Powered, Long Duration, High Altitude Platform." 1986 MTT-S International Microwave Symposium Digest 86.1 (1986 [MWSYM]): 507-510.

A complete microwave power transmission system for a long-endurance, high-altitude (60,000 ft.) airship is described. The system includes an electronically steerable, active phased-array consisting of thousands of identical radiating modules to beam the power, and a light weight, thin-film rectenna mounted on the underside of the airship to absorb and rectifying the incoming microwave power. Application to an airplane is also discussed.



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Abstracts

A 19-Way Isolated Power Divider via the TE/sub 01/ Circular Waveguide Mode Transition

M.H. Chen. "A 19-Way Isolated Power Divider via the TE/sub 01/ Circular Waveguide Mode Transition." 1986 MTT-S International Microwave Symposium Digest 86.1 (1986 [MWSYM]): 511-513.

A 19-way waveguide isolated power divider has been developed with broad bandwidth, low insertion loss and high isolation. Its design allows a flexible number of output ports and uneven power distribution. It can be used as a feed network for an antenna array and, due to this power divider's high isolation characteristics, it can be used as a power combiner for a high power amplifier.



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30-Way Radial Power Combiner for Miniature GaAs FET Power Amplifiers

E. Belohoubek, R. Brown, H. Johnson, A. Fathy, D. Bechtle, D. Kalokitis and E. Mykiety. "30-Way Radial Power Combiner for Miniature GaAs FET Power Amplifiers." 1986 MTT-S International Microwave Symposium Digest 86.1 (1986 [MWSYM]): 515-518.

A compact radial divider/combiner structure is described that combines 30 miniature GaAs FET power amplifiers. A power output of 26 W has been achieved at 11.3 GHz with a 0.5-dB bandwidth of 600 MHz. The combiner is small, lightweight, low loss and offers graceful degradation.

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Power Transfer Between Single-Mode and Multimode Optical Fibers

H.S. Huang, H.-C. Chang and J.-s. Wu. "Power Transfer Between Single-Mode and Multimode Optical Fibers." 1986 MTT-S International Microwave Symposium Digest 86.1 (1986 [MWSYM]): 519-522.

Based on a coupled-mode theory, the power transfer between two parallel single-mode and multimode optical fibers is investigated. Numerical calculations show that power coupling among the guided modes can be very complicated. The theoretical results provide an important guidance for the design of directional couplers composed of such fibers.

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Flat Microwave Responses of Directly Modulated Laser Diodes

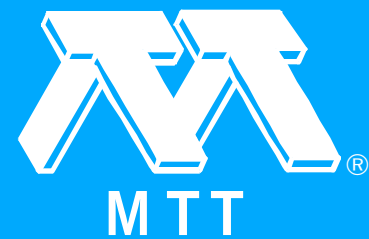
M.C.R. Carvalho and A.A. de Salles. "Flat Microwave Responses of Directly Modulated Laser Diodes." 1986 MTT-S International Microwave Symposium Digest 86.1 (1986 [MWSYM]): 523-526.

Theoretical and experimental results of the frequency response of GaAlAs stripe-geometry laser diodes directly modulated in the microwave range are presented in this paper. Two methods of improving the frequency response flatness are described, the first using a passive microstrip circuit and the second using a FET driving amplifier. Experimental results for both techniques are presented and discussed.

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A Microwave-to-Optical Transducer

L.F. Jelsma. "A Microwave-to-Optical Transducer." 1986 MTT-S International Microwave Symposium Digest 86.1 (1986 [MWSYM]): 527-530.

My theoretical predictions and initial experimental results show that intravalent absorption in semiconductors can be used to modulate light with electric fields that vary at 35 GHz. To produce electric fields of 50-1000 V/cm in a WR(28) waveguide, I use a microwave source that generates a 10- to 160-kW pulse lasting 100-ns. With this source, I can modulate more than 16% of the 3.39- μ m light from a HeNe laser at 77 °K and more than 8% at 300 °K. The percentage of modulation is better than expected. In this paper I develop the light modulation theory, present my initial experimental results, and speculate on how to build a practical microwave-to-optical transducer. I also point out that the transducer, fabricated from germanium, can be used to create fast rise-time optical pulses in the 2- to 4- μ m region of the spectrum.

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Design and Performance of the Millimeter Wave DBR Gunn Oscillators

L. Zong-Wen and Z. Wen-Xun. "Design and Performance of the Millimeter Wave DBR Gunn Oscillators." 1986 MTT-S International Microwave Symposium Digest 86.1 (1986 [MWSYM]): 531-534.

The operation principle and the design method of Distributed Bragg Reflector Gunn oscillators in the millimeter waveband are described based on the theory of coupled-modes in a dielectric grating region, the oscillator is constructed by an inverted-strip dielectric waveguide and an inserted Gunn diode. A practical oscillator with an output of 60~90 mW and 10/sup -5/~10/sup -6/ frequency stability at 36 GHz has been performed, the test results are in agreement with theoretical predictions.



Abstracts

A Combined MMIC/MIC 8-Channel Receive Only Phased Array Demonstrator Operating in I/J Band

G. King and S.J. Flynn. "A Combined MMIC/MIC 8-Channel Receive Only Phased Array Demonstrator Operating in I/J Band." 1986 MTT-S International Microwave Symposium Digest 86.1 (1986 [MWSYM]): 535-538.

An eight element phased array receiver operating in I/J band is presented. Both MMIC and MIC technologies are employed. Chip yield, electronic control, basic system operation and engineering configuration are discussed.



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Medium Power S-Band Rotary Field Ferrite Phase Shifters

C.M. Oness, W.E. Hord and C.R. Boyd, Jr.. "Medium Power S-Band Rotary Field Ferrite Phase Shifters." 1986 MTT-S International Microwave Symposium Digest 86.1 (1986 [MWSYM]): 539-542.

Reciprocal rotary field phase shifters have been developed at S-band frequencies with peak power capacity of 40 KW, average power of 600 W and switching times of 100 microseconds. Data is presented on a production lot of these devices showing the statistical properties of the peak and rms phase error and the peak and average insertion loss.

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Abstracts

Improved Computer-Aided Synthesis Tools for the Design of Matching Networks for Wideband Microwave Amplifiers (1986 [MWSYM])

D.J. Mellor. "Improved Computer-Aided Synthesis Tools for the Design of Matching Networks for Wideband Microwave Amplifiers (1986 [MWSYM])." 1986 MTT-S International Microwave Symposium Digest 86.1 (1986 [MWSYM]): 543-546.

Network synthesis is a powerful design tool when applied to the design of matching networks for wideband microwave amplifiers. Significant design improvements have been made in the computer-aided synthesis process which provides a powerful, efficient and friendly tool for the microwave amplifier designer. Design methodologies are given, computer automation methods outlined and a complete amplifier design example is included.



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Abstracts

Simulation of Intermodulation Distortion in MESFET Circuits with Arbitrary Frequency Separation of Tones

G.W. Rhyne and M.B. Steer. "Simulation of Intermodulation Distortion in MESFET Circuits with Arbitrary Frequency Separation of Tones." 1986 MTT-S International Microwave Symposium Digest 86.1 (1986 [MWSYM]): 547-550.

Design and simulation of microwave integrated circuits requires computer aided analysis tools that can accurately predict a variety of nonlinear distortion effects including gain compression and intermodulation distortion. This paper applies a new frequency domain approach to the simulation of a MESFET amplifier with multifrequency excitation. The unique attributes of the simulation method are that it can be used with general active circuits having multiple input tones of arbitrary amplitude and frequency separation. As an example, gain compression and two-tone intermodulation distortion in a MESFET amplifier are simulated.



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Analysis of Optically Controlled Microwave/Millimeter Wave Device Structures

R.N. Simons and K.B. Bhasin. "Analysis of Optically Controlled Microwave/Millimeter Wave Device Structures." 1986 MTT-S International Microwave Symposium Digest 86.1 (1986 [MWSYM]): 551-554.

The light-induced voltage and the change in the source-to-drain channel current under optical illumination higher than the semiconductor bandgap for GaAs MESFET, InP MESFET, Al/sub 0.3/Ga/sub 0.7/As/GaAs high electron mobility transistor (HEMT) and GaAs permeable base transistor (PBT) were analytically obtained. The GaAs PBT and GaAs MESFET have much higher sensitivity than InP MESFET. The Al/sub 0.3/Ga/sub 0.7/As/GaAs HEMT is observed to have the highest sensitivity. Variation in device parasitic due to optical illumination and its effect on the cutoff frequencies $f_{sub T/}$ and $f_{sub max/}$ are also investigated.

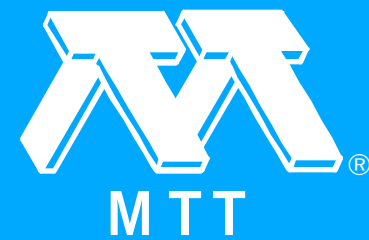
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Abstracts

Session U -- Microwave Acoustics and Magnetostatics

"Session U -- Microwave Acoustics and Magnetostatics." 1986 MTT-S International Microwave Symposium Digest 86.1 (1986 [MWSYM]): 555-555.



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Abstracts

Microwave Acoustic Devices in Systems

B.R. McAvoy. "Microwave Acoustic Devices in Systems." 1986 MTT-S International Microwave Symposium Digest 86.1 (1986 [MWSYM]): 557-559.

Advances in microwave acoustic technology and the attendant progress in device development have been steady for about the past two decades. Progress has been evident not only in the surface acoustic wave (SAW) area but in bulk acoustic wave (BAW) technology as well. This progress has resulted in higher frequencies of operation, more efficient and compact devices for more demanding systems applications. Examples of such devices and applications are described in this paper.



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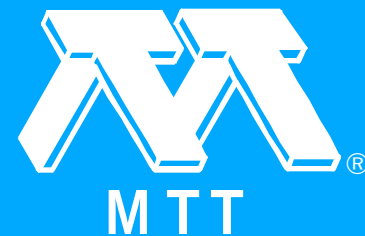


Abstracts

An Overview of Japanese Manufacturing of SAW Devices

S. Fujishima. "An Overview of Japanese Manufacturing of SAW Devices." 1986 MTT-S International Microwave Symposium Digest 86.1 (1986 [MWSYM]): 561-564.

Japanese manufacturing of SAW devices is overviewed here. Japanese market of SAW devices has been limited mainly to consumer electronics such as TV and VCR. Three kinds of basic materials have been widely used. New designing method has been developed for every application, and manufacturing process including packages has been improved to make economical massproduction.



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Abstracts

SAW Convolvers and Signal Processing in a Packet Radio

J.H. Fischer, J. Cafarella and G.T. Flynn. "SAW Convolvers and Signal Processing in a Packet Radio." 1986 MTT-S International Microwave Symposium Digest 86.1 (1986 [MWSYM]): 565-567.

Surface-acoustic-wave convolvers have been combined with digital circuits to create a signal processor for a packet-radio data-communications network. The multifunction radio supports data rates of 44 bps to 1.45 Mbps and signal processing gains from 18 dB to 61 dB for robust communication and ranging in a multipath environment.



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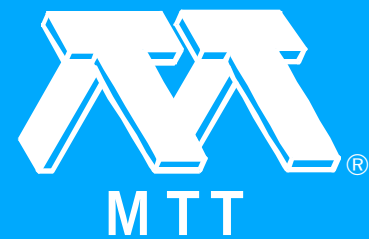
Wideband RF Channelization Using Frequency-Dependent Beam Steering of Focused Bulk Acoustic Waves

F. Sabet-Peyman, K. Chau and I.C. Chang. "Wideband RF Channelization Using Frequency-Dependent Beam Steering of Focused Bulk Acoustic Waves." 1986 MTT-S International Microwave Symposium Digest 86.1 (1986 [MWSYM]): 569-573.

Development of wideband transducers coupled with frequency dependent beam steering of Bulk Acoustic Waves (BAW) in low loss single crystals provide a great opportunity for efficient channelization of broad band microwave signals. Due to material anisotropy, phase and group velocity collinearity represents in many instances a constraint that must be taken into account in a given design. The work presented in this paper deals with the diffraction process in BAW channelizers/spectrum analyzers in a general way. Our diffraction model is based on Huygen's principle to predict the pressure field in a longitudinal device for various input frequencies. The formulation is applied to compute generalized wave disturbances due to an apodized/unapodized linear phased input array and a curved reflector. The material is YAG where parabolic approximation to the slowness curve is valid for the required steering angles.

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MSSW Transversal Filters Based on Current Weighting in Narrow (10 μm) Transducers

Y.J. Ataiyan, J.M. Owens, K.W. Reed, R.L. Carter and W.A Davis. "MSSW Transversal Filters Based on Current Weighting in Narrow (10 μm) Transducers." 1986 MTT-S International Microwave Symposium Digest 86.1 (1986 [MWSYM]): 575-578.

A Magnetostatic Surface Wave, tunable bandpass filter using current weighted transducer arrays based on transversal filtering techniques has been built. A 100 MHz bandpass filter was realized with a minimum insertion loss of 15 dB and sidelobe suppression of 20 dB. The usable tunability range of the device was from 2 to 3.5 GHz.

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A Novel MSW Programmable Barker Coder/Decoder

S.H. Talisa, J.D. Adam and T.W. O'Keeffe. "A Novel MSW Programmable Barker Coder/Decoder." 1986 MTT-S International Microwave Symposium Digest 86.1 (1986 [MWSYM]): 579-581.

A thirteen-bit Barker coder and correlator was designed and built which uses a novel technique for phase encoding the signal, based on small d.c. magnetic fields generated by current loops surrounding each one of thirteen delay lines. The experimental results presented correspond to a reduction of the number of bits to seven.



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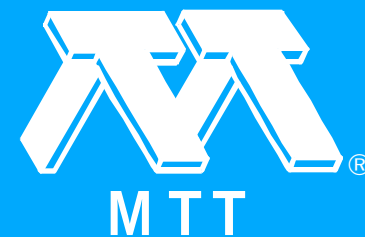
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Abstracts

Session V -- GaAs FET Oscillators, Doublers, and Mixers

"Session V -- GaAs FET Oscillators, Doublers, and Mixers." 1986 MTT-S International Microwave Symposium Digest 86.1 (1986 [MWSYM]): 583-583.



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Abstracts

Design of a Novel FET Frequency Doubler Using a Harmonic Balance Algorithm

R. Gilmore. "Design of a Novel FET Frequency Doubler Using a Harmonic Balance Algorithm." 1986 MTT-S International Microwave Symposium Digest 86.1 (1986 [MWSYM]): 585-588.

The design of a wideband FET frequency doubler operating with a 4-8 GHz input bandwidth is described. The doubler and bandreject amplifier combination achieve an average conversion loss of 3.5 dB across the 8-16 GHz output band. The design method uses the harmonic balance algorithm implemented on an IBM PC-AT personal computer.



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Abstracts

Highly Stable 35 GHz GaAs FET Oscillator

G.S. Dow, D. Sensiper and J.M. Schellenberg. "Highly Stable 35 GHz GaAs FET Oscillator." 1986 MTT-S International Microwave Symposium Digest 86.1 (1986 [MWSYM]): 589-591.

A 35 GHz FET oscillator stabilized with a dielectric resonator has achieved a single sideband noise-to-carrier ratio of -87 dBc/Hz at $f_m = 25$ kHz, external Q /spl cong/ 3000, and frequency stability of 1 ppm/°C. Using this oscillator as the LO, a compact MIC Ka-band receiver was also developed.



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Abstracts

A Unified Design of Dielectric Resonator Oscillators for Telecommunication Systems

S.-W. Chen, L.-C. Chang and J.Y. Chin. "A Unified Design of Dielectric Resonator Oscillators for Telecommunication Systems." 1986 MTT-S International Microwave Symposium Digest 86.1 (1986 [MWSYM]): 593-596.

A unified design approach for improving the performance of both regular DRO & Voltage Tuned DRO (VTDRO) is presented with a step-by-step procedure. The novel designs of 23GHz DRO and 18GHz VTDRO are reported together with their experimental results showing superior performance over the previously published results; for example, the frequency-temperature stability at 23GHz has been improved by a factor of four, while the frequency tuning sensitivity at 18GHz by a factor of five.



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Abstracts

A New N. FETS Oscillator-Combiner Using Tubular Dielectric Resonators

J.P. Joer, R. Quere and J. Obregon. "A New N. FETS Oscillator-Combiner Using Tubular Dielectric Resonators." 1986 MTT-S International Microwave Symposium Digest 86.1 (1986 [MWSYM]): 597-600.

A new oscillator-combiner using two tubular dielectric resonators, coupled to N transistors, is presented. An equivalent "TE" representation having N branches is introduced allowing to derive easily the oscillation-condition. Experimental results obtained with three transistors have given an oscillator with 225 mW output power at 11 GHz without spurious modes. A combiner efficiency of 75% has been measured resulting in an overall oscillator efficiency of 15%.



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A Millimetre-Wave Self-Oscillating Mixer Using a GaAs FET Harmonic-Mode Oscillator

D.H. Evans. "A Millimetre-Wave Self-Oscillating Mixer Using a GaAs FET Harmonic-Mode Oscillator." 1986 MTT-S International Microwave Symposium Digest 86.1 (1986 [MWSYM]): 601-603.

A 34 GHz self-oscillating mixer is described. The harmonic-mode oscillator which is constructed in microstrip produces 4 mW and as a mixer has minimum detectable signal sensitivity of -121.6dBm/ Hz at a Doppler frequency of 4 kHz. It is potentially a low cost sensor for motion and proximity detection.

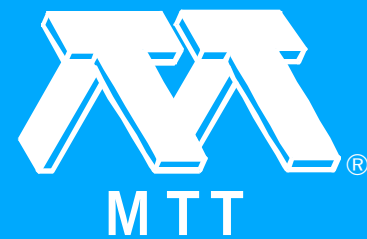
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Abstracts

Session W -- Focused Session -- Microwave Aspects and Applications of GHz/GBIT Optical Transmission Systems I

"Session W -- Focused Session -- Microwave Aspects and Applications of GHz/GBIT Optical Transmission Systems I." 1986 MTT-S International Microwave Symposium Digest 86.1 (1986 [MWSYM]): 605-605.



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Abstracts

Overview of the Application of Microwave Techniques for Lightwave Systems - Invited

H. Sobol. "Overview of the Application of Microwave Techniques for Lightwave Systems - Invited." 1986 MTT-S International Microwave Symposium Digest 86.1 (1986 [MWSYM]): 607-610.

Microwave techniques have a significant role in advancing the state-of-the art of lightwave systems. Applications include the analysis and design of structures to support lightwave propagation, the development of devices and circuits to modulate, demodulate, and process microwaves and microwave bandwidth signals on lightwave carriers, and the development of circuits to process microwave bandwidth baseband signals. The merging of microwave and lightwave technologies will open new opportunities in system design.



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Abstracts

Optical Injection Locking of FET Oscillators Using Fiber Optics

D.C. Buck and M.A. Cross. "Optical Injection Locking of FET Oscillators Using Fiber Optics." 1986 MTT-S International Microwave Symposium Digest 86.1 (1986 [MWSYM]): 611-614.

We discuss the effects of multimode fiber-optic coupling on optical injection-locked GaAs MESFET oscillators. Locking frequency range data are presented and the effects of laser mode locking and fiber modal microphone discussed. The effects of FET photodetection efficiency as a function of modulation frequency are identified together with means for locking range enhancement.



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Comparison of Indirect Optical Injection Locking Techniques of Multiple X-Band Oscillators (1986 [MWSYM])

P. Wahi, Z. Turski, A.S. Daryoush and P.R. Herczfeld. "Comparison of Indirect Optical Injection Locking Techniques of Multiple X-Band Oscillators (1986 [MWSYM])." 1986 MTT-S International Microwave Symposium Digest 86.1 (1986 [MWSYM]): 615-618.

Experimental results of indirect optical injection locking of two X-band oscillators are presented. Large signal modulation of the laser diode generates harmonics, which are employed to synchronize both oscillators over 110°C using an S-band master source. Both laser diode and FET oscillator nonlinearities can be exploited to achieve frequency multiplication and obtain subharmonic injection locking at X-band and above. The merits of these different methods are evaluated based on locking range and FM noise characteristics.

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Abstracts

Session X -- Microwave Measurements I

"Session X -- Microwave Measurements I." 1986 MTT-S International Microwave Symposium Digest 86.1 (1986 [MWSYM]): 619-619.



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Abstracts

A Broadband, Electric-Field Probe Using Resistively Tapered Dipoles, 100 kHz-18 GHz

M. Kanda and L.D. Driver. "A Broadband, Electric-Field Probe Using Resistively Tapered Dipoles, 100 kHz-18 GHz." 1986 MTT-S International Microwave Symposium Digest 86.1 (1986 [MWSYM]): 621-624.

This paper discusses the theoretical, design, fabrication, evaluation, and calibration aspects of a prototype broadband electric-field probe. Its resistively tapered miniature dipole elements allow measurement of electric fields between 1 and 1600 V/m from 1 MHz to 15 GHz, with a flatness of ± 2 dB and an isotropic response of ± 0.3 dB.



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An Automated Measurement Technique for Measuring Amplifier Load-Pull and Verifying Large-Signal Device Models

M. Pierpoint, R.D. Pollard and J.R. Richardson. "An Automated Measurement Technique for Measuring Amplifier Load-Pull and Verifying Large-Signal Device Models." 1986 MTT-S International Microwave Symposium Digest 86.1 (1986 [MWSYM]): 625-628.

A physical model has been used to characterise the large-signal behaviour of a GaAs MESFET terminated with a wide range of load impedances and a new, automated, load-pull system developed to make measurements in order to verify the performance of the model. The heart of the measurement system is a motorised slide-screw tuner which operates over 2-18 GHz with reflection coefficients greater than 0.93 above 3 GHz.

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Abstracts

Direct Calibration and Measurement of Microstrip Structures on Gallium Arsenide (1986 [MWSYM])

P.R. Shepherd and R.D. Pollard. "Direct Calibration and Measurement of Microstrip Structures on Gallium Arsenide (1986 [MWSYM])." 1986 MTT-S International Microwave Symposium Digest 86.1 (1986 [MWSYM]): 629-632.

Measurements on coupled microstrip line structures on gallium arsenide are described which uses direct launch and calibration standards in the same microstrip medium. Novel techniques are adopted to ensure repeatability and overcome problems of fragility of the substrates. Measured results show good agreement with theoretical analysis.



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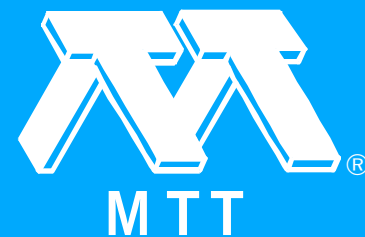


Abstracts

A System for Performing Ultra High Resolution Backscatter Measurements of Splashes

J.P. Hansen. "A System for Performing Ultra High Resolution Backscatter Measurements of Splashes." 1986 MTT-S International Microwave Symposium Digest 86.1 (1986 [MWSYM]): 633-636.

A novel laboratory measurement system is described. The apparatus combines ultra high resolution radar techniques and split screen video photography in order to capture the microwave scattering effects of small scale transient features. One example presented is a time history of the backscatter at 9.0 GHz caused by the splash of a water drop on a water surface.



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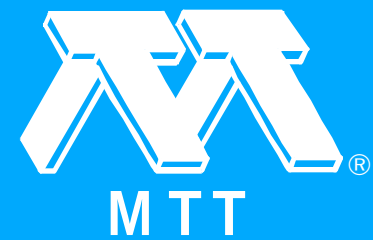
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Abstracts

Session Y -- MIC Subsystems

"Session Y -- MIC Subsystems." 1986 MTT-S International Microwave Symposium Digest 86.1 (1986 [MWSYM]): 637-637.



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Ka-Band Microstrip Integrated Circuit FMCW Transceiver

T.N. Trinh, E. Benko and W.S. Wong. "Ka-Band Microstrip Integrated Circuit FMCW Transceiver." 1986 MTT-S International Microwave Symposium Digest 86.1 (1986 [MWSYM]): 639-642.

A high performance Ka-band millimeter-wave integrated circuit FMCW transceiver has been developed. The transceiver consists of a voltage-controlled microstrip Gunn oscillator (Gunn VCO), a 10 dB coupler, a circulator, a single-balanced mixer, a low pass filter and a single-stage IF amplifier. Both packaged and beamlead varactor diodes for the Gunn VCO were evaluated. The entire RF circuit is printed on a single ferrite substrate using thin film microstrip IC technology and integrated into a small module. The transceiver produces more than 20 dBm CW output power via a coaxial connector at 35 GHz for tuning bandwidth exceeding 1 GHz. The RF-to-IF gain is at least 23 dB using a monolithic IF preamplifier, and the SSB noise figure is better than 12 dB. The unit is hermetically shielded in a 1.2 x 1.5 x 0.375 inch (3 x 3.8 x 0.95 cm) enclosure.

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A Ka-Band Dual-Channel Tracking Receiver Converter

M.A. Smith, A.M. Pavio and B. Kim. "A Ka-Band Dual-Channel Tracking Receiver Converter." 1986 MTT-S International Microwave Symposium Digest 86.1 (1986 [MWSYM]): 643-644.

An amplitude and phase tracking integrated receiver converter, with a self-contained local oscillator, has been developed for a variety of EW applications in Ka-band. The module described, which operates in a band centered at 34 GHz, employs a dual double-balanced mixer, a push-push dielectric resonator local oscillator, and a monolithic LO buffer amplifier. The module was assembled using microstrip circuit techniques and coaxial connectors and can easily be integrated with other system components.

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Abstracts

Printed-Circuit Ka-Band Mixer with Compact Filter for Step-Tuned LO

P.J. Meier. "Printed-Circuit Ka-Band Mixer with Compact Filter for Step-Tuned LO." 1986 MTT-S International Microwave Symposium Digest 86.1 (1986 [MWSYM]): 645-648.

A miniaturized Ka-band mixer which accepts widely separated LO frequencies has been developed, allowing a wide RF band to be covered in two steps. This restricts the IF bandwidth and eliminates 2x2 spurious mixing products. The mixer includes a unique, compact, LO filter that helps minimize the IF SWR.



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A Planar Log-Periodic Mixtenna for Millimeter and Submillimeter Wavelengths

P.H. Siegel. "A Planar Log-Periodic Mixtenna for Millimeter and Submillimeter Wavelengths." 1986 MTT-S International Microwave Symposium Digest 86.1 (1986 [MWSYM]): 649-652.

A design for a combined planar mixer/antenna for use at near millimeter and submillimeter wave-lengths is described. The antenna is one of the class of planar log-periodic structures originally developed by DuHamel and Isbell. The active mixing element may be separately mounted or fully integrated with the antenna and can be either a planar Schottky diode or SIS (superconductor insulator superconductor) junction. The results of extensive antenna pattern and impedance measurements made on a microwave scale model are discussed. It is felt that the proposed mixtenna structure is suitable as a moderate bandwidth receiver or as an element of a focal plane or limited scan phased array.

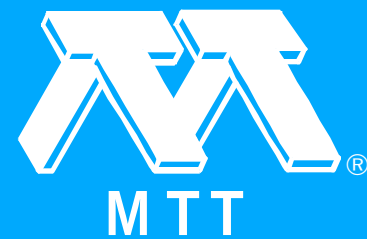
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Abstracts

Session Z -- Focused Session -- Microwave Aspects and Applications of GHz/GBIT Optical Transmission Systems II

"Session Z -- Focused Session -- Microwave Aspects and Applications of GHz/GBIT Optical Transmission Systems II." 1986 MTT-S International Microwave Symposium Digest 86.1 (1986 [MWSYM]): 653-653.



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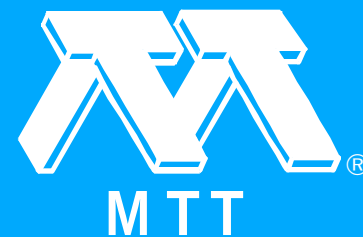


Abstracts

Microwave and Millimeter Wave Bandwidth Optical Communications

*J.E. Bowers. "Microwave and Millimeter Wave Bandwidth Optical Communications." 1986
MTT-S International Microwave Symposium Digest 86.1 (1986 [MWSYM]).*

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Limitations on Switching Speed in Wideband Semiconductor Lasers

R.S. Tucker, J.M. Wiesenfeld, P.M. Downey and J.E. Bowers. "Limitations on Switching Speed in Wideband Semiconductor Lasers." 1986 MTT-S International Microwave Symposium Digest 86.1 (1986 [MWSYM]): 655-657.

An experimental and theoretical study of large-signal switching transients in directly modulated semiconductor lasers is reported. The main parameters affecting high-speed switching are identified and device-dependent limitations on modulation at multi-gigabit per second data rates are described.

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Linearity Characterization of Connectorized Laser Diodes Under Microwave Intensity Modulation by AM/AM and AM/PM Measurements

W.I. Way and A. Afrashteh. "Linearity Characterization of Connectorized Laser Diodes Under Microwave Intensity Modulation by AM/AM and AM/PM Measurements." 1986 MTT-S International Microwave Symposium Digest 86.1 (1986 [MWSYM]): 659-662.

Measurements and analysis of the AM/AM and AM/PM characteristics of microwave intensity modulated GaAlAs laser diodes with multimode pigtailed and biconic connectors have been carried out. In general, AM/AM is the main nonlinearity distortion for a connectorized laser diode. However, AM/PM distortion may become comparable with or dominant over AM/AM distortion when the modulation frequency is close to the resonance region of the laser diode.

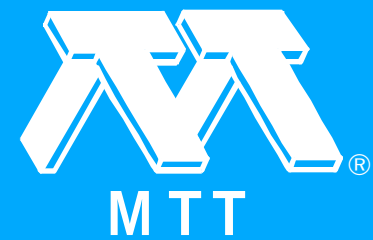
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Abstracts

Session AA -- Microwave Measurements Techniques II

"Session AA -- Microwave Measurements Techniques II." 1986 MTT-S International Microwave Symposium Digest 86.1 (1986 [MWSYM]): 663-663.



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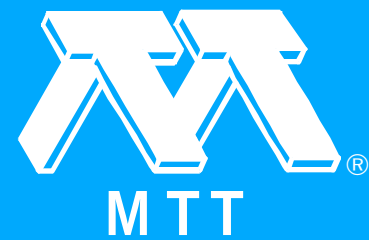


Abstracts

Calibrating a Dual Six-Port or Four-Port for Measuring Two-Ports with Any Connectors

C.A. Hoer and G.F. Engen. "Calibrating a Dual Six-Port or Four-Port for Measuring Two-Ports with Any Connectors." 1986 MTT-S International Microwave Symposium Digest 86.1 (1986 [MWSYM]): 665-668.

A technique is described for calibrating a dual six-port & four-port ANA so that the scattering parameters of two-port devices having any combination of connectors can be measured. The technique is a generalization of the "thru-reflect-line" (TRL) calibration technique in which the "thru" is replaced with a second length of precision transmission line.



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Integrated Fin-Line 6-Ports for MM-Wave Network Analyzers

M. Malkomes and R. Walsdorf. "Integrated Fin-Line 6-Ports for MM-Wave Network Analyzers." 1986 MTT-S International Microwave Symposium Digest 86.1 (1986 [MWSYM]): 669-672.

The design and performance of an integrated 6-port mm-wave reflectometer is presented. The design uses Fin-Line technology and beam lead diode detectors in a Ka- full-band application. The high precision measurement capability of the 6-port device has been tested successfully in an automated 6-port network analyzer setup.



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New Extensions of Six-Port Theory and Practice

L. Kaliouby and R.G. Bosisio. "New Extensions of Six-Port Theory and Practice." 1986 MTT-S International Microwave Symposium Digest 86.1 (1986 [MWSYM]): 673-676.

This paper presents new extensions of six-port theory and practice from the following three points of view: 1) Theory: A new relationship between reflection coefficient and calibration constants is given, 2) Calibration: A new simple explicit six-port calibration solution using three positions of a sliding short is developed, 3) Design: A new six-port design for continuous Gamma-plane is introduced.



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Coherent RF Error Statistics (1986 [MWSYM])

R.B. Dybdal and R.H. Ott. "Coherent RF Error Statistics (1986 [MWSYM])." 1986 MTT-S International Microwave Symposium Digest 86.1 (1986 [MWSYM]): 677-680.

RF error statistics for power, voltage, and phase are presented for an error component which is coherently related to a desired signal. The error component is assumed to have a constant magnitude and a phase distribution which is equally likely and uniformly distributed from 0 to 360°. The statistics which result have non-zero mean values for power and voltage errors and the standard deviation of the errors differ significantly from those projected from Gaussian statistics.

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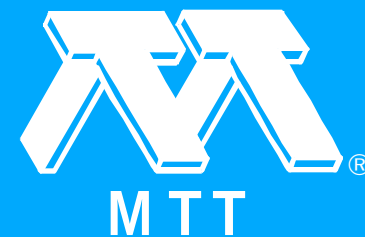


Abstracts

Microwave Resonator Circuit Model from Measured Data Fitting

W.P. Wheless, Jr. and D. Kajfez. "Microwave Resonator Circuit Model from Measured Data Fitting." 1986 MTT-S International Microwave Symposium Digest 86.1 (1986 [MWSYM]): 681-684.

An iterative procedure is developed for least squares estimation, from measured impedance data, of the parameters specifying a lumped-element resonant circuit equivalent to a dielectric resonator single resonance. The procedure is applicable to large sets of measured data obtained by an automatic network analyzer.



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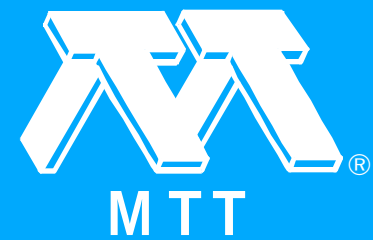
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Abstracts

Session BB -- Passive Circuit Modeling

"Session BB -- Passive Circuit Modeling." 1986 MTT-S International Microwave Symposium Digest 86.1 (1986 [MWSYM]): 685-685.



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Abstracts

Microstrip Filter Design Including Dispersion Effects and Radiation Losses

P.B. Katehi and L.P. Dunleavy. "Microstrip Filter Design Including Dispersion Effects and Radiation Losses." 1986 MTT-S International Microwave Symposium Digest 86.1 (1986 [MWSYM]): 687-690.

A numerical technique for the design of parallel-coupled bandpass microstrip filters is discussed. The method accounts accurately for the dispersion effects due to the presence of the substrate, the associated surface wave propagation and radiation losses. The presented technique does not have any frequency limitations and can be applied to various microstrip filters. Comparison with experimental results shows excellent agreement.



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Dispersion of Transient Signals in Microstrip Transmission Lines (1986 [MWSYM])

R.L. Veghte and C.A. Balanis. "Dispersion of Transient Signals in Microstrip Transmission Lines (1986 [MWSYM])." 1986 MTT-S International Microwave Symposium Digest 86.1 (1986 [MWSYM]): 691-694.

The distortion of an electrical pulse caused by dispersion as it propagates along a microstrip line is investigated. A model for dispersion of the phase constant is selected to meet the frequency, accuracy, and microstrip parametric requirements. Numerical integration and Taylor series expansion techniques are used to compute the shape of the DC dispersed pulses having square and Gaussian envelope shapes. Taylor series expansion methods are more convenient for the analysis of RF pulses.

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Abstracts

Characteristics of Multiconductor, Asymmetric, Slow-Wave Microstrip Transmission Lines (1986 [MWSYM])

T.C. Mu, H. Ogawa and T. Itoh. "Characteristics of Multiconductor, Asymmetric, Slow-Wave Microstrip Transmission Lines (1986 [MWSYM])." 1986 MTT-S International Microwave Symposium Digest 86.1 (1986 [MWSYM]): 695-698.

Spectral Domain Technique has been applied to analyze multiconductor, asymmetric slow-wave microstrip lines. It is observed that slow-wave factor of odd mode of coupled microstrip lines may be equal to or larger than that of even mode under appropriate conditions. This presents the flexibility to realize a large variety of passive components, such as directional coupler, phase shifter, power combiner/divider.



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Coplanar Waveguide vs. Microstrip for Millimeter Wave Integrated Circuits

R.W. Jackson. "Coplanar Waveguide vs. Microstrip for Millimeter Wave Integrated Circuits." 1986 MTT-S International Microwave Symposium Digest 86.1 (1986 [MWSYM]): 699-702.

Using a full wave analysis, coplanar waveguide transmission line is compared to microstrip in terms of conductor loss, dispersion and radiation into parasitic modes. It is shown that, on standard. 1 mm semiconductor at 60 GHz, the dimensions of coplanar waveguide can be chosen to give better results in terms of conductor loss and dispersion than microstrip. Curves are presented comparing the microstrip open end and the coplanar waveguide short circuit in terms of parasitic mode generation.

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Abstracts

Discontinuities in Fin-Line on Semiconductor Substrate (1986 [MWSYM])

K. Uhde. "Discontinuities in Fin-Line on Semiconductor Substrate (1986 [MWSYM])." 1986 MTT-S International Microwave Symposium Digest 86.1 (1986 [MWSYM]): 703-706.

Discontinuities in both slot width and substrate complex dielectric constant are investigated theoretically. The fin-line slot pattern is defined on a double-layer substrate with finite conductivity. Numerical results are presented showing that a step in the permittivity can almost be compensated for by a step in the slotwidth.



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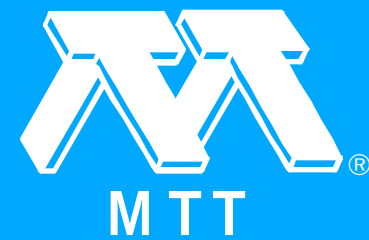
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Abstracts

Session CC -- Optical Devices for Microwave Applications

"Session CC -- Optical Devices for Microwave Applications." 1986 MTT-S International Microwave Symposium Digest 86.1 (1986 [MWSYM]): 707-707.



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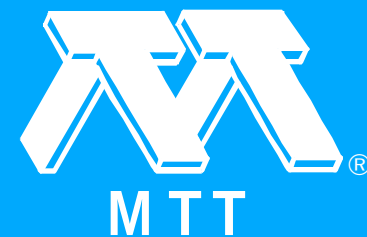


Abstracts

10 GHz RF Fiber Optic Links

C.M. Gee, I.L. Newberg, G.D. Thurmond and H.W. Yen. "10 GHz RF Fiber Optic Links." 1986 MTT-S International Microwave Symposium Digest 86.1 (1986 [MWSYM]): 709-712.

A 10-GHz direct laser modulation and an external modulation link were demonstrated. Signal-to-noise ratios of 130 dB/Hz and 115 dB/Hz have been measured for the external modulation link at 1.3 μm wavelength and for the direct modulation link at 0.83 μm wavelength, respectively.



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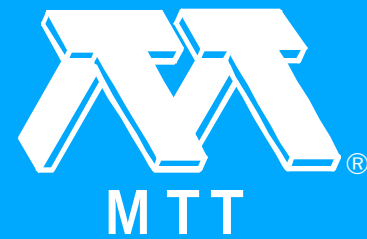


Abstracts

A 1GBit/s Optical/Electrical Input Monolithic GaAs Transmitter I.C.

M.P. Walton, P.R. Haugen and S.L. Palmquist. "A 1GBit/s Optical/Electrical Input Monolithic GaAs Transmitter I.C.." 1986 MTT-S International Microwave Symposium Digest 86.1 (1986 [MWSYM]): 713-716.

A 1GBit/s optical input transmitter chip has been developed to evaluate the performance of optical fibers as a communication media in high speed electronics. The transmitter chip has been fabricated in depletion mode GaAs with a one micron gate length. Optical/electrical functionality has been demonstrated at the wafer level.



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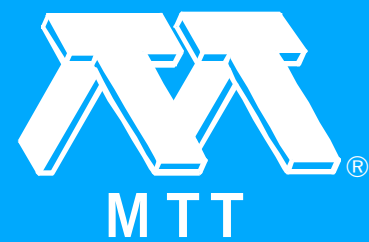
GaAs/GaAlAs Heterojunction Bipolar Phototransistor for Monolithic Photoreceiver Operating at 140 Mbit/s (1986 [MWSYM])

H. Wang, C. Bacot, C. Chevalier and D. Ankri. "GaAs/GaAlAs Heterojunction Bipolar Phototransistor for Monolithic Photoreceiver Operating at 140 Mbit/s (1986 [MWSYM])." 1986 MTT-S International Microwave Symposium Digest 86.1 (1986 [MWSYM]): 717-719.

The first monolithic integrated photodetector-preamplifier implemented with GaAs-GaAlAs heterojunction phototransistor and transistors has been fabricated and tested. A heterojunction phototransistor (HPT), two heterojunction bipolar transistors (HBT's) and four resistors are integrated in a 0.5 x 0.5 mm² GaAs chip. The photoreceiver with a 26 k Ω external feedback resistor has a bandwidth of 80 MHz with a transimpedance gain of 7000V/A. The noise measurements indicate that a minimum detectable power of -30 dBm is obtained at 140 Mbit/s for an error rate of 10⁻⁹.

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Self-Oscillating GaAs FET Demodulator and Downconverter for Microwave Modulated Optical Signals

C. Rauscher, L. Goldberg and A.M. Yurek. "Self-Oscillating GaAs FET Demodulator and Downconverter for Microwave Modulated Optical Signals." 1986 MTT-S International Microwave Symposium Digest 86.1 (1986 [MWSYM]): 721-724.

Recovery of a high-frequency modulation signal from an optical carrier is accomplished by employing a commercially available single-gate GaAs FET in a multifunctional role. The transistor serves simultaneously as detector, tunable local oscillator, harmonic generator, and mixing element, thereby achieving demodulation and downconversion all in one. Implementation of the concept is illustrated with an experimental circuit that uses a device with sub-quarter-micron gate geometry and provides an output response in the designated 3-to-7-GHz intermediate-frequency interval. Circuit characteristics are reported for various frequency ranges of optical carrier modulation, demonstrating practicability of the approach up through 90 GHz.

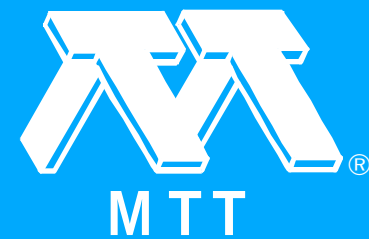
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Abstracts

Session DD -- Ferrites

"Session DD -- Ferrites." 1986 MTT-S International Microwave Symposium Digest 86.1 (1986 [MWSYM]): 725-725.



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Simultaneous Dual-Polarization Ferrite Phase Shifter

W.E. Hord and C.R. Boyd, Jr.. "Simultaneous Dual-Polarization Ferrite Phase Shifter." 1986 MTT-S International Microwave Symposium Digest 86.1 (1986 [MWSYM]): 727-730.

Radar system needs exist for antennas capable of forming simultaneous orthogonally polarized congruent agile beams. For a phased array system this implies that the phase shifters must be capable of transmitting and receiving any arbitrary polarization. This paper describes the performance of a latching reciprocal ferrite shifter at X-band frequencies which provides polarization-independent performance at moderate power levels and with low insertion loss.

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Temperature Insensitive Dual-Mode Phase Shifter

H. Asao, M. Matsunaga and F. Takeda. "Temperature Insensitive Dual-Mode Phase Shifter." 1986 MTT-S International Microwave Symposium Digest 86.1 (1986 [MWSYM]): 731-734.

This paper describes the temperature insensitive dual-mode phase shifter which has been developed in Mitsubishi Electric Corporation. The phase deviation is less than 18° over temperature range $-30^\circ\text{C} \sim +90^\circ\text{C}$. This is about one-third of the conventional one.

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



Abstracts

An Adjustable-Phase Power Divider

C.R. Boyd, Jr.. "An Adjustable-Phase Power Divider." 1986 MTT-S International Microwave Symposium Digest 86.1 (1986 [MWSYM]): 735-738.

A ferrite phase shifter configuration is described, that is capable of coupling one input to two outputs with low insertion loss and arbitrary insertion phase. In planar phased-array antennas, this approach can provide reciprocal beam-forming with the number of phase shifters reduced to half the number of elements.



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Abstracts

Broadband Stripline Circulator

E. Schloemann and R.E. Blight. "Broadband Stripline Circulator." 1986 MTT-S International Microwave Symposium Digest 86.1 (1986 [MWSYM]): 739-742.

Performance data on experimental stripline circulators using single-crystal YIG or Li-ferrite discs and external YIG (or Li-ferrite) domes (for achieving a nearly uniform internal magnetic fieldstrength) are summarized and compared with theoretical expectations. Reasonably good circulator performance is observed in the frequency range from 2.8 to 10.2 GHz for the circulator based on YIG and in the frequency range from 5.8 GHz to 18 GHz for the circulator based on Li-ferrite.



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Isolators in Finline Technique

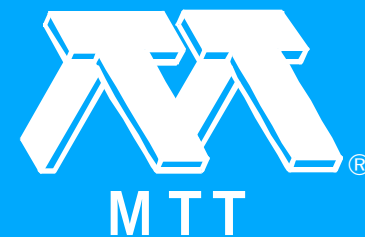
C. Schieblich and U. Goebel. "Isolators in Finline Technique." 1986 MTT-S International Microwave Symposium Digest 86.1 (1986 [MWSYM]): 743-746.

A novel configuration for finline isolators is presented. The magnetic bias field is perpendicular to the broad wall of the ferrite slab, combining resonance-type with field-displacement operation. 40% bandwidth in X-band with an insertion loss of 1 dB was obtained, an extension to higher frequencies is straightforward.

Abstracts

Session EE -- Joint with Monolithics Symposium -- Opening Session

*"Session EE -- Joint with Monolithics Symposium -- Opening Session." 1986 MTT-S
International Microwave Symposium Digest 86.1 (1986 [MWSYM]): 747-747.*



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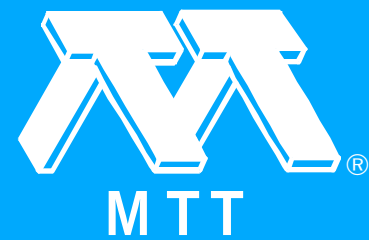


Abstracts

Microwave/Millimeter Wave Monolithic Integrated Circuits (MIMIC) Program (1986 [MWSYM])

E.D. Maynard, Jr.. "Microwave/Millimeter Wave Monolithic Integrated Circuits (MIMIC) Program (1986 [MWSYM])." 1986 MTT-S International Microwave Symposium Digest 86.1 (1986 [MWSYM]): 749-752.

The Microwave/Millimeter Wave Monolithic Initiative (M³I) was started by concerns in the smart munitions guidance and control community over the projected costs of millimeter wave seekers. A survey of monolithic analog integrated circuits was made by a DoD Working Group, consisting of personnel from OSD, Army, Navy, Air Force, DARPA and SDIO. The team visited 23 companies and several government facilities engaged in development of the technology.



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Microwave/Millimeter Wave Monolithic Integrated Circuits (MIMIC) Program (1986 [MWSYM])

E.D. Maynard, Jr.. "Microwave/Millimeter Wave Monolithic Integrated Circuits (MIMIC) Program (1986 [MWSYM])." 1986 MTT-S International Microwave Symposium Digest 86.1 (1986 [MWSYM]): 753-756.

The Microwave/Millimeter Wave Monolithic Initiative (M³I) was started by concerns in the smart munitions guidance and control community over the projected costs of millimeter wave seekers. A survey of monolithic analog integrated circuits was made by a DoD Working Group, consisting of personnel from OSD, Army, Navy, Air Force, DARPA and SDIO. The team visited 23 companies and several government facilities engaged in development of the technology.



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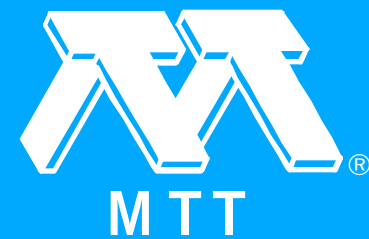
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Abstracts

Session FF -- Biological Effects and Medical Applications

"Session FF -- Biological Effects and Medical Applications." 1986 MTT-S International Microwave Symposium Digest 86.1 (1986 [MWSYM]): 757-757.



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Abstracts

A Three-Band Microwave Radiometer System for Noninvasive Measurement of the Temperature at Various Depths

S. Mizushina, Y. Hamamura and T. Sugiura. "A Three-Band Microwave Radiometer System for Noninvasive Measurement of the Temperature at Various Depths." 1986 MTT-S International Microwave Symposium Digest 86.1 (1986 [MWSYM]): 759-762.

An experimental three-band (1.5,2.5,3.5±0.5GHz) radiometer system and a data analysis procedure have been developed for noninvasive measurement of the temperature at various depths in a biological body. Using them, we made temperature measurement experiments on the abdominal region of rabbits. The results of the experiments demonstrate the feasibility of the multifrequency radiometry for this purpose.



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Biological Temperature Retrieval by Scanning Radiometry

F. Bardati, M. Mongiardo, D. Solimini and P. Tognolatti. "Biological Temperature Retrieval by Scanning Radiometry." 1986 MTT-S International Microwave Symposium Digest 86.1 (1986 [MWSYM]): 763-766.

This paper refers to the retrieval of two-dimensional thermal fields in biological bodies from multispectral microwave measurements by a scanning waveguide applicator. A formulation of the inverse radiometric problem suitable for a two-step solution (transverse deconvolution and profile retrieval) is outlined. The performance of the inversion procedure is tested by a numerical evaluation of the impulse response of the resulting algorithm.





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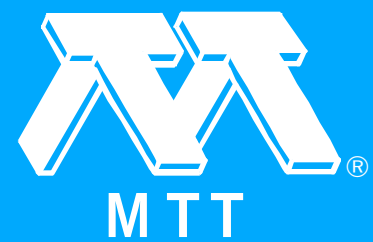
Instrumentation for Invasive and Non-Invasive Microwave Hyperthermia of Brain Tumors

R.W. Paglione, F. Sterzer, A. Winter and J. Laing. "Instrumentation for Invasive and Non-Invasive Microwave Hyperthermia of Brain Tumors." 1986 MTT-S International Microwave Symposium Digest 86.1 (1986 [MWSYM]): 767-769.

Nineteen patients with malignant brain tumors who had failed to respond to conventional therapies were treated with invasive thermotherapy. In the last four of these patients the thermotherapy was combined with brachytherapy. Hyperthermic temperatures (-43°C) were induced in the tumors using microwaves at a frequency of 2450 MHz that were guided into the tumors by one or more semi-rigid coaxial applicators. The feasibility of non-invasively heating malignant brain tumors that are located close to the skull is being investigated. A microwave lens that can concentrate 915 MHz microwave power into small tissue volumes shows promise of being clinically useful.

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Swept Frequency Measurements of Microwave Antennas in Feline & Canine Brain

M. Salcman, G. Neuberth, R.W. Nudelman, F.T. Ferraro and M. Hartman. "Swept Frequency Measurements of Microwave Antennas in Feline & Canine Brain." 1986 MTT-S International Microwave Symposium Digest 86.1 (1986 [MWSYM]): 771-774.

Interstitial microwave hyperthermia may prove to be an important therapy for malignant brain tumors. For safety and efficiency, the size and number of intracranial microwave antennas needs to be limited. Low power swept frequency measurements of VSWR were carried out in the brains of anesthetized cats and dogs utilizing stereotactically placed monopole antennas. The coupling efficiency of antennas at any frequency was degraded ($VSWR > 2:1$) if a length of antenna less than $2h$ ($h = \lambda/4 \cdot \sqrt{\epsilon}$) was inserted or if a plastic catheter was utilized. Such measurements indicate that (h) can be shortened 25% from the resonant length without seriously degrading antenna performance. The total length can be halved if a catheter with a high dielectric is used. High power tests (2 -10w) of short antennnas at 915 MHz in a ceramic catheter ($\epsilon = 10$) at 45-50°C produce thermal fields approximately 2 cm in diameter in normal brain. It should be possible to efficiently and safely heat human brain tumors of average size utilizing these antennas and catheters at 915 MHz.

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Abstracts

Energy Deposition Patterns within Limb Models Heated with a Mini Annular Phased Array (MAPA) Applicator

J.L. Guerquin-Kern, M.J. Hagmann, C.K. Charny and R.L. Levin. "Energy Deposition Patterns within Limb Models Heated with a Mini Annular Phased Array (MAPA) Applicator." 1986 MTT-S International Microwave Symposium Digest 86.1 (1986 [MWSYM]): 775-778.

A series of experiments has been carried out in order to characterize a MAPA applicator prior to possible clinical implementation. The energy deposition patterns were determined in several human limb models of different complexities. The maximum energy deposition observed in a homogeneous cylindrical phantom was found to be at the middle of the applicator. For more realistically shaped, homogeneous limb models, the point of maximum energy deposition was shifted towards a smaller cross-sectional region; this was also the case for isolated human legs. Furthermore, significant heating was observed in the bone of the isolated legs. Such phenomena illustrate the limitation of using classical 2-D numerical models for predicting the energy deposition patterns in heterogeneous bodies.



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Cytogenetic Observations on Thymidine Synchronized Bovine Lymphocytes Exposed to 7.25 GHz Microwaves

B. Bisceglia, G. D'Ambrosio, D. Di Berardino, M.B. Lioi and M.R. Scarfi. "Cytogenetic Observations on Thymidine Synchronized Bovine Lymphocytes Exposed to 7.25 GHz Microwaves." 1986 MTT-S International Microwave Symposium Digest 86.1 (1986 [MWSYM]): 779-781.

Thymidine synchronized bovine lymphocytes were exposed in the S phase to 7.25 GHz microwaves by means of a waveguide system. The exposures were 1 hour long and the temperature rise was less than 1°C. No specific effect of microwaves was evidenced, but chromosome breaks occurred following either microwave or conventional heating. Thymidine alone was found to induce polyploidy and the 1°C heating seems to reduce this effect.



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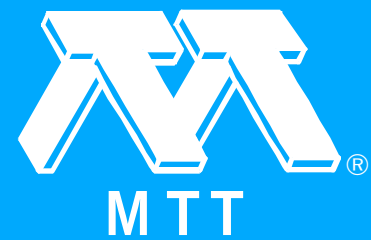
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Session GG -- Analytical and Numerical Techniques

"Session GG -- Analytical and Numerical Techniques." 1986 MTT-S International Microwave Symposium Digest 86.1 (1986 [MWSYM]): 783-783.



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Abstracts

An Improved Transmission Matrix Formulation of Cascaded Discontinuities and its Application to E-Plane Circuits (1986 [MWSYM])

R.R. Mansour and R.H. MacPhie. "An Improved Transmission Matrix Formulation of Cascaded Discontinuities and its Application to E-Plane Circuits (1986 [MWSYM])." 1986 MTT-S International Microwave Symposium Digest 86.1 (1986 [MWSYM]): 785-788.

We study the effect of the relative convergence problem on the transmission matrix formulation of cascaded discontinuities. A numerically efficient modified formulation satisfying the edge condition is presented. Application is in the analysis of waveguiding structures in which a number of conductors are placed on various interfaces. Numerical results are presented for double ridged waveguides and fin lines.



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Three Dimensional Finite - Element Formulation for Finline Discontinuity Problems

O. Picon, V.F. Hanna and J. Citerne. "Three Dimensional Finite - Element Formulation for Finline Discontinuity Problems." 1986 MTT-S International Microwave Symposium Digest 86.1 (1986 [MWSYM]): 789-792.

A three dimensional finite - element formulation is proposed for finding directly the electric or magnetic field at a given frequency of excitation inside a general multiaxial finline discontinuity. It is shown that this formulation can be used to find the scattering parameters of a general finline bend discontinuity problem. Results are presented for a case study of a finline step discontinuity problem.

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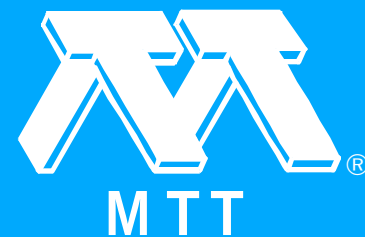


Abstracts

A Time Domain Finite Difference Method and its Application

D.-H. Choi and W.J.R. Hoefer. "A Time Domain Finite Difference Method and its Application." 1986 MTT-S International Microwave Symposium Digest 86.1 (1986 [MWSYM]): 793-796.

This paper describes for the first time the application of the Finite Difference in the time-domain to the solution of three-dimensional eigenvalue problems. Maxwell's equations are discretized in space and time, and steady state solutions are obtained through a time-averaging process. Eigenfrequencies are then obtained via Fourier transform. While achieving the same accuracy and versatility as the TLM method, it requires less than half the CPU time and memory under identical simulation conditions.



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Abstracts

Proposal of Surface-Wave Planar Circuit, Formulation of its Planar Circuit Equations and its Practical Application

J.-P. Hsu, T. Anada and H. Eriguchi. "Proposal of Surface-Wave Planar Circuit, Formulation of its Planar Circuit Equations and its Practical Application." 1986 MTT-S International Microwave Symposium Digest 86.1 (1986 [MWSYM]): 797-800.

This paper proposes the concept of a surface-wave planar circuit and formulates surface-wave planar circuit equations based on Maxwell's equations. As examples of the application of these equations to practical problems, step discontinuity, planar-type transmission line and circular-shaped resonator of covered image-line type are considered.



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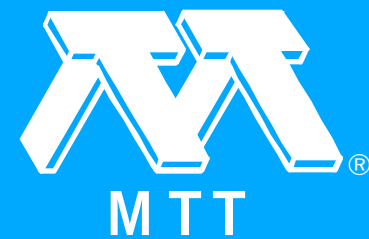
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Abstracts

Session HH -- Joint with Monolithics Symposium -- Microwave Amplifiers

*"Session HH -- Joint with Monolithics Symposium -- Microwave Amplifiers." 1986 MTT-S
International Microwave Symposium Digest 86.1 (1986 [MWSYM]): 801-801.*



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Abstracts

High Performance Monolithic Power Amplifier Using a Unique Ion Implantation Process (1986 [MWSYM])

S.K. Wang, K.G. Wang and C.D. Chang. "High Performance Monolithic Power Amplifier Using a Unique Ion Implantation Process (1986 [MWSYM])." 1986 MTT-S International Microwave Symposium Digest 86.1 (1986 [MWSYM]): 803-805.

State-of-the-art X-band power FETs and monolithic amplifiers have been fabricated by a high yield planar process using a unique double-peaked implant profile. A 1-mm FET has achieved 40 percent power added efficiency with 720 mW output power and 6.3 dB gain at 10 GHz. A two-stage monolithic amplifier has delivered 2.2 W output power at 9.5 GHz for a record 0.6 W/mm power density. The monolithic amplifier chips have also achieved 20 percent dc-yield and 5 percent uniformity in I_{DSS} and V_{PO} .



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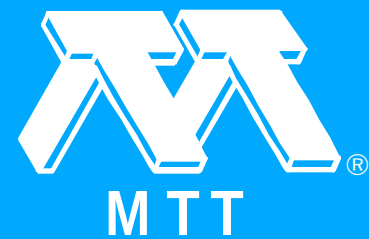
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A Low Cost, 3-7 GHz, 1/2 Watt MMIC GaAs Amplifier (1986 [MWSYM])

S.B. Moghe and R. Genin. "A Low Cost, 3-7 GHz, 1/2 Watt MMIC GaAs Amplifier (1986 [MWSYM])." 1986 MTT-S International Microwave Symposium Digest 86.1 (1986 [MWSYM]): 807-810.

A low cost, 3-7 GHz, 1/2 Watt MMIC GaAs amplifier has been successfully designed and tested. The amplifier features small chip size (1.2 mm sq.), high gain (12 ± 1.5 dB), high power added efficiency (20%), good RF yield (57%) and high tolerance to process variations. Packaged amplifiers were built with this chip for both the 2-6 GHz and the 5.9-6.4 GHz bands. Saturated output power of 25 dBm was achieved in the 2-6 GHz band, and 27 dBm in the 5.9-6.4 GHz band.

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A Power Distributed Amplifier Using Constant-R Networks (1986 [MWSYM])

E.M. Chase and W. Kennan. "A Power Distributed Amplifier Using Constant-R Networks (1986 [MWSYM])." 1986 MTT-S International Microwave Symposium Digest 86.1 (1986 [MWSYM]): 811-815.

This paper describes the design, implementation and performance of a power distributed amplifier with a minimum gain of 5dB, input and output VSWR less than 1.5:1, and greater than 22dBm of 1dB compressed power over the 2 to 18GHz band. This amplifier makes use of several circuit design advances to improve both bandwidth and power capability and measures 1.0mm by 1.4mm (1.4 sq. mm).

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Abstracts

A Stable 2-26.5 GHz Two-Stage Dual-Gate Distributed MMIC Amplifier (1986 MWSYM)

J. Orr. "A Stable 2-26.5 GHz Two-Stage Dual-Gate Distributed MMIC Amplifier (1986 MWSYM)." 1986 MTT-S International Microwave Symposium Digest 86.1 (1986 [MWSYM]): 817-820.

A 2 to 26.5 GHz monolithic distributed amplifier with 18.75 ± 1.25 dB of gain, better than 12 dB return losses at input and output, and greater than 40 dB of isolation has been realized on a single 3.02mm x 1.62mm chip.



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A High Gain, Monolithic Distributed Amplifier Using Cascode Active Elements (1986 [MWSYM])

R. LaRue, S. Bandy and G. Zdasiuk. "A High Gain, Monolithic Distributed Amplifier Using Cascode Active Elements (1986 [MWSYM])." 1986 MTT-S International Microwave Symposium Digest 86.1 (1986 [MWSYM]): 821-824.

A novel, monolithic, distributed amplifier has achieved a record gain of over 10 dB from 2-18 GHz. The design utilizes five quarter-micron gate length, cascode connected, FETs on epitaxial material. Circuit simulations predict over 10 dB gain from 2-30 GHz for an amplifier with seven active elements. Novel features of the design, fabrication and testing are discussed.



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Abstracts

A High Performance 2-18.5 GHz Distributed Amplifier, Theory and Experiment (1986 [MWSYM])

T. McKay and R. Williams. "A High Performance 2-18.5 GHz Distributed Amplifier, Theory and Experiment (1986 [MWSYM])." 1986 MTT-S International Microwave Symposium Digest 86.1 (1986 [MWSYM]): 825-829.

A high performance 2-18.5 GHz monolithic GaAs MES-FET distributed amplifier has been designed and fabricated. The m-derived drain line design is analyzed theoretically and a closed form gain equation is presented. Theoretical predictions are compared to measured results and more complicated CAD models. The measured small signal gain is typically $8.0 \pm 0.25\text{dB}$ from 2-18.5 GHz at standard bias. Typical input return loss is greater than 12dB and the output return loss is greater than 15dB. The saturated output power is in excess of 23dBm over most of the band and the noise figure is less than 7.5dB.



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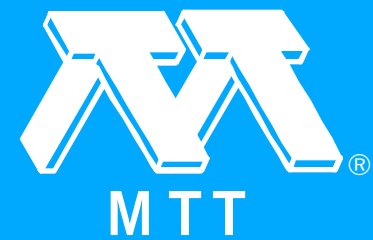
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Abstracts

Welcome to the 1987 International Microwave Symposium (1987 Vol. I [MWSYM])

S.L. March. "Welcome to the 1987 International Microwave Symposium (1987 Vol. I [MWSYM])." 1987 MTT-S International Microwave Symposium Digest 87.1 (1987 Vol. I [MWSYM]): iii-iii.

On behalf of the members of the Steering Committee, it gives me great pleasure to welcome you to the 1987 IEEE MTT-S international Microwave Symposium. As this is the first time that our annual Symposium will be meeting in Las Vegas, we hope that you will enjoy your visit. I am confident that you will find Microwave Week in Las Vegas to be an informative and rewarding experience, both technically and socially.



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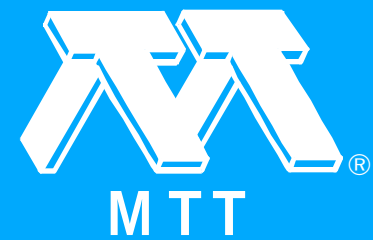
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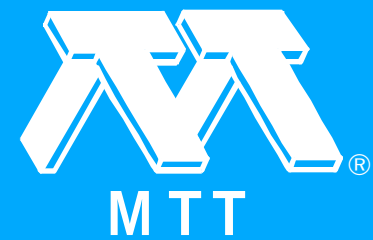
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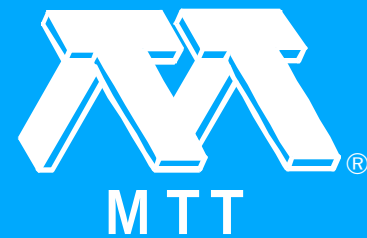
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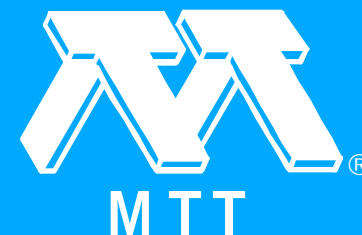
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1987 Technical Program, Contents, and Papers by Sessions (1987 Vol. I [MWSYM])

*"1987 Technical Program, Contents, and Papers by Sessions (1987 Vol. I [MWSYM])." 1987
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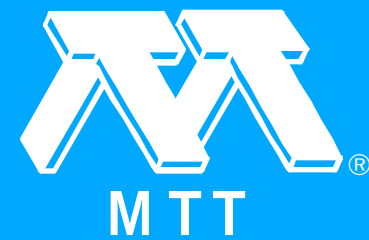
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"Session B -- Joint Session of MTT-S and MW & MMW Monolithic Circuits Symposia - Non-Linear and Power Circuits." 1987 MTT-S International Microwave Symposium Digest 87.1 (1987 Vol. I [MWSYM]): 83-83.



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Abstracts

Nonlinear Modeling for MMIC's (1987 Vol. I [MWSYM])

D. Estreich. "Nonlinear Modeling for MMIC's (1987 Vol. I [MWSYM])." 1987 MTT-S International Microwave Symposium Digest 87.1 (1987 Vol. I [MWSYM]): 85-88.

Nonlinear microwave CAD as applied to GaAs MMIC's is still in its infancy. A brief review is given of some of the work on modeling the nonlinear or "large-signal" behavior of the GaAs FET and nonlinear microwave circuit simulation. This is an important topic to the future success of GaAs MMIC's. Several important issues are raised with respect to nonlinear CAD for GaAs MMIC's.



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K/sub a/-Band Monolithic GaAs Power FET Amplifiers (1987 Vol. I [MWSYM])

H.-L.A. Hung, A. Ezzeddine, L.B. Holdeman, F.R. Phelleps, J.F. Allison, A.B. Cornfeld, T. Smith and H.C. Huang. "K/sub a/-Band Monolithic GaAs Power FET Amplifiers (1987 Vol. I [MWSYM])." 1987 MTT-S International Microwave Symposium Digest 87.1 (1987 Vol. I [MWSYM]): 89-92.

GaAs power MMIC amplifiers with an optimized FET structure operating at K/sub a/-band have achieved a small-signal gain of 4.3 dB and an output power of 481 mW. These 1.7 x 0.9-mm MMICs include DC-blocking capacitors and bias networks. A cascaded four-stage amplifier has achieved a power gain of 18.9 dB and output power of 437 mW at 28 GHz. These results may represent the highest power/gain yet demonstrated from cascaded stages of MMICs with on-chip bias and DC blocking at K/sub a/-band.

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Wideband GaAs MMIC Receiver (1987 Vol. I [MWSYM])

D.C. Yang, R. Esfandiari, T.S. Lin and T. O'Neill. "Wideband GaAs MMIC Receiver (1987 Vol. I [MWSYM])." 1987 MTT-S International Microwave Symposium Digest 87.1 (1987 Vol. I [MWSYM]): 93-95.

A wideband GaAs MMIC receiver module has been developed using half-micron gate MESFET technology. The fabrication process used is optical lithography with ion-implanted undoped LEC GaAs wafers. The module consists of three generic monolithic chips: an RF amplifier, an IF amplifier, and an image rejection filter which is integrated on a dual-gate MESFET mixer chip. The RF input frequency is 6 to 10 GHz and the IF output is at 3 GHz. Test results have shown an overall conversion gain of more than 20 dB, and less than a 5.5 dB noise figure. The isolation between RF and IF ports is better than 22 dB, between LO and IF is more than 30 dB, and between LO and RF isolation is 20 dB. The DC functional yield of more than 70-80% has also been achieved for each chip type.

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1-6 GHz GaAs MMIC Linear Attenuator with Integral Drivers (1987 Vol. I [MWSYM])

G. Lizama, T. Andrade and R. Benton. "1-6 GHz GaAs MMIC Linear Attenuator with Integral Drivers (1987 Vol. I [MWSYM])." 1987 MTT-S International Microwave Symposium Digest 87.1 (1987 Vol. I [MWSYM]): 97-99.

This paper describes the performance of a voltage-controlled attenuator with a 12 dB linear attenuation vs. control voltage range. This linear attenuator greatly facilitates the realization of both closed and open loop gain compensation networks. Over the -55°C to 85°C range the attenuator recorded a 7.2 ± 1 dB/V linear transfer function while using only 25 mW from a single 4 V power supply.

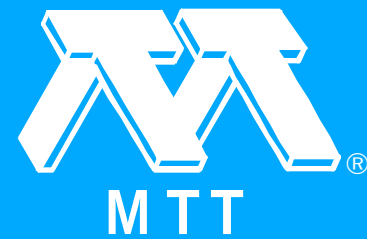
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Simple Analytical Modeling of GaAs MESFET Nonlinear Behavior

T. Kawai and F.J. Rosenbaum. "Simple Analytical Modeling of GaAs MESFET Nonlinear Behavior." 1987 MTT-S International Microwave Symposium Digest 87.1 (1987 Vol. I [MWSYM]): 103-106.

A simple resistive model for the GaAs MESFET which accounts for many of its nonlinear properties is proposed. A new DC characterization approach is suggested and used to predict the performance of a single-stage feedback amplifier. Good agreement is obtained between theory and experiment.

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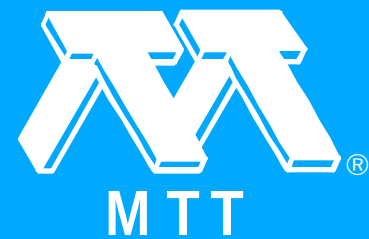
Large-Signal Modeling of GaAs Power FET Amplifiers

M.A. Khatibzadeh, R.J. Trew and I.J. Bahl. "Large-Signal Modeling of GaAs Power FET Amplifiers." 1987 MTT-S International Microwave Symposium Digest 87.1 (1987 Vol. I [MWSYM]): 107-110.

A new large-signal, analytic model for the GaAs MESFET is used in conjunction with the modified harmonic balance technique to study the performance of a monolithic, C-band power FET amplifier. The new device model is physics based and requires device, material and bias data as input. The model includes the effects of non-uniform doping profiles and charge accumulation in the channel. Both small- and large-signal parameters calculated with the model are in good agreement with measured data. The power and harmonic performance of the complete amplifier are also in good agreement with measured data.

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Optimum Design of Non Linear Power FET Amplifiers

C. Guo, M. Camiade, D. Rousset, A. Cessey, J. Obregon and A. Bert. "Optimum Design of Non Linear Power FET Amplifiers." 1987 MTT-S International Microwave Symposium Digest 87.1 (1987 Vol. I [MWSYM]): 111-113.

In this paper, an efficient approach to optimum design of power amplifiers stages is described. The impedances presented to the FET are optimized independently of the topology chosen for their realization. They are then synthesized by usual methods of linear circuits. The proposed method has been applied to the design of broadband power FET amplifiers. The realizations have given a good correlation between the theoretical and experimental results. Moreover, the method may be used to the optimum design of power FET multipliers.

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Generalized Power Series Analysis of Intermodulation Distortion in a MESFET Amplifier - Simulation and Experiment (1987 Vol. I [MWSYM])

G.W. Rhyne and M.B. Steer. "Generalized Power Series Analysis of Intermodulation Distortion in a MESFET Amplifier - Simulation and Experiment (1987 Vol. I [MWSYM])." 1987 MTT-S International Microwave Symposium Digest 87.1 (1987 Vol. I [MWSYM]): 115-118.

Design of microwave integrated circuits requires accurate simulation tools capable of predicting a variety of nonlinear distortion effects including gain compression and intermodulation distortion. This paper uses the recently developed generalized power series analysis to simulate a MESFET amplifier. For the first time, the simulations are compared to experimental results for single-tone and two-tone inputs. Good agreement is seen. This analysis is suited to any complex analog circuits having arbitrary input frequency spacing.



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The Spectral Balance: A General Method for Analysis of Nonlinear Microwave Circuits Driven by Non-Harmonically Related Generators

M. Gayral, E. Ngoya, R. Quere, J. Rousset and J. Obregon. "The Spectral Balance: A General Method for Analysis of Nonlinear Microwave Circuits Driven by Non-Harmonically Related Generators." 1987 MTT-S International Microwave Symposium Digest 87.1 (1987 Vol. I [MWSYM]): 119-121.

A very wide class of non-linear microwave circuits including mixers, oscillators (with their noise generators) and multitone amplifiers, are driven by non-harmonically related signals, and involve very far or closely-spaced frequency components. In this paper an efficient method is proposed to perform the balance of non-linear circuits driven by non-harmonically related input signals. It may be named: The spectral balance.

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Modeling of Circular Spiral Inductors for MMICs

I. Wolff and H. Kapusta. "Modeling of Circular Spiral Inductors for MMICs." 1987 MTT-S International Microwave Symposium Digest 87.1 (1987 Vol. 1 [MWSYM]): 123-126.

A computer model for planar circular spiral inductors considering the distributed nature, the substrate backside metallization and the metallization thickness is presented. The inductance of the structure is calculated using a rigorous evaluation of the two-dimensional inductance integral. The influence of the substrate backside metallization is considered by introducing a mirror coil and all capacitive effects are calculated from high accuracy, frequency dependent formulas for coupled microstrip lines. The theoretical results are discussed and compared to measurements with MIC inductors on dielectric substrate and MMIC inductors on GaAs.

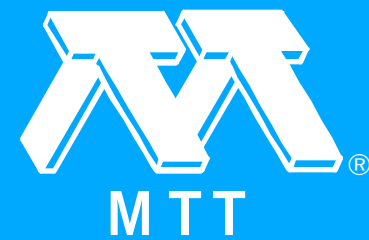
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Session D -- Microwave Filters and Multiplexer

"Session D -- Microwave Filters and Multiplexer." 1987 MTT-S International Microwave Symposium Digest 87.1 (1987 Vol. I [MWSYM]): 127-127.



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Quasi-Lowpass, Quasi-Elliptic Symmetric Filter

M.C. Horton. "Quasi-Lowpass, Quasi-Elliptic Symmetric Filter." 1987 MTT-S International Microwave Symposium Digest 87.1 (1987 Vol. I [MWSYM]): 129-132.

Levy has shown that a function developed by Acheiser/Zolotarev (LAZ) can yield a lowpass response with we large reflection ripple near dc. Rhodes and Alseyab developed a novel method of obtaining even/odd mode impedances of a symmetrical network and applied their technique to low pass filters with one transmission zero (TZ) at infinity and all others at a specified stopband frequency. This paper combines outstanding features of these references to present a new quasi-lowpass, quasi-elliptic symmetric filter having LAZ passband response and finite stopband TZ's. Design advantages are pointed out and filter realizations are discussed.

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Dielectric High-Power Bandpass Filter Using Quarter-Cut TE/sub 01delta/ Image Resonator for Cellular Base Stations (1987 Vol. I [MWSYM])

T. Nishikawa, K. Wakino, K. Tsunoda and Y. Ishikawa. "Dielectric High-Power Bandpass Filter Using Quarter-Cut TE/sub 01delta/ Image Resonator for Cellular Base Stations (1987 Vol. I [MWSYM])." 1987 MTT-S International Microwave Symposium Digest 87.1 (1987 Vol. I [MWSYM]): 133-136.

A dielectric high-power bandpass filter using "Quarter-cut TE/sub 01delta/ Image Resonators" has been developed. This resonator construction has a high unloaded Q over 7000 and also provides a sufficient thermal diffusion path to the metal housing. The insertion loss and the attenuation level of the 8-Pole elliptic function type filter are 0.37 dB and 95 dB respectively. The physical size of the dielectric filter is 280x135x65 (mm), one third to one fifth the volume of conventional cavity resonator filters.

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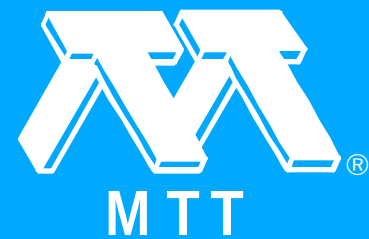
Canonical Bandpass Filters Using Dual-Mode Dielectric Resonators

Y. Kobayashi and K. Kubo. "Canonical Bandpass Filters Using Dual-Mode Dielectric Resonators." 1987 MTT-S International Microwave Symposium Digest 87.1 (1987 Vol. I [MWSYM]): 137-140.

A canonical bandpass filter constructed by placing dual-mode dielectric resonators coaxially in a cutoff circular waveguide is discussed. Rigorous analysis of the dual-mode dielectric resonator and inter-resonator coupling is performed with the mode matching technique. Four- and six-pole elliptic bandpass filters are realized at 12 GHz.

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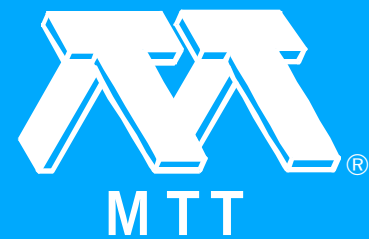
Dual Mode Dielectric Resonator Filters without Iris

K.A. Zaki, C. Chen and A.E. Atia. "Dual Mode Dielectric Resonator Filters without Iris." 1987 MTT-S International Microwave Symposium Digest 87.1 (1987 Vol. I [MWSYM]): 141-144.

Two filter realizations using dual mode dielectric resonators in a simple tubular enclosure are described. The new configurations do not require iris to achieve the coupling among the resonators; thus eliminating expensively machined parts with tight tolerances. They also achieve lower midband insertion loss than comparable filters with iris, because conduct ion currents on the cavity ends are eliminated. Measured results on two 4-pole elliptic function experimental filters realized in the new structures agreed closely with theory.

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Quadruple-Mode Filters

R.R. Bonetti and A.E. Williams. "Quadruple-Mode Filters." 1987 MTT-S International Microwave Symposium Digest 87.1 (1987 Vol. I [MWSYM]): 145-147.

The basic unit of the quadruple-mode filter is a cylindrical cavity designed at the degeneracy of the dual TE/sub lmn/ and the dual TM/lpq/ modes. The design and performance of a single-cavity, 4-pole elliptic function bandpass filter, centered at 4 GHz, and a two-cavity, 8-pole quasi-elliptic bandpass filter at 12 GHz are described. Both units exhibit excellent correlation between theory and experiment.

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Matched Four Port Hybrid Filters

C.I. Mobbs. "Matched Four Port Hybrid Filters." 1987 MTT-S International Microwave Symposium Digest 87.1 (1987 Vol. I [MWSYM]): 149-152.

A method is present for the design of matched filters using 3dB hybrids which are suitable for channeliser/multiplexer applications. A procedure for integrating the hybrids into the channel filters has been devised, which when applied to printed circuit filters having good amplitude and phase tracking, leads to low loss, high performance devices which are easy to manufacture and align.



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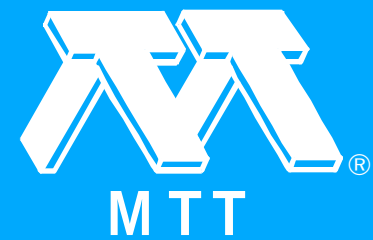
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"Session E -- Low Noise Techniques." 1987 MTT-S International Microwave Symposium Digest 87.1 (1987 Vol. I [MWSYM]): 153-153.



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A 2-20 GHz, High-Gain, Monolithic HEMT Distributed Amplifier (1987 Vol. I [MWSYM])

C. Nishimoto, R. LaRue, S. Bandy, M. Day, J. Eckstein, C. Webb, C. Yuen and G. Zdasiuk. "A 2-20 GHz, High-Gain, Monolithic HEMT Distributed Amplifier (1987 Vol. I [MWSYM])." 1987 MTT-S International Microwave Symposium Digest 87.1 (1987 Vol. I [MWSYM]): 155-158.

A low-noise 2-20 GHz monolithic distributed amplifier utilizing 0.3-micron gate-length HEMT devices has achieved $11\text{-dB} \pm 0.5\text{ dB}$ of gain. This represents the highest gain reported for a distributed amplifier using single FET gain cells. A record low noise figure of 3 dB was achieved mid-band (7-12 GHz). The circuit design utilizes five HEMT transistors of varying width with gates fabricated by E-beam lithography.



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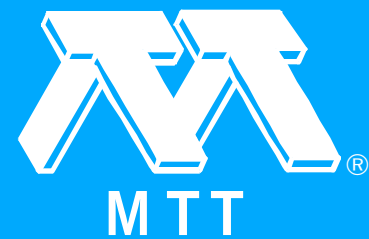
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State-of-the-Art Ion-Implanted Low-Noise GaAs MESFET and Monolithic Amplifier (1987 Vol. I [MWSYM])

K.G. Wang and S.K. Wang. "State-of-the-Art Ion-Implanted Low-Noise GaAs MESFET and Monolithic Amplifier (1987 Vol. I [MWSYM])." 1987 MTT-S International Microwave Symposium Digest 87.1 (1987 Vol. I [MWSYM]): 161-163.

State-of-the-art GaAs low-noise MESFET and monolithic amplifier have been fabricated using a high yield, planar, ion-implantation process. A 0.5 μm -gate FET has achieved 1.2 dB noise figure with 8.8 dB associated gain at 12 GHz and 1.7 dB noise figure with 6.6 dB associated gain at 18 GHz. A two-stage monolithic amplifier using this FET process has achieved 1.8 dB noise figure with 23.6 dB associated gain at 9.5 GHz. The dc yield of the amplifier chips is better than 40 percent.

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Abstracts

A Low Noise Distributed Amplifier with Gain Control (1987 Vol. I [MWSYM])

C. Hutchinson and W. Kennan. "A Low Noise Distributed Amplifier with Gain Control (1987 Vol. I [MWSYM])." 1987 MTT-S International Microwave Symposium Digest 87.1 (1987 Vol. I [MWSYM]): 165-168.

A 2 to 18 GHz monolithic GaAs distributed amplifier has been developed with 17dB nominal gain, less than 2.0:1 input and output VSWR, less than 6.0dB noise figure, and greater than 40dB gain control. The chip size at 3.0 sq. mm. (1.63mm by 1.88mm) makes it cost effective for a wide variety of applications.



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Wide-Band Monolithic GaAs Phase Detector for Homodyne Reception (1987 Vol. I [MWSYM])

P. Jean, V. Pauker and P. Dautriche. "Wide-Band Monolithic GaAs Phase Detector for Homodyne Reception (1987 Vol. I [MWSYM])." 1987 MTT-S International Microwave Symposium Digest 87.1 (1987 Vol. I [MWSYM]): 169-171.

A multipurpose, 0.04 - 4 GHz, monolithic GaAs detector circuit has been fabricated. It shows a sensitivity of 2.5 V/rad with a DC offset of 300 mV for a differential dynamic range of 8 V. It has been successfully tested as a phase detector in a homodyne receiver over L and S bands.



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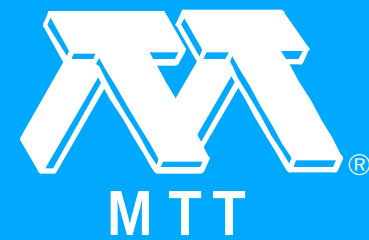
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Session F -- Microwave Integrated Circuits (1987 Vol. I [MWSYM])

*"Session F -- Microwave Integrated Circuits (1987 Vol. I [MWSYM])." 1987 MTT-S
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High Q Dielectric Resonator Frequency Discriminator

S.J. Fiedziuszko. "High Q Dielectric Resonator Frequency Discriminator." 1987 MTT-S International Microwave Symposium Digest 87.1 (1987 Vol. I [MWSYM]): 175-176.

A novel dielectric resonator frequency discriminator utilizing a degenerate, hybrid mode is described. Principle of operation is similar to cavity type discriminator. Advantages of the dielectric resonator approach include simplicity, compatibility with MIC and MMIC structures, low cost, small size, high temperature stability and high Q.

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Abstracts

A High Gain GaAs MESFET Frequency Quadrupler

E. Camargo and F.S. Correpa. "A High Gain GaAs MESFET Frequency Quadrupler." 1987 MTT-S International Microwave Symposium Digest 87.1 (1987 Vol. I [MWSYM]): 177-180.

This paper presents a comprehensive analysis carried out on a frequency quadrupler from 1 to 4 GHz using a 1 μ m dual gate GaAs MESFET. Two different circuit options are proposed, namely with and without feedback. They were constructed on soft substrates and the preliminary microwave results are a + 10 mW output power with a 8.5 dB associated multiplication gain and 6% DC-to-RF power efficiency.



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Uni-Planar MIC Balanced Multiplier - A Proposal of New Structure for MIC's

H. Ogawa, T. Hirota and A. Minagawa. "Uni-Planar MIC Balanced Multiplier - A Proposal of New Structure for MIC's." 1987 MTT-S International Microwave Symposium Digest 87.1 (1987 Vol. 1 [MWSYM]): 181-184.

A novel uni-planar balanced MIC (Microwave Integrated Circuit) multiplier is proposed and its characteristics discussed. The circuit uses a combination of coplanar waveguides and slotlines on one side of the substrate. The uni-planar MIC multiplier has been designed at the 13-GHz band and fabricated on an alumina substrate, and good performance has been achieved.

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Stabilization and Power Combining of Planar Microwave Oscillators with an Open Resonator

S.-L. Young and K.D. Stephan. "Stabilization and Power Combining of Planar Microwave Oscillators with an Open Resonator." 1987 MTT-S International Microwave Symposium Digest 87.1 (1987 Vol. I [MWSYM]): 185-188.

The fabrication advantages of planar microwave circuits over their waveguide counterparts are well known, but efforts to design highly stable oscillators and high-power oscillators in planar form with solid-state devices become increasingly difficult at the shorter microwave and millimeter wavelengths. We report herein experiments in which microstrip circuits are coupled electromagnetically to an open cavity resonator. The energy stored in the cavity leads to improved oscillator stability and lower noise sidebands. Two oscillators can be coupled to the same cavity mode, and power combining to a planar output element has been demonstrated. Although most experiments involved hybrid 10-GHz oscillators, preliminary results with a 31-GHz oscillator using a monolithic circuit indicate that the same techniques will be feasible with MMICs at millimeter wavelengths.

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Abstracts

Fast Switching X and Ku Band Multi Frequency Dielectric Resonator Oscillator Using a Single GaAs FET

A.P.S. Khanna and R. Soohoo. "Fast Switching X and Ku Band Multi Frequency Dielectric Resonator Oscillator Using a Single GaAs FET." 1987 MTT-S International Microwave Symposium Digest 87.1 (1987 Vol. I [MWSYM]): 189-191.

A novel scheme of generating fast-switchable, highly accurate and spurious-free stable signals at widely different frequencies is presented. Using a single GaAs FET oscillator circuit and switching the dielectric resonators through PIN diodes, an efficient and high performance four-switchable frequency DRO assembly has been realized. Settling times of less than 2 μ s, in which the output frequency is within ± 10 ppm of the final frequency, have been achieved.



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Abstracts

A Low-Noise L-Band Dielectric Resonator Stabilized Microstrip Oscillator

E.C. Niehenke and P.A. Green. "A Low-Noise L-Band Dielectric Resonator Stabilized Microstrip Oscillator." 1987 MTT-S International Microwave Symposium Digest 87.1 (1987 Vol. I [MWSYM]): 193-196.

Design and performance of a unique microstrip L-band bipolar transistor dielectric resonator stabilized oscillator (DRO) is described which achieves ultralow single-sideband phase noise (-163 dBc/Hz at 100 kHz offset frequency), low $1/f$ noise corner frequency of 12 kHz, with near-constant frequency (1280 ± 0.06 MHz) and power (12.55 ± 0.15 dBm) over -50° to 75°C . Circuit details to minimize noise as well as transistor selection criteria and measurements are presented. Back-to-back varactors provide 350 kHz electronic tuning range for phase-locking applications without any increase of noise.



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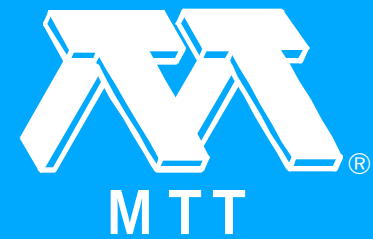
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Abstracts

Session G -- Couplers and Power Dividers

"Session G -- Couplers and Power Dividers." 1987 MTT-S International Microwave Symposium Digest 87.1 (1987 Vol. I [MWSYM]): 197-197.



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Abstracts

S Band Mode Coupler Design for Antenna Feeds

G.A. Seek. "S Band Mode Coupler Design for Antenna Feeds." 1987 MTT-S International Microwave Symposium Digest 87.1 (1987 Vol. I [MWSYM]): 199-202.

The design and testing of an S-Band TE/sub 21/ mode coupler is presented. The coupler is used in a simultaneous receive (autotracking)/transmit feed antenna. Theoretical coupler designs and performance are compared with measured test results for a prototype and production unit.



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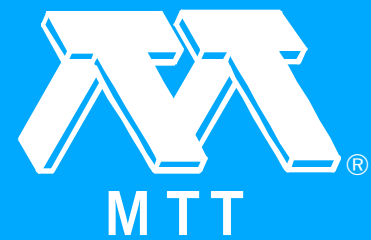


Abstracts

Impedance Transforming 3-dB 90° Hybrids (1987 Vol. I [MWSYM])

R. Gupta, S. Anderson and W. Getsingert. "Impedance Transforming 3-dB 90° Hybrids (1987 Vol. I [MWSYM])." 1987 MTT-S International Microwave Symposium Digest 87.1 (1987 Vol. I [MWSYM]): 203-206.

Design techniques and performance results for impedance transforming 3-dB 90° hybrids are presented. A broadband hybrid with 50- to 20- Ω impedance transformation has been realized by tandem connection of coupled-line sections. Measured results show an amplitude balance of 3.7 ± 0.68 dB and return loss and isolation of approximately 15 dB over the 3- to 5-GHz range. Test results for a 50- Ω tandem hybrid and a 50- to 25- Ω branch-line hybrid are also presented.



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Abstracts

Analysis and Synthesis of Ttriplate Branch-Line 3dB Coupler Based on the Planar Circuit Theory

T. Anada and J.-P. Hsu. "Analysis and Synthesis of Ttriplate Branch-Line 3dB Coupler Based on the Planar Circuit Theory." 1987 MTT-S International Microwave Symposium Digest 87.1 (1987 Vol. I [MWSYM]): 207-210.

This paper is presented how to analyze and synthesize a triplate branch-line 3dB coupler based on the planar circuit theory, which takes into account the electromagnetic field disturbance at transmission line junctions and its mutual interaction. Moreover, the corresponding branch-line 3dB coupler analyzed and synthesized here is constructed practically and measured for 1-12GHz. Since the synthesized results agree well with the measured results, the validity and the usefulness of this planar circuit theory is confirmed.



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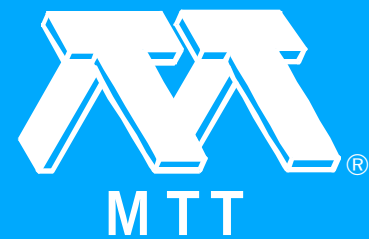
Multiple-Port Power Dividers/Combiners Circuits Using Circular Microstrip Disc Configuration (1987 Vol. I [MWSYM])

M.D. Abouzahra and K.C. Gupta. "Multiple-Port Power Dividers/Combiners Circuits Using Circular Microstrip Disc Configuration (1987 Vol. I [MWSYM])." 1987 MTT-S International Microwave Symposium Digest 87.1 (1987 Vol. I [MWSYM]): 211-214.

A generalized method for evaluating the S-parameters of a multiport center-fed circular microstrip disc power divider/combiner circuit is presented. The method is based on the planar circuit approach in which the two-dimensional Green's function of a circular segment is used. Various symmetrical power divider/combiner circuits are designed and tested. The effect of introducing shorted posts between the circumferential ports on the reduction of radiation losses is discussed. Experimental results verifying the design methodology and the optimization procedure are given.

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A Wideband Finline Power Divider in a Metallized Plastic Housing: Design and Performance

J. Ruxton and R. Vahldieck. "A Wideband Finline Power Divider in a Metallized Plastic Housing: Design and Performance." 1987 MTT-S International Microwave Symposium Digest 87.1 (1987 Vol. 1 [MWSYM]): 215-218.

This paper describes the design and performance of a wideband power divider which utilizes finline technology and is housed in a metallized plastic housing. The power divider exhibits excellent performance across the entire waveguide band demonstrating its feasibility in the design of wideband millimeter wave feed networks. To the author's knowledge this is the first published report of an E-plane circuit housed in plastic.

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Abstracts

Session H -- MMIC Manufacturability

"Session H -- MMIC Manufacturability." 1987 MTT-S International Microwave Symposium Digest 87.1 (1987 Vol. I [MWSYM]): 219-219.



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Abstracts

Successful Automated Alloy Attachment of GaAs MMIC's (1987 Vol. I [MWSYM])

J.S. Pavio. "Successful Automated Alloy Attachment of GaAs MMIC's (1987 Vol. I [MWSYM])." 1987 MTT-S International Microwave Symposium Digest 87.1 (1987 Vol. I [MWSYM]): 221-223.

Automated alloy attachment of GaAs MMIC's is presented utilizing a reflow furnace for attachment of multiple devices at one time rather than manual scrub of each monolithic separately. Reflow characteristics of a variety of solders were analyzed as well as behavior of those solders during long term temperature bake and during 1000 cycles of thermal cycling. RF and thermal impedance data was measured through 600 thermal cycles in order to verify long term electrical performance. Finally, the study addressed fractures in GaAs due to thermal expansion differences between the alloy and the GaAs MMIC itself. The main objective for the monolithic attachment study was to identify alloy materials and to develop processes which provide the following characteristics.



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Abstracts

Low Cost MMIC Insertion Using Thick Film Processing (1987 Vol. I [MWSYM])

A. Bettner, B. Hundley and P. Salisbury. "Low Cost MMIC Insertion Using Thick Film Processing (1987 Vol. I [MWSYM])." 1987 MTT-S International Microwave Symposium Digest 87.1 (1987 Vol. I [MWSYM]): 225-227.

Multilayer thick-film circuits have been developed to provide single supply biasing and reactive matching to MMIC chips. The result is a method of achieving large amounts of gain at extremely low cost.



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A Low Cost Packaging/Testing Procedure for Manufacturing GaAs MMIC (1987 Vol. I [MWSYM])

R. Esfandiari, D. Yang, S. Chan, S. Lin and R.K. Ellis. "A Low Cost Packaging/Testing Procedure for Manufacturing GaAs MMIC (1987 Vol. I [MWSYM])." 1987 MTT-S International Microwave Symposium Digest 87.1 (1987 Vol. I [MWSYM]): 229-231.

The development of a low cost, high throughput testing/package procedure for GaAs MMIC is described. Automated on-wafer RF and DC testing is essential for volume production of MMIC chips. However, most MMIC circuits cannot be tested at wafer level due to lack of proper RF test environment. The proposed frame tape chip carrier approach takes full advantage of the RF probe system. This technique reduces the high cost of RF package measurements and reliability testing. The measurement and packaging is demonstrated on several MMIC chips. It can easily be automated for high volume production.



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A Low Noise GaAs MMIC Satellite Downconverter for the 6 to 4 GHz Band (1987 Vol. I [MWSYM])

A.R. Harvey, F.J. Cotton, D.C. Pennington, R.M. Eaton and P.D. Cooper. "A Low Noise GaAs MMIC Satellite Downconverter for the 6 to 4 GHz Band (1987 Vol. I [MWSYM])." 1987 MTT-S International Microwave Symposium Digest 87.1 (1987 Vol. I [MWSYM]): 233-236.

An all GaAs MMIC wideband 6 to 4 GHz downconverter technology demonstrator has been designed, developed, fabricated and tested. The module achieves an overall conversion gain of 67 dB with a 3.2 dB noise figure. The MMIC chip set developed includes an LNA, an active splitter, phase shifters, a mixer, broadband power combiners and an IF amplifier. The assembly represents a significant size and weight reduction compared to conventional hybrid units.

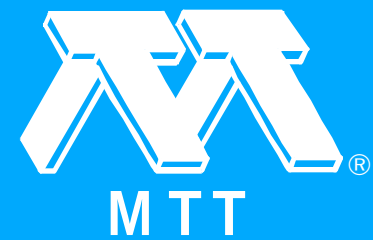
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Abstracts

Session I -- Biomedical Aspects of Microwaves

"Session I -- Biomedical Aspects of Microwaves." 1987 MTT-S International Microwave Symposium Digest 87.1 (1987 Vol. I [MWSYM]): 237-237.



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A New Type of Lightweight Low Frequency Electromagnetic Hyperthermia Applicator

R.H. Johnson, A.W. Preece, J.W. Hand and J.R. James. "A New Type of Lightweight Low Frequency Electromagnetic Hyperthermia Applicator." 1987 MTT-S International Microwave Symposium Digest 87.1 (1987 Vol. I [MWSYM]): 239-242.

A new applicator is described consisting of a resonant circuit formed from a current carrying sheet in the absence of a ground plane and which can be easily matched to a coaxial feeder. Designs for operation at frequencies in a range 10 to 1000 MHz are possible and aperture dimensions can be chosen almost independently of frequency.



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Abstracts

Regional Heating of Tissue with Control of Applied Power and with Minimized Leakage Radiation

J.W. Brose and G. Flachenecker. "Regional Heating of Tissue with Control of Applied Power and with Minimized Leakage Radiation." 1987 MTT-S International Microwave Symposium Digest 87.1 (1987 Vol. I [MWSYM]): 243-246.

Distance-sensitive applicators for UHF diathermic are described. A novel power and frequency controlled diathermic system using this applicators shows a leakage radiation of more than 20dB below that of conventional systems when unloaded. Furtheron, the new system keeps the actually applied power constant as long as the patient is in a correct position.



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Optimal Source Distribution for Maximum Power Dissipation at the Center of a Lossy Sphere

C.M. Rappaport and F.R. Morgenthaler. "Optimal Source Distribution for Maximum Power Dissipation at the Center of a Lossy Sphere." 1987 MTT-S International Microwave Symposium Digest 87.1 (1987 Vol. I [MWSYM]): 247-250.

The ideal penetration limits for localized, non-invasive heating of tumors at the center of a volume of muscle tissue are determined. Using both an integral formulation and a modal approach, the optimum surface phase and amplitude source distributions which prevent excessive heating of healthy, intervening tissue are derived.



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Abstracts

Measurement of Dielectric Properties of Biological Substances Using Improved Open-Ended Coaxial Line Resonator Method

X. Dening, L. Liping and J. Zhiyau. "Measurement of Dielectric Properties of Biological Substances Using Improved Open-Ended Coaxial Line Resonator Method." 1987 MTT-S International Microwave Symposium Digest 87.1 (1987 Vol. I [MWSYM]): 251-254.

An improved open-ended coaxial line resonator method is presented. By considering the influences of radiation effect and higher order modes, the measurement frequency range has successfully extended to X-band. The results of seven organs of a dog have given, which can be referred in bioelectromagnetics.



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Abstracts

The Use of Coaxial Probes for Precise Dielectric Measurements: A Reevaluation

B.R. Epstein, M.A. Gerdt and K.R. Foster. "The Use of Coaxial Probes for Precise Dielectric Measurements: A Reevaluation." 1987 MTT-S International Microwave Symposium Digest 87.1 (1987 Vol. 1 [MWSYM]): 255-258.

A convenient method has been developed during the past few years for study in the dielectric properties of materials. The method consists of placing the open end of a semirigid coaxial line against the sample and measuring the probe reflection coefficient with an automated network analyzer (ANA). As part of an ongoing attempt to confirm previous reports of resonant-type absorption in DNA solutions at 1-10 GHz, we have analyzed the technique to estimate the magnitude of resonance-type artifacts expected from instrumental factors. The reflection coefficients of the probe were measured using the HP-8510 ANA with time domain gating to exclude connector artifact. We propose an improved probe technique that greatly diminishes artifacts arising from variation of the probe from nominal dimensions, and radiation conductance above 1 GHz.



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Session J -- Open Forum I (1987 Vol. I [MWSYM])

"Session J -- Open Forum I (1987 Vol. I [MWSYM])." 1987 MTT-S International Microwave Symposium Digest 87.1 (1987 Vol. I [MWSYM]): 259-259.



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The Noise Behavior of an Injection-Locked Magnetron Reflection Amplifier

R.D. Weglein and H.A. Leach. "The Noise Behavior of an Injection-Locked Magnetron Reflection Amplifier." 1987 MTT-S International Microwave Symposium Digest 87.1 (1987 Vol. I [MWSYM]): 261-264.

The noise performance of a modified X-band fixed-frequency magnetron in the fractional kilowatt range is described in this paper. The magnetron was operated in the injection-locked mode via a three-port circulator. The effects of pulse length, pulse repetition frequency and phase-reversal waveforms on the close-in phase and amplitude noise up to 10 KHz from the carrier is described. With 16 db injection-locking gain at 10% duty factor, additive phase noise less than -115 dBc/Hz at 5 KHz offset frequency was measured, regardless of waveform.

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Abstracts

Radial Line Stubs Improve Performance of Microstrip Impedence Matching Network

J.L. Hutchings. "Radial Line Stubs Improve Performance of Microstrip Impedence Matching Network." 1987 MTT-S International Microwave Symposium Digest 87.1 (1987 Vol. I [MWSYM]).

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Abstracts

Linearization of Diode Detector Characteristics

C. Zhaowu and X. Binchun. "Linearization of Diode Detector Characteristics." 1987 MTT-S International Microwave Symposium Digest 87.1 (1987 Vol. I [MWSYM]): 265-267.

A novel mathematical model is introduced for determining the RF input power as a function of Schottky diode detector output voltage. It has been used in Ka-band. The results show that it is well suited for linearization of detector character large input power range.



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Abstracts

Statistical Analysis of Simulated Automatic Network Analyzer Measurements

V. Sotoudeh and M. Roos. "Statistical Analysis of Simulated Automatic Network Analyzer Measurements." 1987 MTT-S International Microwave Symposium Digest 87.1 (1987 Vol. I [MWSYM]): 269-272.

In this paper, the simulation model of a dual four-port ANA (DFANA) has been used to generate a set of data incorporating the measurement errors of such an instrument. These errors have been assumed to be primarily due to the different sources of noise and uncertainties normally existing in a DFANA measurement system. Measurement statistical analysis has been presented.



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Measurement of Non-Planar Dielectric Samples Using an Open Resonator

W.F.P. Chan and B. Chambers. "Measurement of Non-Planar Dielectric Samples Using an Open Resonator." 1987 MTT-S International Microwave Symposium Digest 87.1 (1987 Vol. I [MWSYM]): 273-276.

A new technique for the measurement of the complex permittivity of dielectric samples having convex-concave surfaces using an open resonator is reported. The paper discusses the theory behind the new technique and describes measurements made at 11.6 GHz on perspex samples whose surfaces have radii of curvature as small as 330mm. The results obtained are in good agreement with those for the same material measured in flat sheet form.

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Precise Measurement Method for Temperature Coefficient of Microwave Dielectric Resonator Material

T. Nishikawa, K. Wakino, H. Tamura, H. Tanaka and Y. Ishikawa. "Precise Measurement Method for Temperature Coefficient of Microwave Dielectric Resonator Material." 1987 MTT-S International Microwave Symposium Digest 87.1 (1987 Vol. I [MWSYM]): 277-280.

A precise measurement method for the temperature coefficient of dielectric resonator material was developed. The error of measurement was decreased from 0.5 ppm/°C to 0.05 ppm/°C compared with the conventional method. This measurement method made techniques for improving stability possible, such as for filters, multiplexer and oscillators.

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Microwave Scanning Microscopy for Planar Structure Diagnostics

R.J. Gutmann, J.M. Borrego, P. Chakrabarti and M.-S. Wang. "Microwave Scanning Microscopy for Planar Structure Diagnostics." 1987 MTT-S International Microwave Symposium Digest 87.1 (1987 Vol. 1 [MWSYM]): 281-284.

Microwave scanning microscopy is being developed to detect lateral conductivity variations in semiconductor wafers and to profile dielectric and conducting quasi-planar surfaces. We have utilized three different critically-coupled one-port cavities, with thin-diameter conducting coupling elements providing enhanced lateral sensitivity in microstrip and rectangular waveguide cavities and a circular aperture coupling element in a cylindrical waveguide cavity providing enhanced depth resolution capability. Lateral resolutions on the order of a few roils (0.002 wavelengths) and depth resolutions of a few microns (0.0001 wavelengths) have been achieved with conventional, low-power x-band instrumentation. Lateral resolution measurements of evaporated aluminum/silicon gratings with sheet conductance contrast of 300, ion-implanted n+/n silicon conductivity gratings with sheet conductance contrast of 2 and dielectrically isolated, single-crystal-tub silicon wafers are described. More limited depth profile measurements are presented to illustrate depth resolution capability.

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Wideband Measurement of Nonstandard Transmission Paths

R. Garver, J. Tatum and S. Hayes. "Wideband Measurement of Nonstandard Transmission Paths." 1987 MTT-S International Microwave Symposium Digest 87.1 (1987 Vol. I [MWSYM]): 285-288.

This paper presents a means of interpreting the measurements of attenuation of non-50-ohm transmission paths when the measurements are made on a 50-ohm system. Nonstandard transmission paths are modeled as lossy lengths of transmission line. Equations are derived to calculate the transmission parameters of a nonstandard transmission path derived from its scalar S_{21} parameters when measured on a 50-ohm scalar analyzer. The parameters can then be used for calculating the response of the path interfacing other impedances.

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Abstracts

Steady-State, Quasi-Steady-State and Transient-State Analyses of Delay Line Discriminators for FM Noise Measurement

J.-P. Ruan. "Steady-State, Quasi-Steady-State and Transient-State Analyses of Delay Line Discriminators for FM Noise Measurement." 1987 MTT-S International Microwave Symposium Digest 87.1 (1987 Vol. I [MWSYM]): 289-290.

The steady-state, quasi-steady-state and transient-state concepts are introduced to the analyses of delay line discriminators for FM noise measurement. Only by this means, is it possible to determine the admitted range for RF drift when the discriminator has been adjusted to the nominal frequency; the linearized frequency deviation range when it's used as large frequency deviation measurement, f.e. the system calibration and the measured range of the baseband frequency respectively, so that the system constrained performances can be mastered to the full.



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Abstracts

A Practical Method for Calibrating a Coaxial Noise Source with a Waveguide Standard (1987 Vol. I [MWSYM])

Y. Kato and I. Yokoshima. "A Practical Method for Calibrating a Coaxial Noise Source with a Waveguide Standard (1987 Vol. I [MWSYM])." 1987 MTT-S International Microwave Symposium Digest 87.1 (1987 Vol. I [MWSYM]): 291-294.

A practical method for calibrating a coaxial noise source with a waveguide standard has been developed by extending the adaptor-changing method reported before, and a practical equation to give its noise temperature, the measurement procedure and the error analysis are described.



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Abstracts

An Efficient Electromagnetic Analysis of Arbitrary Microstrip Circuits

J.C. Rautio and R.F. Harrington. "An Efficient Electromagnetic Analysis of Arbitrary Microstrip Circuits." 1987 MTT-S International Microwave Symposium Digest 87.1 (1987 Vol. I [MWSYM]): 295-298.

A microstrip analysis suitable for monolithic microwave integrated circuits is described. The analysis subdivides microstrip metalization into small subsections and determines all currents and fields. Agreement between measured and calculated data demonstrates a high level of accuracy.



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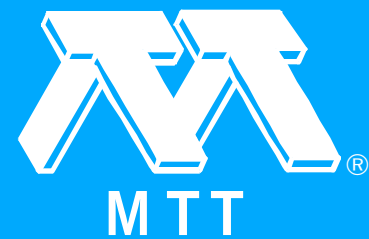
Spectral-Domain Analysis for Dielectric Antenna Loaded with Metallic Strips

T.H. Wu, K.S. Chen and S.T. Peng. "Spectral-Domain Analysis for Dielectric Antenna Loaded with Metallic Strips." 1987 MTT-S International Microwave Symposium Digest 87.1 (1987 Vol. I [MWSYM]): 299-301.

A spectral-domain analysis is presented for a millimeter-wave antenna that consists of a dielectric rod loaded periodically with metallic strips. Numerical results are given for the leakage constant and the radiation angle over a large range of frequency. In particular, the effect of finite antenna width is examined in detail, with the polarization coupling between TE and TM modes properly taken into account in the analysis. Experiments are carried out in the X-band frequencies, and the results obtained verify the theory very well.

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Resonant Frequencies of the Axial Symmetric Modes in a Dielectric Resonator

W.C. Chew and M. Moghaddam. "Resonant Frequencies of the Axial Symmetric Modes in a Dielectric Resonator." 1987 MTT-S International Microwave Symposium Digest 87.1 (1987 Vol. 1 [MWSYM]): 303-305.

Dielectric resonators have been proven possible for a long time. However, they had not been popular in the past due to the absence of temperature stable and low loss materials. The recent advent of low loss, temperature stable materials has made them useful in a number of microwave circuit applications. The analysis of such a resonator in the past has relied on approximate methods. We shall present a rigorous field analysis of the circular dielectric resonator embedded in an in homogeneous medium. The analysis is via a numerical mode matching method, whereby the problem of finding the modes of the circular dielectric cylinder is cast into a conventional eigenvalue problem which could be solved rapidly on the computer. This method bypasses the need to use Hankel and Bessel functions, which could be time consuming to evaluate. The scattering of the field off the ends of the resonator are characterized by reflection operators. The resonant frequencies of the resonator could be easily found by requiring the phase coherence of the wave after reflection off the two ends of the resonator.

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Abstracts

A Generalized Description of the Spherical Three-Layer Resonator with an Anisotropic Dielectric Material

I. Wolff. "A Generalized Description of the Spherical Three-Layer Resonator with an Anisotropic Dielectric Material." 1987 MTT-S International Microwave Symposium Digest 87.1 (1987 Vol. I [MWSYM]): 307-310.

The eigenvalue equation of a three layer spherical resonator with arbitrary material parameters and an anisotropic dielectric inner sphere is described. The axial-symmetric modes of the resonator, the field distributions, the Q-factors and applications are discussed.



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Abstracts

Numerical Spectral Matrix Method for Propagation in Anisotropic Layered Media

A.A. Mostafa, C.M. Krowne and K.A. Zaki. "Numerical Spectral Matrix Method for Propagation in Anisotropic Layered Media." 1987 MTT-S International Microwave Symposium Digest 87.1 (1987 Vol. I [MWSYM]): 311-314.

A 6x6 macroscopic tensor is used to characterize each layer of a multilayered structure that may have arbitrary anisotropy and loss, as well as arbitrary number of conductors at each interface. The calculated propagation constant reflects the dispersion behavior of the transmission system. Numerical data are presented for both low and high anisotropy dielectric layered structures.



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Abstracts

Compact Grating Structure for Application to Filters and Resonators for Monolithic Microwave Integrated Circuits

T.H. Wang and T. Itoh. "Compact Grating Structure for Application to Filters and Resonators for Monolithic Microwave Integrated Circuits." 1987 MTT-S International Microwave Symposium Digest 87.1 (1987 Vol. I [MWSYM]): 315-318.

Possible high-Q circuits based on a new crosstie overlay slow-wave structure are proposed for monolithic microwave integrated circuits. Configurations and results of slow-wave factors are presented. This structure is used for construction of a frequency-selective reflector with a compact size. The effect of loss is considered.



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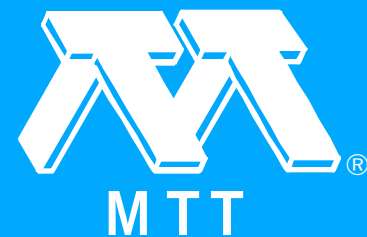


Abstracts

On the Consistency of Two Conventional Coupled-Mode Formulations for Parallel Dielectric Waveguides

H.-C. Chang. "On the Consistency of Two Conventional Coupled-Mode Formulations for Parallel Dielectric Waveguides." 1987 MTT-S International Microwave Symposium Digest 87.1 (1987 Vol. I [MWSYM]): 319-321.

Two different formulations of the conventional coupled-mode theory, one based on the partition of the total field and the other based on the projections of the same field on local complete sets, are compared. They are proved to be consistent with each other when the individual waveguide mode overlap integrals are appropriately taken into account.



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Analysis of the Transmission Properties of Grounded Finlines on Anisotropic Substrates

A. Beyer and D. Kother. "Analysis of the Transmission Properties of Grounded Finlines on Anisotropic Substrates." 1987 MTT-S International Microwave Symposium Digest 87.1 (1987 Vol. 1 [MWSYM]): 323-326.

This contribution describes a rigorous method for an efficient computation of finlines on anisotropic substrates. It allows a realistic description of these waveguides because it can also consider the second order effects such as the influence of the metallization thickness and of the substrate grooves on the transmission properties, which are calculated by means of integral eigenvalue equations generated for the interfaces of the considered crosssection. Several examples for the effective dielectric constant illustrate the applicability of the described method.

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Abstracts

The Method of Lines for the Analysis of Planar Waveguides Having Uniaxially Anisotropic Substrates

B.M. Sherrill and N.G. Alexopoulos. "The Method of Lines for the Analysis of Planar Waveguides Having Uniaxially Anisotropic Substrates." 1987 MTT-S International Microwave Symposium Digest 87.1 (1987 Vol. I [MWSYM]): 327-329.

The efficient Method of Lines is formulated for the dispersive characterization of planar waveguide structures having uniaxially anisotropic dielectric substrates. This new formulation is exercised upon a configuration of fin-line, one with a substrate bearing an isolated strip opposite a fin. Numerical results follow displaying the importance of heeding anisotropy in modeling.



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Abstracts

A Generalized Dispersive Analysis of Integrated Circuit Transmission Line Structures on Anisotropic Substrates

A.G. D'Assuncao, M.R.G. Maia, D.A. Rogers and A.J. Giarola. "A Generalized Dispersive Analysis of Integrated Circuit Transmission Line Structures on Anisotropic Substrates." 1987 MTT-S International Microwave Symposium Digest 87.1 (1987 Vol. I [MWSYM]): 331-332.

A spectral domain analysis of planar transmission lines on anisotropic layers is performed. The dielectric layers are assumed to be uniaxial anisotropic. The Hertz potentials and the Galerkin method are used to obtain the propagation characteristics for single and coupled microstrip lines on single and double layers and for bilateral fin-lines.



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Dual Bounds Variational Formulation of Skin Effect Problems

P. Waldow and I. Wolff. "Dual Bounds Variational Formulation of Skin Effect Problems." 1987 MTT-S International Microwave Symposium Digest 87.1 (1987 Vol. I [MWSYM]): 333-336.

Accurate loss calculation of transmission lines is an important topic in monolithic microwave integrated circuits (MMICs). This paper describes a general variational approach for calculating dual bounds of the interesting circuit parameters. Using the dual bounds approach, the computational expense can be reduced drastically; the accuracy of the solution for the interesting circuit parameters R, L is guaranteed by the corresponding upper and lower bounds. Combined with an improved classical full-wave analysis, the method presented here is a good tool for the loss calculation due to the skin effect in microstrip like structures.

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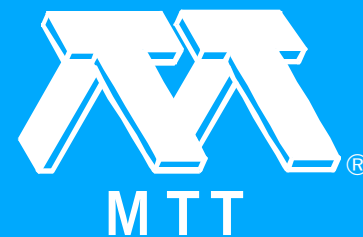


Abstracts

An Adaptive Spectral Response Modeling Procedure for Multi-Port Waveguide Junctions

J.-F. Lee and Z.J. Cendes. "An Adaptive Spectral Response Modeling Procedure for Multi-Port Waveguide Junctions." 1987 MTT-S International Microwave Symposium Digest 87.1 (1987 Vol. 1 [MWSYM]): 337-339.

An adaptive scheme is proposed to generate the spectral response of waveguide junctions in minimum computation time. The procedure uses the newly developed transfinite element method to determine the fields in junctions at a few adaptively selected frequencies and then employs these solutions to generate the spectral response over the full frequency range.



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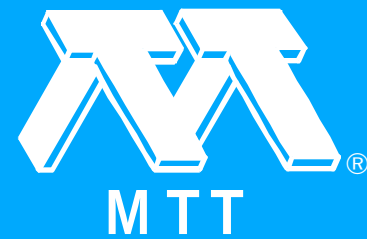


Abstracts

A Unified Hybrid Mode Analysis for Planar Transmission Lines with Multilayer Isotropic/Anisotropic Substrates

R.R. Mansour and R.H. MacPhie. "A Unified Hybrid Mode Analysis for Planar Transmission Lines with Multilayer Isotropic/Anisotropic Substrates." 1987 MTT-S International Microwave Symposium Digest 87.1 (1987 Vol. I [MWSYM]): 341-344.

A unified hybrid mode analysis is presented for determining the propagation characteristics of multiconductor multilayer planar transmission lines. The analysis employs the conservation of complex power technique, and the emphasis is on numerical efficiency and simplicity. Numerical results, for finline and microstrip configurations, aim at the clarification of the effects of the metallization thickness, dielectric anisotropy and substrate mounting grooves.



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Resonant Frequency Stability Analysis of Dielectric Resonators with Tuning Mechanisms

F. Hernandez-Gil, R. Perez-Leal and A. Gebauer. "Resonant Frequency Stability Analysis of Dielectric Resonators with Tuning Mechanisms." 1987 MTT-S International Microwave Symposium Digest 87.1 (1987 Vol. I [MWSYM]): 345-348.

The Finite Element Method is applied to calculate the resonant frequency stability and the quality factor of dielectric resonators with tuning mechanisms. The resonant frequency temperature dependence is studied as a function of the tuning. Results for with metal cylindrical and ring resonators tuned and dielectric screws are included.

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Abstracts

A Broadband Groove Guide Coupler for Millimeter-Wave Applications

R. Vahldieck and J. Ruxton. "A Broadband Groove Guide Coupler for Millimeter-Wave Applications." 1987 MTT-S International Microwave Symposium Digest 87.1 (1987 Vol. I [MWSYM]): 349-352.

In this paper we describe the theoretical design and performance of a broadband groove guide coupler. In contrast to conventional design techniques one of the grooves is partially filled with a dielectric. Both grooves are coupled via a slot in a thin metallic septum separating the grooves. It will be shown how a flat coupling over a wide frequency range can be obtained by taking advantage of the dispersion of even and odd modes and the frequency dependence of the modes in the individual grooves.



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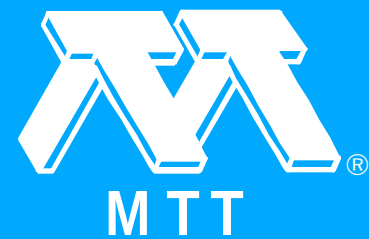
Tunable Waveguide-to-Microstrip Transition for Millimeter-Wave Applications

A.K. Sharma. "Tunable Waveguide-to-Microstrip Transition for Millimeter-Wave Applications." 1987 MTT-S International Microwave Symposium Digest 87.1 (1987 Vol. I [MWSYM]): 353-356.

A novel waveguide-to-microstrip transition suitable for narrow as well as wide band applications at millimeter-wave frequencies is presented. It consists of a planar circuit having tapered sections of antipodal fin line and longitudinal slots whose length can be varied by tuning blocks placed underneath them. By selecting appropriate position of the tuning blocks, the transition can be optimized to achieve the desired bandwidth and center frequency. The tunability feature makes it very useful in test fixtures for device and circuit characterization.

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Optimum Synthesis of Symmetrical Branch-Waveguide Directional Couplers

P.L. Carle. "Optimum Synthesis of Symmetrical Branch-Waveguide Directional Couplers." 1987 MTT-S International Microwave Symposium Digest 87.1 (1987 Vol. I [MWSYM]): 357-360.

An optimised synthesis procedure to design branch-waveguide directional couplers for satellite beam forming network applications is reported. This procedure allows to achieve a very significant improvement, particularly for the input reflection and isolation, also for couplers with few branches. A 5-branch 3 dB coupler, designed with the described method, has been manufactured in WR75 waveguide. Comparing scattering parameter measurements with the computed frequency performance shows that the synthesis procedure is verified very satisfactorily. Return loss and isolation values are 40 dB minimum on a 15% bandwidth. The computer package allows also to calculate the sensitivity of the electrical characteristics versus geometrical parameters and then enables to evaluate the tolerances required for the mechanical manufacturing. Moreover theoretical results of a 7-branch 3 dB coupler with wide frequency band (11.7-14.5 GHz) are presented.

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Abstracts

A Generalized Theory of Tapered Transmission Line Matching Transformers and Asymmetric 180° Couplers Supporting Non-TEM Modes

P. Pramanick and P. Bhartia. "A Generalized Theory of Tapered Transmission Line Matching Transformers and Asymmetric 180° Couplers Supporting Non-TEM Modes." 1987 MTT-S International Microwave Symposium Digest 87.1 (1987 Vol. I [MWSYM]): 361-364.

This paper presents a generalized Fourier transform pair for the analysis and synthesis of tapered transmission lines supporting a non-TEM mode. The Fourier transform pair first pointed out by Bolinder, and subsequently used by Klopfenstein for TEM lines can be shown to be a special case of the present transform pair. A step by step synthesis method has been described for exact designs of matching transformers and asymmetric 180° directional couplers.



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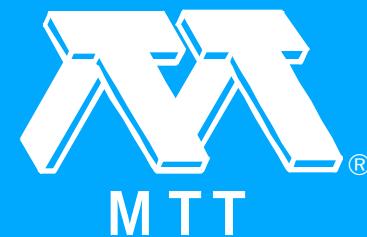


Abstracts

Design Techniques for GaAs Logic Boards

W.R. Curtice and R. Rudnick. "Design Techniques for GaAs Logic Boards." 1987 MTT-S International Microwave Symposium Digest 87.1 (1987 Vol. I [MWSYM]).

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Abstracts

Bandstop Filter in Nonradiative Dielectric Waveguide Using Rectangular Resonators (1987 Vol. I [MWSYM])

J.A.G. Malherbe and J.C. Coetzee. "Bandstop Filter in Nonradiative Dielectric Waveguide Using Rectangular Resonators (1987 Vol. I [MWSYM])." 1987 MTT-S International Microwave Symposium Digest 87.1 (1987 Vol. I [MWSYM]): 365-366.

A bandstop filter realized by means of rectangular resonators coupled to the centre dielectric strip of a Nonradiative Dielectric (NRD) waveguide is described. This filter has the advantage that it is simple to manufacture, making use of a centre dielectric of standard cross section. The design procedure is similar to the conventional stripline design procedure, with the stubs replaced by "stubs" of dielectric, or resonators. The properties of the stubs are obtained through measurement.



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Whispering-Gallery Modes of Dielectric Structures - Applications to Millimeter Wave Bandstop Filters (1987 Vol. I [MWSYM])

X.H. Jiao, P. Guillon, L.A. Bermudez and P. Auxemery. "Whispering-Gallery Modes of Dielectric Structures - Applications to Millimeter Wave Bandstop Filters (1987 Vol. I [MWSYM])." 1987 MTT-S International Microwave Symposium Digest 87.1 (1987 Vol. I [MWSYM]): 367-370.

The purpose of this paper is to show the feasibility of mm-wave resonators utilizing W.G. modes excited in planar and cylindrical dielectric structures. Measured resonant frequencies in Ka and W bands are reported. Their applications in mm-wave integrated circuits are also dealt with. For this, a bandstop filter, obtained by coupling two W.G. modes D.Rs to a dielectric image guide is presented at about 35 GHz.

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Abstracts

A 0.5-4.0 GHz Tunable Bandpass Filter Using YIG Film Grown by LPE (1987 Vol. I [MWSYM])

Y. Murakami, T. Ohgihara and T. Okamoto. "A 0.5-4.0 GHz Tunable Bandpass Filter Using YIG Film Grown by LPE (1987 Vol. I [MWSYM])." 1987 MTT-S International Microwave Symposium Digest 87.1 (1987 Vol. I [MWSYM]): 371-374.

A tunable bandpass filter using YIG film grown by LPE has been developed. Over the wide tuning range from 0.5 GHz to 4.0 GHz, low insertion loss and high spurious suppression have been achieved. The performance of this filter satisfies the requirements for use as a tracking preselector in a microwave spectrum analyzer.



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Determination of Dual-Mode Q Factors from Measured Data

W.P. Wheless, Jr. and D. Kajfez. "Determination of Dual-Mode Q Factors from Measured Data." 1987 MTT-S International Microwave Symposium Digest 87.1 (1987 Vol. I [MWSYM]): 375-378.

An iterative least estimation procedure is squares parameter applied to large sets of measured data, obtained with the aid of a vector network analyzer, to determine the unloaded Q factors of two resonant modes in near frequency proximity. The procedure is capable of analyzing the data of very closely spaced dual resonances, such as typically occur in dual-mode filters utilizing degenerate hybrid modes in dielectric resonators.

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Abstracts

A Bandpass Filter Using High-Q Dielectric Ring Resonators

Y. Kobayashi and M. Minegishi. "A Bandpass Filter Using High-Q Dielectric Ring Resonators." 1987 MTT-S International Microwave Symposium Digest 87.1 (1987 Vol. I [MWSYM]): 379-382.

A Tchebyscheff bandpass filter constructed by placing high-Q TE/sub 01delta/ dielectric ring resonators coaxially in a TE/sub 01/ cutoff circular waveguide is designed precisely by the mode matching technique. Some discussions for design of the high-Q resonators and inter-resonator coupling are presented.



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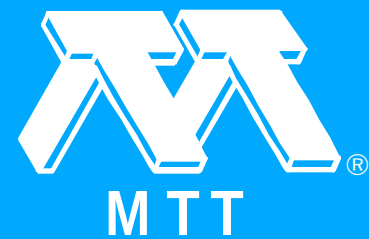
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A Grooved Monoblock Comb-Line Filter Suppressing the Third Harmonics

Y. Isota, M. Miyazaki, O. Ishida and F. Takeda. "A Grooved Monoblock Comb-Line Filter Suppressing the Third Harmonics." 1987 MTT-S International Microwave Symposium Digest 87.1 (1987 Vol. 1 [MWSYM]): 383-386.

A grooved monoblock comb-line filter has been developed. By putting the grooves on the outer surfaces of dielectric block, the second passband is shifted to the higher frequency than the third harmonics. So this filter is very effective for suppressing the third harmonics, besides these grooves are effective for inter-resonator coupling.

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18-30 GHz Broadband Bandpass Harmonic Reject Filter

T.N. Ton, Y.C. Shih and L.Q. Bui. "18-30 GHz Broadband Bandpass Harmonic Reject Filter." 1987 MTT-S International Microwave Symposium Digest 87.1 (1987 Vol. I [MWSYM]): 387-389.

An 18-30 GHz harmonic reject filter has been designed using a distributed prototype. The aspect ratio of the coupled suspended stripline structure is chosen to equalize the even- odd-mode electrical lengths when considering the open-end effects, The measured insertion loss is about 1 dB in the passband and more than 40 dB rejection up to twice the center frequency.

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A Planar Integrated Antenna and Receiver Front End

V.D. Hwang, T. Uwano and T. Itoh. "A Planar Integrated Antenna and Receiver Front End." 1987 MTT-S International Microwave Symposium Digest 87.1 (1987 Vol. I [MWSYM]): 391-394.

A compact, self-contained, and planar circuit that integrates a coupled slot antenna, a balanced mixer, and a Gunn diode local oscillator is described. This circuit utilizes the even/odd mode properties of the coupled slotlines to achieve intrinsic RF-LO and RF-IF isolation.

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ICRF Wave Coupling and Optimization of a Dielectric-Filled Waveguide Launcher

J.-L. Lee and J.E. Scharer. "ICRF Wave Coupling and Optimization of a Dielectric-Filled Waveguide Launcher." 1987 MTT-S International Microwave Symposium Digest 87.1 (1987 Vol. 1 [MWSYM]): 395-398.

A shorted-probe coupling scheme for a dielectric-filled, high power waveguide launcher for plasma heating has been constructed, modeled and analyzed. Measured reflection coefficients show good agreement with the model, especially in the optimum tuned region. The attenuation of the deionized water as the dielectric filler for the waveguide is examined as well.

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Abstracts

High-Power, Short-Pulse Forming Circuits

R. Tan, M. Berry and R. Garver. "High-Power, Short-Pulse Forming Circuits." 1987 MTT-S International Microwave Symposium Digest 87.1 (1987 Vol. I [MWSYM]): 399-402.

Fast-rise, short microwave pulses at 100 kW peak power have been obtained. Arc-activated expanders have been developed in coaxial transmission line at S-band and in waveguide at X-band that provide fast-rise rf pulses (1 to 10 ns) from slow-rise inputs. These expanders are placed on the output of 1-MW magnetrons to provide fast-rise pulses in the 50- to 100-kW range. When the expander is followed by a single shunt $Z_0/2$ transmission line as a pulse-forming network, it provides short pulses with fast risetimes and fast falltimes. These pulse-forming networks also suppress "front porch" leakage caused by the finite isolation of the expanders.



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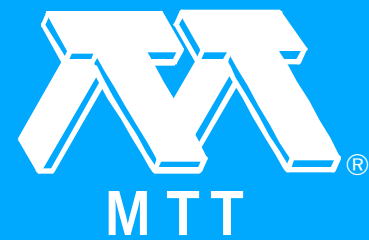


Abstracts

A Rigorous Field Analysis of Multilayered SAW Devices

W.J. Ghijsen and P.M. van den Berg. "A Rigorous Field Analysis of Multilayered SAW Devices." 1987 MTT-S International Microwave Symposium Digest 87.1 (1987 Vol. I [MWSYM]): 403-406.

A rigorous analysis of the acousto-electric field in general multilayered SAW devices in the time Laplace-transform domain is outlined. The configuration of investigation contains an arbitrary number of homogeneous and reciprocal media of any kind of anisotropy and orientation. The basic equations of homogeneous media are solved using a spatial Fourier transformation. Using this solution and the boundary conditions at the interfaces, the total field problem is reduced to a boundary value problem of the electric potential and the electric surface charge density in the plane of the electrodes, and a relation between the Fourier transforms of these quantities. This dual boundary value problem is solved iteratively, by minimization of the root-mean-square error in one of the boundary conditions.



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Ferrite Phase Shifter Finite Element Analysis Including Losses

G. Forterre, P.H. Giesbers and E. Laroche. "Ferrite Phase Shifter Finite Element Analysis Including Losses." 1987 MTT-S International Microwave Symposium Digest 87.1 (1987 Vol. I [MWSYM]): 407-410.

Transmission lines of arbitrary cross-section loaded by dielectric and gyromagnetic lossy media of arbitrary shape are analyzed. A finite element method using a new transverse fields formulation is used, which leads to an eigenvalue problem. This direct method allows to take into account complex frequency dependent physical parameters. Numerical examples are carried out on a ferrite phase shifter. Attenuation of the guided wave is evaluated.

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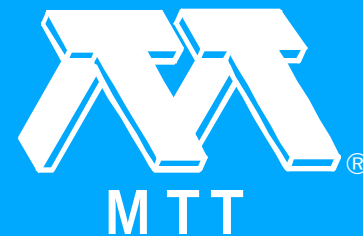


Abstracts

The Absorption Character of Ferrite-Ceramic Complex Material

D.-Z. Zhang and Y.-X. Zhang. "The Absorption Character of Ferrite-Ceramic Complex Material." 1987 MTT-S International Microwave Symposium Digest 87.1 (1987 Vol. I [MWSYM]): 411-414.

With specific technology and fabrication process, a new special uniform solid solution material may be obtained, that with variety of composition is made from high initial permeability soft magnet ferrite and high dielectric constant ceramic material. This new complex material, uniform solid solution, is a very good microwave absorption material.



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Microwave Ferrite Dual-Mode Polarization Technology

X. Yiwei, J. Renpei and L. Shigen. "Microwave Ferrite Dual-Mode Polarization Technology." 1987 MTT-S International Microwave Symposium Digest 87.1 (1987 Vol. I [MWSYM]): 415-418.

Both nonreciprocal birefringent effect and variable polarization effect of microwave ferrite materials are discussed in the light of coupling wave theory, and with the help of these effects, a new type of dual-mode ferrite fast-speed variable polarizer is developed. On the other hand, the corresponding optimal magnetization field distribution (OMFD) is researched and numerically calculated, and the analog-test is also done.



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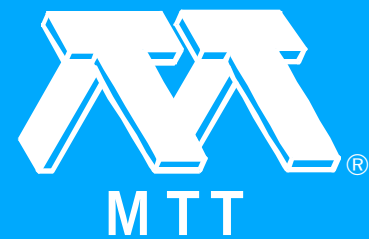
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A Bandpass Filter Using Circular Discontinuities in Nonradiative Dielectric Waveguide

J.C. Olivier and J.A.G. Malherbe. "A Bandpass Filter Using Circular Discontinuities in Nonradiative Dielectric Waveguide." 1987 MTT-S International Microwave Symposium Digest 87.1 (1987 Vol. 1 [MWSYM]): 419-422.

The design of a new bandpass filter in Non-radiative Dielectric (NRD) Waveguide is described. The filter makes use of an inverter-prototype and series fullwave resonators. The T-sections necessary to realize the inverters are realized by means of round holes drilled through the dielectric centre conductor. The properties of the round discontinuities are fitted to those of rectangular holes, and the design is executed by means of closed form equations. The measured practical response is in very good agreement with the predicted theoretical properties.

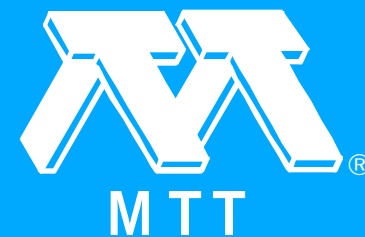
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Session K -- MMW Technology and Applications (1987 Vol. I [MWSYM])

"Session K -- MMW Technology and Applications (1987 Vol. I [MWSYM])." 1987 MTT-S International Microwave Symposium Digest 87.1 (1987 Vol. I [MWSYM]): 423-423.



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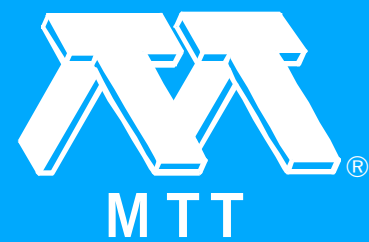
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Application of Grating-Filter Techniques in Microstrip to Obtain Narrowband Millimeter-Wave Bandpass Filters with Low Radiation Losses

P.K. Ikalainen and G.L. Matthaei. "Application of Grating-Filter Techniques in Microstrip to Obtain Narrowband Millimeter-Wave Bandpass Filters with Low Radiation Losses." 1987 MTT-S International Microwave Symposium Digest 87.1 (1987 Vol. I [MWSYM]): 425-428.

Microstrip lines are attractive for the lower millimeter-wave ranges, but use of relatively thick substrates would be desirable in order to minimize ohmic losses. On such substrates the usual types of microstrip bandpass filters (formed from, e.g., coupled line segments with open ends) tend to radiate strongly, giving poor performance. It has been found that a grating technique initially developed for use with dielectric waveguide can be adapted for microstrip, with some modifications. The grating technique yields narrowband mm-wave microstrip filters with little radiation and strong filter characteristics. Experimental filters have been designed and tested with good results.

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Abstracts

Recent Advances in the Modelling and Performance of Millimeter Wave InP and GaAs VCO's and Oscillators

L.D. Cohen and E. Sard. "Recent Advances in the Modelling and Performance of Millimeter Wave InP and GaAs VCO's and Oscillators." 1987 MTT-S International Microwave Symposium Digest 87.1 (1987 Vol. I [MWSYM]): 429-432.

The use of a lumped element circuit form has provided a new means to model and quantify the equivalent circuit parameters of InP and GaAs Gunn VCO's and oscillators under large signal conditions. The modelling has resulted in excellent agreement between calculated and measured performance of wide-band VCO's and oscillators in the 26 to 60 GHz frequency range. New insights into device operation and performance will be presented.



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A 94 GHz Synchronized Oscillator-Chain for Fast, Continuous 360° Phase Modulation

H. Barth. "A 94 GHz Synchronized Oscillator-Chain for Fast, Continuous 360° Phase Modulation." 1987 MTT-S International Microwave Symposium Digest 87.1 (1987 Vol. I [MWSYM]): 433-436.

A continuous phase shift of 0 to 360° has been achieved at 94 GHz by injection locking a 2nd harmonic mode Gunn-oscillator at its fundamental frequency. Phase shifting is achieved by varactor tuning the free running fundamental frequency within the locking range. The resulting phase shift between reference signal and the VCO output signal is ± 90 degrees at the fundamental frequency and doubled to ± 180 degrees at the 2nd harmonic frequency. The phase shifted signal as well as the reference signal each have output powers of more than 20 mW at 94 GHz.



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Millimeter Wave Characteristics of Fresnel Zone Plates

D.N. Black and J.C. Wiltse. "Millimeter Wave Characteristics of Fresnel Zone Plates." 1987 MTT-S International Microwave Symposium Digest 87.1 (1987 Vol. I [MWSYM]): 437-440.

Characteristics are given for Fresnel zone plates used as quasi-optical focusing or frequency-filtering elements at frequencies from 35 to 210 GHz. An analytical description of the far-field pattern has been developed. Design data, measured results are given for a new type of flat lens.

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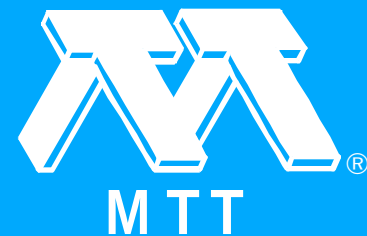


Abstracts

35 GHz Low Noise HEMT Amplifier

J.M. Schellenberg, M.V. Maher, S.K. Wang, K.G. Wang and K.K. Yu. "35 GHz Low Noise HEMT Amplifier." 1987 MTT-S International Microwave Symposium Digest 87.1 (1987 Vol. I [MWSYM]): 441-442.

A low noise HEMT amplifier has been developed for operation at 35 GHz. The three-stage amplifier exhibits a noise figure of 3.1 dB with an associated gain of 17.4 ± 0.4 dB across the 34.25 to 35.75 GHz frequency band.



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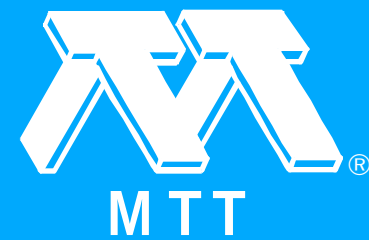
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Session L -- Microwave Measurements (1987 Vol. I [MWSYM])

"Session L -- Microwave Measurements (1987 Vol. I [MWSYM])." 1987 MTT-S International Microwave Symposium Digest 87.1 (1987 Vol. I [MWSYM]): 443-443.



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Abstracts

A Nondestructive Microwave Beam Lead Diode Measurement

J.F. White and S.J. Parisi. "A Nondestructive Microwave Beam Lead Diode Measurement." 1987 MTT-S International Microwave Symposium Digest 87.1 (1987 Vol. I [MWSYM]): 445-448.

Beam lead PIN diodes are commonly measured at 1 MHz or, on a sample basis destructively at microwave frequencies. This paper describes reproducible non-destructive microwave measurements using a vacuum hold down fixture.



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Abstracts

A Measurement and Calibration Technique for Accurate Measurement of Amplifier S Parameters

M. Roos and V. Sotoudeh. "A Measurement and Calibration Technique for Accurate Measurement of Amplifier S Parameters." 1987 MTT-S International Microwave Symposium Digest 87.1 (1987 Vol. 1 [MWSYM]): 449-451.

With the current emphasis on active systems it is becoming more important to accurately measure amplifiers. Due to the nature of current measurement systems, and the requirements of two port error correction it is difficult to measure a device which cannot be reversed. This paper describes a means for this measurement and calibration.



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Abstracts

An 18 to 26.5 GHz Waveguide Load-Pull System Using Active-Load Tuning

K. Kotzebue, T.S. Tan and D. McQuate. "An 18 to 26.5 GHz Waveguide Load-Pull System Using Active-Load Tuning." 1987 MTT-S International Microwave Symposium Digest 87.1 (1987 Vol. I [MWSYM]): 453-456.

An 18 to 26.5 GHz waveguide load-pull system using active-load tuning capable of measuring devices with high load reflection coefficients has been designed and constructed using standard waveguide components. The system and its application to the large-signal characterization of GaAs FETs and amplifiers at 26 GHz will be presented.



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Abstracts

Dielectric Constant Evaluation of Insulating Materials: An Accurate, Practical Measurement System

J.A. Weiss and D.A. Hawks. "Dielectric Constant Evaluation of Insulating Materials: An Accurate, Practical Measurement System." 1987 MTT-S International Microwave Symposium Digest 87.1 (1987 Vol. I [MWSYM]): 457-460.

The concept, design, and illustrative results are presented for a coaxial resonant-cavity system used to determine dielectric constant and loss tangent in the UHF-microwave frequency range. Its significant practical features of convenience, simplicity, and reproducibility of measurements together with excellent accuracy make it suitable for evaluation of microcircuit substrates and other critical materials.



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Abstracts

Method for Determining Dielectric Properties of Solids from Measurements on Pulverized Materials

S.O. Nelson. "Method for Determining Dielectric Properties of Solids from Measurements on Pulverized Materials." 1987 MTT-S International Microwave Symposium Digest 87.1 (1987 Vol. 1 [MWSYM]): 461-463.

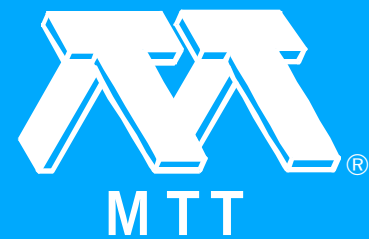
A procedure is outlined for determining the dielectric properties of solid materials of known densities from the dielectric properties of pulverized samples measured at a few different bulk densities. Properties for the solid are obtained by extrapolation of functions of the dielectric constant and loss factor that are linearly related to the bulk density of the air-particle mixture.



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Dielectric and Temperature Measurements During Microwave Curing of Epoxy in a Sweeping Resonant Cavity

J. Jow, M. Finzel, J. Asmussen and M.C. Hawley. "Dielectric and Temperature Measurements During Microwave Curing of Epoxy in a Sweeping Resonant Cavity." 1987 MTT-S International Microwave Symposium Digest 87.1 (1987 Vol. I [MWSYM]): 465-468.

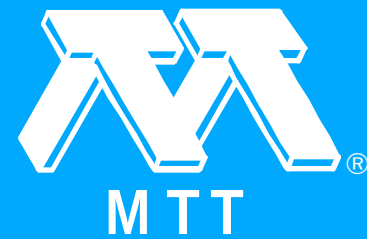
A TM/sub 012/ -mode cylindrical cavity was mechanically critically couple with a microwave circuit at 3.2 GHz. A fluoro optic temperature sensing device was used to monitor temperature in the microwave environment. Stoichiometric mixtures of epoxy (DER 332) and amine (DDS) were heated in this sweeping resonant cavity for curing times of 10 and 30 minutes, respectively. On-line temperature and dielectric properties versus time profiles were measured during the curing process. The dielectric properties versus temperature also measured during cooling. Thereafter, extent of cure of epoxy was determined Differential Scanning Calorimeter.

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Abstracts

Session M -- Communications Systems (1987 Vol. I [MWSYM])

"Session M -- Communications Systems (1987 Vol. I [MWSYM])." 1987 MTT-S International Microwave Symposium Digest 87.1 (1987 Vol. I [MWSYM]): 469-469.



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Abstracts

Performance of a Ka-Band Satellite System Under Variable Transmitted Signal Power Conditions

G. Fujikawa and R. Kerczewski. "Performance of a Ka-Band Satellite System Under Variable Transmitted Signal Power Conditions." 1987 MTT-S International Microwave Symposium Digest 87.1 (1987 Vol. 1 [MWSYM]): 471-474.

A laboratory hardware-based satellite communication system simulator has been used to measure the effects of transmitted signal power changes on the performance of a Ka-band system. Such power changes can be used to compensate for signal fade due to rain attenuation. This paper presents and discusses the results of these measurements.



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Abstracts

Phase Transients in Digital Radio Local Oscillators

M.E. Znojkwicz and B. Vassilakis. "Phase Transients in Digital Radio Local Oscillators." 1987 MTT-S International Microwave Symposium Digest 87.1 (1987 Vol. I [MWSYM]): 475-478.

Phase transients that occur in microwave local oscillators are discussed. The harmful effects of these transients on coherent digital transmission are evaluated, with emphasis placed on complex modulation schemes such as 64 QAM or 256 QAM. The sources of phase transients are identified, and the methods that quantify these transients are presented along with procedures that ensure phase transient free operation of local oscillators.



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Abstracts

Power Amplifier for Microwave Digital Radios with Inherent Phase Compensation

P. Bura, D. Geleman and P. Ntake. "Power Amplifier for Microwave Digital Radios with Inherent Phase Compensation." 1987 MTT-S International Microwave Symposium Digest 87.1 (1987 Vol. I [MWSYM]): 479-481.

The linearity requirements and the design of an amplifier for a 64 QAM digital radio are described. A partial phase compensation between the cascaded bi-polar transistor and FET amplifying stages helps to achieve bit error rates better than 10^{-20} .



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Abstracts

Advanced 6/4 GHz Receiver for Space Application

L. Duque, S. Jarvis, G. Gatti and R. Dion. "Advanced 6/4 GHz Receiver for Space Application." 1987 MTT-S International Microwave Symposium Digest 87.1 (1987 Vol. I [MWSYM]): 483-486.

This paper describes an advanced 6/4 GHz satellite receiver developed in order to meet the extended WARC 79 frequency allocation needs. The receiver provides low-noise and very low level of in-band spurious signals over an extended 750 MHz bandwidth. This highly reliable receiver utilizes the state of the art packaged FET space qualified at the present time and meets very stringent requirements over a qualification temperature range of -5 to + 55°C. Details of the design and measured performance is given.



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Abstracts

GHz Band Monolithic Modem ICs (1987 Vol. I [MWSYM])

H. Kikuchi, S. Konaka and M. Umehira. "GHz Band Monolithic Modem ICs (1987 Vol. I [MWSYM])." 1987 MTT-S International Microwave Symposium Digest 87.1 (1987 Vol. I [MWSYM]): 487-490.

A double balanced mixer IC, a 90° phase shifter IC and a carrier switch IC for high speed QPSK modems have been developed using monolithic lumped constant circuit techniques and advanced Si-bipolar process technology. These ICs are applicable to QPSK modems transmitting baseband signals in excess of 400 Mb/s at 1 GHz local frequency.



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Abstracts

Session N -- Focused Session Advances in Millimeter Wave Systems (60-230 GHz) (1987 Vol. I [MWSYM])

"Session N -- Focused Session Advances in Millimeter Wave Systems (60-230 GHz) (1987 Vol. I [MWSYM])." 1987 MTT-S International Microwave Symposium Digest 87.1 (1987 Vol. I [MWSYM]): 491-491.



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Abstracts

Recent Advances in Millimeter Wave Instrumentation for Radio Astronomy

J.M. Payne. "Recent Advances in Millimeter Wave Instrumentation for Radio Astronomy." 1987 MTT-S International Microwave Symposium Digest 87.1 (1987 Vol. I [MWSYM]): 493-495.

During the past few years major advances have been made in instrumentation for millimeter wave radio astronomy. Antennas have been built with large apertures and high precision and the sensitivity of receivers has improved greatly. This paper summarizes the more important of these advances.



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Abstracts

A Survey of Advanced Developments in Millimeter Wave Seeker Front Ends

T.T. Fong. "A Survey of Advanced Developments in Millimeter Wave Seeker Front Ends." 1987 MTT-S International Microwave Symposium Digest 87.1 (1987 Vol. I [MWSYM]): 496-496.

The maturity of millimeter wave solid state components, particularly in the developments based on integrated circuits, has significantly enhanced the implementations of small lightweight radars in missile guidance and helicopter and tank fire control applications. These systems have been developed over the past ten years based on inherent advantages of adverse weather and improved resolution of millimeter waves which provide a solution to the smoke and dust battlefield environments. In this paper, the recent advances in millimeter wave missile seeker front ends will be reviewed; developments in the 94 GHz region will be emphasized. Recent developments in millimeter wave components and their applications in form factored integrated front ends are discussed. Comparison of systems using several different waveforms are made in the context of performance, size, weight and cost.



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A High Power Coherent 95 GHz Radar (HIPCOR-95)

J.C. Butterworth. "A High Power Coherent 95 GHz Radar (HIPCOR-95)." 1987 MTT-S International Microwave Symposium Digest 87.1 (1987 Vol. I [MWSYM]): 499-502.

The Georgia Tech Research Institute is developing, under contract with the U.S. Army Missile Command, a high power, wide band-width, coherent 95 GHz (HIPCOR-95) radar using a traveling wave tube amplifier (TWT) and an extended interaction klystron amplifier (EKA). The HIPCOR-95 radar has two modes of operation; a 80 watt peak power, 2 GHz bandwidth mode utilizing the TWT, and a 1 kW peak power, 350 MHz bandwidth mode utilizing the EKA. This paper describes the design and fabrication of the waveform signal generator, millimeter wave transmitter, and the polarization agility assembly, and the proposed data collection and processing hardware.

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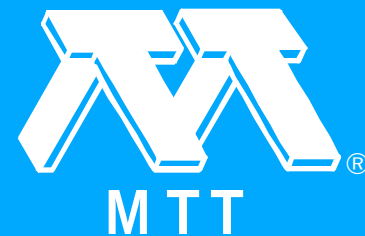


Abstracts

Recent Advances in Gyrotrons and Free Electron Lasers (Invited Talk)

R.J. Temkin. "Recent Advances in Gyrotrons and Free Electron Lasers (Invited Talk)." 1987 MTT-S International Microwave Symposium Digest 87.1 (1987 Vol. I [MWSYM]): 503-505.

The status of gyrotrons and free electron lasers operating at microwave, millimeter wave and submillimeter wavelengths is reviewed. These novel, fast wave devices are making rapid progress, opening up a variety of new applications.



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Abstracts

Session O -- Noise Measurements

"Session O -- Noise Measurements." 1987 MTT-S International Microwave Symposium Digest 87.1 (1987 Vol. I [MWSYM]): 507-507.



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Abstracts

A New Measurement System for Oscillator Noise Characterization

A.N. Riddle and R.J. Trew. "A New Measurement System for Oscillator Noise Characterization." 1987 MTT-S International Microwave Symposium Digest 87.1 (1987 Vol. I [MWSYM]): 509-512.

The prediction of oscillator noise has been one of the more difficult problems in circuit analysis. A new system for measuring modulation (amplitude or phase) transfer and upconversion is presented which allows insight into the causes of oscillator noise. This system can measure modulation at less than -50dbc and accurately predict the oscillator noise spectrum.



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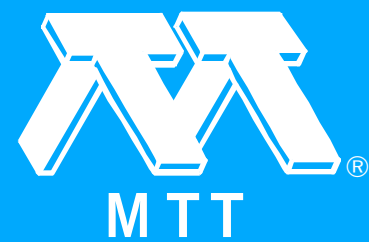
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Microwave Noise Characterization of GaAs MESFETs by On-Wafer Measurement of the Output Noise Current

M.S. Gupta, O. Pitzalis, Jr., S.E. Rosenbaum and P.T. Greiling. "Microwave Noise Characterization of GaAs MESFETs by On-Wafer Measurement of the Output Noise Current." 1987 MTT-S International Microwave Symposium Digest 87.1 (1987 Vol. I [MWSYM]): 513-516.

A simplified noise equivalent circuit is presented for GaAs MESFETs in the common-source configuration, consisting of five linear circuit elements: the gate-to-source capacitance C_{gs} , the total input resistance R_{it} , the transconductance g_m , the output resistance R_o , and a noise current source of spectral density S_{io} at the output port. All of these elements have been determined by on-wafer measurements. The minimum noise figure F_{min} calculated from this model, as well as the bias and frequency dependence of F_{min} , agree with the measured microwave noise figure of the device. Thus the determination of the F_{min} can be done rapidly, conveniently, without the need for tuning, and at the wafer stage of device fabrication solely by on-wafer measurements.

Click on title for a complete paper.



Abstracts

A New Automated Noise and Gain Parameter Measurement System

V.A. Hirsch and T.H. Miers. "A New Automated Noise and Gain Parameter Measurement System." 1987 MTT-S International Microwave Symposium Digest 87.1 (1987 Vol. I [MWSYM]): 517-520.

This paper describes an automated noise and gain parameter measurement system which operates to 26.5 GHz. A new test set configuration and thorough measurement techniques are employed to minimize errors. The noise and gain parameters for an 0.3 μm gate GaAs FET at 10 and 22 GHz are presented.



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The Evaluation of Phase Noise in Low Noise Oscillators

D.M. Harrison, M.J. Howes and R.D. Pollard. "The Evaluation of Phase Noise in Low Noise Oscillators." 1987 MTT-S International Microwave Symposium Digest 87.1 (1987 Vol. 1 [MWSYM]): 521-524.

A new measurement system for the characterisation of low noise oscillators is described. Injection locking rather than phase locking is used to achieve phase quadrature in the two oscillator phase detector method. This method is simpler to implement than conventional phase locked systems and by using a fixed rather than an electronically tuned reference, offers improved limiting sensitivity.



Abstracts

New Millimeter Wave Noise Sources with High Reliability

P.P. Tong, N.G. Fernandez, J.M. Gladstone and E.G. Cristal. "New Millimeter Wave Noise Sources with High Reliability." 1987 MTT-S International Microwave Symposium Digest 87.1 (1987 Vol. I [MWSYM]): 525-528.

Two new highly reliable broadband millimeter wave noise sources have been developed. One operates from 26.5 to 40 GHz, R-band, and the other from 33 to 50 GHz, Q-band. The R-band source has an excess noise ratio of 12.1 ± 0.4 dB with a reflection coefficient of less than .11 when turned on. The Q-band source has an excess noise ratio of 10 ± 1.8 dB with a reflection coefficient of less than .16 when turned on. A new GaAs avalanche diode specifically designed for high noise output and long term reliability was developed for the noise source. The diode with its embedding structure will be described. Reliability data as well as noise measurement techniques and examples will also be presented.



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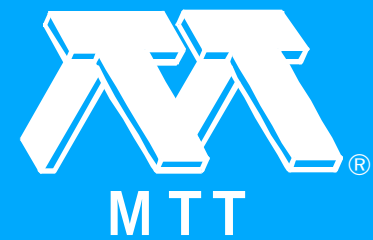
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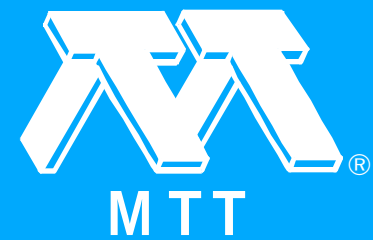
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Abstracts

Session P -- Radar Systems

"Session P -- Radar Systems." 1987 MTT-S International Microwave Symposium Digest 87.2 (1987 Vol. II [MWSYM]): 529-529.



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Solid-State Transmitter/Modulator for the Mode Select Airport Beacon System Sensor

T.M. Nelson, M.J. Reinhart, K.J. Yoo, D.A. Poltorak and R.K. Palmer. "Solid-State Transmitter/Modulator for the Mode Select Airport Beacon System Sensor." 1987 MTT-S International Microwave Symposium Digest 87.2 (1987 Vol. II [MWSYM]): 531-534.

This solid-state communications transmitter/modulator has been developed for the Westinghouse interrogator to be used on the Mode Select (Mode S) Airport Beacon System Sensor. These all solid state Air Traffic Control Systems will be installed in 137 airports in the United States to update and improve present airport/plane communications. They are also compatible with the present air traffic communication system that they will replace, the Air Traffic Control Radar Beacon System (ATCRBS); this feature will accommodate any planes that will not yet have the updated Mode S equipment.

Click on title for a complete paper.



Abstracts

94GHz Integrated Monopulse Radar Demonstrator

C.E. Burnett. "94GHz Integrated Monopulse Radar Demonstrator." 1987 MTT-S International Microwave Symposium Digest 87.2 (1987 Vol. II [MWSYM]): 535-538.

The design and development of a new miniaturised Monopulse Radar demonstrator is described. The construction of the front-end is illustrated and some experimental performance results are presented.



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Abstracts

Self Adaptive Bandpass Filters with Applications to "Frequency Set-On" Oscillators

J.D. Rhodes. "Self Adaptive Bandpass Filters with Applications to "Frequency Set-On" Oscillators." 1987 MTT-S International Microwave Symposium Digest 87.2 (1987 Vol. II [MWSYM]): 539-542.

There are many potential applications particularly at microwave frequencies, for filters whose characteristics vary according to the signal applied to the device. Self adaptive bandpass filters are one class which produce a bandpass characteristic around the carrier frequency of a signal. One application is in multimode oscillators where any mode will then be stable when excited by a sample of an r.f. pulse.



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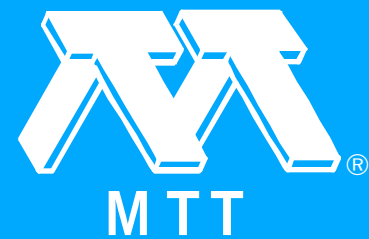
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Noise in Pulsed Microwave Systems

C. Wong, E.P. Caramanis, A. Skantzaris, J. Bender and R.A. Campbell. "Noise in Pulsed Microwave Systems." 1987 MTT-S International Microwave Symposium Digest 87.2 (1987 Vol. II [MWSYM]): 543-545.

The relationship between the noise spectrum of a pulsed microwave signal and that of the same signal operating in the CW mode is derived theoretically and verified through measurements. It is shown that a simple closed form solution exists for wideband white noise but more involved calculations are required otherwise.

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Abstracts

Session Q -- Open Forum II

"Session Q -- Open Forum II." 1987 MTT-S International Microwave Symposium Digest 87.2 (1987 Vol. II [MWSYM]): 547-547.



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Abstracts

Multioctave Multithrow Active Switches

D.L. Dunn, P.G. Asher and C.D. Chang. "Multioctave Multithrow Active Switches." 1987 MTT-S International Microwave Symposium Digest 87.2 (1987 Vol. II [MWSYM]): 549-551.

Multioctave, multithrow active switches have been developed to operate from 2 to 18 GHz. A SPDT switch and a SP4T switch have been constructed. The switches demonstrate 4 dB forward gain and 60 dB of isolation between the input and common port. The switches employ monolithic distributed amplifiers to obtain the forward gain.



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Abstracts

A Comparative Study of TEGFET and MESFET Large Signal Character and Saturation Mechanisms

M. Weiss and D. Pavlidis. "A Comparative Study of TEGFET and MESFET Large Signal Character and Saturation Mechanisms." 1987 MTT-S International Microwave Symposium Digest 87.2 (1987 Vol. II [MWSYM]): 553-556.

A new method for large-signal transistor analysis is presented and applied to TEGFETs and MESFETS. Saturation mechanisms of both types of transistors are described and operation differences are discussed. The importance and influence of higher harmonic signal components on the large signal characteristics is also shown.



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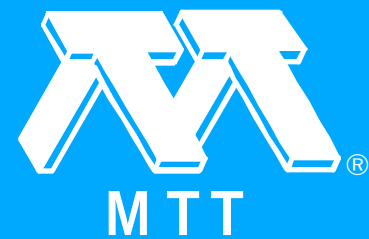
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Comparative Study of Phase Noise in HEMT and MESFET Microwave Oscillators

M. Pouysegur, J. Graffeuil, J.F. Sautereau and J.P. Fortea. "Comparative Study of Phase Noise in HEMT and MESFET Microwave Oscillators." 1987 MTT-S International Microwave Symposium Digest 87.2 (1987 Vol. II [MWSYM]): 557-560.

Several identical X band cavity stabilized MESFET and HEMT oscillators are presented. Their phase noise and some other noise data are reported. Under exactly the same oscillating conditions, the MESFET oscillators exhibit the best phase noise performance not only because of their lower low frequency noise but also because of a better linearity which provides a smaller LF noise conversion in the microwave frequency range.

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A GaAs Monolithic 6-GHz Low-Noise Amplifier for Satellite Receivers (1987 Vol. II [MWSYM])

R. Mott. "A GaAs Monolithic 6-GHz Low-Noise Amplifier for Satellite Receivers (1987 Vol. II [MWSYM])." 1987 MTT-S International Microwave Symposium Digest 87.2 (1987 Vol. II [MWSYM]): 561-564.

A design approach and accurate modeling techniques have been developed to realize a GaAs monolithic, 6-GHz, two-stage, low-noise amplifier (LNA) with a measured 1.7-dB noise figure and associated 21-dB gain. This satellite-compatible, self-biased LNA design, with chip dimensions of 80 x 135 mil, utilizes an ion-implantation FET model which predicts measured in-band amplifier gain to within 0.5 dB and peak frequency response to within 4 percent. The derived noise parameter estimation process, which uses a Gaussian elimination technique to predict the measured noise figure to within 0.2 dB, reduces a set of complex binomial equations to simple relationships which are easily programmable. A deep-recessed gate realization of this LNA design demonstrates that LNA low-noise performance is achievable under FET saturated drain current conditions.

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Miniature Gain Block for Satellite Communication Transceivers

A. Fadry, R. Brown and E. Belohoubek. "Miniature Gain Block for Satellite Communication Transceivers." 1987 MTT-S International Microwave Symposium Digest 87.2 (1987 Vol. II [MWSYM]): 565-567.

The development and optimization of a two-stage Ku-band feedback amplifier using miniature lumped element circuits in batch processed form is described. Bondwires are replaced by electroformed interconnects to reduce parasitic and improve reproducibility and reliability. Results on pre-space qualification thermal and radiation tests are presented.

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A GaAs Microwave MESFET with Extremely Low Distortion

G.-G. Zhou, T. Curtis and R. Chen. "A GaAs Microwave MESFET with Extremely Low Distortion." 1987 MTT-S International Microwave Symposium Digest 87.2 (1987 Vol. II [MWSYM]): 569-572.

A ku-band GaAs power FET with extremely low signal distortion was fabricated on a material with graded doping profile, grown by a special vapor phase epitaxy technique. The device has a nearly constant g_m over a wide range of the bias. At $P_{sub\ o} = 18$ dBm and $P_{sub\ sat} = 24$ dBm power levels of a 6 to 18 GHz broad band amplifier, this device demonstrates second harmonic levels as low as 40 dBc and 22 dBc, respectively, which is the lowest ever reported.

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Abstracts

The Deformable-Channel Model - A New Approach to High-Frequency MESFET Modelling (1987 Vol. II [MWSYM])

F. Crowne, A. Eskandarian, H.B. Sequeira and R. Jahkete. "The Deformable-Channel Model - A New Approach to High-Frequency MESFET Modelling (1987 Vol. II [MWSYM])." 1987 MTT-S International Microwave Symposium Digest 87.2 (1987 Vol. II [MWSYM]): 573-574.

High-frequency small-signal circuit parameters are evaluated for a saturated-channel MESFET by including transit-time effects in a rigorous way through a study of induced shape changes in the saturated-channel region. Results agree well with empirical equivalent-circuit parameters for a physical MESFET.



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Load-Line Analysis in the Frequency Domain with Distributed Amplifier Design Examples

M.L. Salib, D.E. Dawson and H.K. Hahn. "Load-Line Analysis in the Frequency Domain with Distributed Amplifier Design Examples." 1987 MTT-S International Microwave Symposium Digest 87.2 (1987 Vol. II [MWSYM]): 575-578.

Time-Domain analysis of a multi-FET circuit over a wide frequency range and for several power levels using SPICE is not practical because of excessive computer time causing high cost and slow feedback to the designer. The load-line analysis to be described is a linear technique in the frequency domain and is therefore fast. A load-line ellipse is generated at each node of interest and graphically displayed and superimposed on the I-V curves of the device at that node. The driving signal to the amplifier and the amplifier matching networks are adjusted so that the load-line ellipse just fills the linear region of the FET I-V characteristics. Amplifier designs based on this approach agree with measured results within 0.5 dB at frequencies up to 18 GHz. What allows this technique to give accurate results is the sampling of the branch current "inside" the FET model while the FET parasitic are absorbed into the rest of the amplifier circuit.

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Abstracts

Fast-Settling, Low Noise Ku Band Fundamental Bipolar VCO

A.P.S. Khanna. "Fast-Settling, Low Noise Ku Band Fundamental Bipolar VCO." 1987 MTT-S International Microwave Symposium Digest 87.2 (1987 Vol. II [MWSYM]): 579-581.

This paper discusses fast-settling fundamental-output voltage-controlled oscillators in the Ku Band (15 to 18 GHz & 12 to 15 GHz), using silicon bipolar transistors and silicon varactor diodes. With these oscillators the output frequency settles within 2 μ s to within ± 1 MHz of the final frequency. Phase noise at 16.2 GHz was measured to be -93 dBc/Hz at 100 kHz from the carrier.



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Abstracts

Long Term Stability of DROs Compared to Crystal Oscillators

K.R. Varian. "Long Term Stability of DROs Compared to Crystal Oscillators." 1987 MTT-S International Microwave Symposium Digest 87.2 (1987 Vol. II [MWSYM]): 583-586.

Guidelines are presented for GaAs FET DRO's which when followed result in the DRO's long term drift characteristics being similar to crystal oscillators. The guidelines fall into three categories: electrical stresses in the FET, fabrication issues of the DRO, and processing of the FET (a screening test for the GaAs FETs is described). Experimental data is included on a sample of units that support the proposed guidelines.



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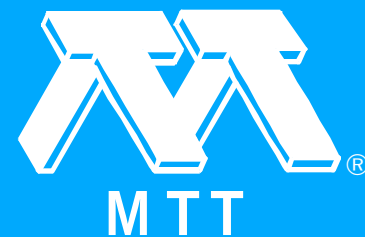


Abstracts

Low Phase Noise X/Ku-Band VCO

D.A. Boyd. "Low Phase Noise X/Ku-Band VCO." 1987 MTT-S International Microwave Symposium Digest 87.2 (1987 Vol. II [MWSYM]): 587-590.

A balanced, thin-film VCO utilizing silicon bipolar transistors and hyper-abrupt varactor diodes has yielded 40% tuning bandwidth while demonstrating excellent frequency stability. Key features of this design are: High RF output power, linear tuning characteristics, excellent sub-harmonic rejection, and low single sideband phase noise. At an operating frequency of 11.5 GHz, single sideband phase noise of -104 dBc/Hz at 100 KHz offset has been obtained. An X-band VCO subsystem designed for missile LO applications utilizing the developed oscillator is also presented.



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Abstracts

Microwave Resistance of Gallium Arsenide and Silicon p-i-n Diodes

R.H. Caverly and G. Hiller. "Microwave Resistance of Gallium Arsenide and Silicon p-i-n Diodes." 1987 MTT-S International Microwave Symposium Digest 87.2 (1987 Vol. II [MWSYM]): 591-594.

The purpose of this paper is to demonstrate that the p-i-n diode resistance is definable as a function of frequency and depends on the diode geometry and electronic properties. A formula for the p-i-n diode resistance is presented and compared with experimental resistance versus frequency data for both silicon and gallium arsenide p-i-n diodes.



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W-Band Crossbar Mixers Integrated Entirely on a Single-Sided Substrate Yielding 15 GHz Instantaneous Bandwidth

S. Low. "W-Band Crossbar Mixers Integrated Entirely on a Single-Sided Substrate Yielding 15 GHz Instantaneous Bandwidth." 1987 MTT-S International Microwave Symposium Digest 87.2 (1987 Vol. II [MWSYM]): 595-597.

Broadband millimeter-wave crossbar mixers using commercially available GaAs beamlead diodes and integrated circuit technology are described. The entire integrated mixer circuit is printed on the same substrate surface allowing for future extension to MMIC form. Measured performance of a compact single balanced mixer at 100 GHz shows an instantaneous 15 GHz RF and IF bandwidth and a conversion loss of 7 dB. This design is most suitable for future ESM receivers.

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Diode Phase Shifter and Model in Waveguide

J.A. Lester and C.M. Jackson. "Diode Phase Shifter and Model in Waveguide." 1987 MTT-S International Microwave Symposium Digest 87.2 (1987 Vol. II [MWSYM]): 599-602.

Two models for a diode phase shifter in waveguide are presented. The first is a circuit model of the diode that can be used to predict response for design of different phase shift values. The second is an RLC model that can be realized as a strip and a strip with a gap for simulation of the diode.

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Wide-Band True Time Delay Phase Shifter Devices

P.R. Herczfeld, A.S. Daryoush, M. Kieli, S. Siegel and R. Soref. "Wide-Band True Time Delay Phase Shifter Devices." 1987 MTT-S International Microwave Symposium Digest 87.2 (1987 Vol. II [MWSYM]): 603-606.

Fiber optic links in microwave and millimeter wave region have recently been demonstrated. Integration of these links into systems require the development of fiber optic devices such as novel true time delay devices. Most of the currently available fiber optic time delay components provide for constant, fixed time delays. Many applications on the other hand, such as optically controlled phased arrays, would require variable time delays for phase shifting purposes. This paper is concerned with variable time delay devices and their systems integration.

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A Novel Whiskerless Schottky Diode for Millimeter and Submillimeter Wave Application

W.L. Bishop, K. McKinney, R.J. Mattauch, T.W. Crowe and G. Green. "A Novel Whiskerless Schottky Diode for Millimeter and Submillimeter Wave Application." 1987 MTT-S International Microwave Symposium Digest 87.2 (1987 Vol. II [MWSYM]): 607-610.

A novel whiskerless Schottky diode has been developed in which shunt capacitance is minimized by means of an etched surface channel. This structure is easily fabricated and the DC I-V characteristics are as good as those of the best available whisker-contacted devices. Preliminary RF characterization in an unoptimized mount at 110 GHz has yielded room temperature SSB mixer noise temperature of 950 K and SSB conversion loss of 6.4 dB. The diode is robust and can be operated at cryogenic temperatures. Potential applications include waveguide and planar mixers, planar arrays, multipliers, varactor tuners, and microwave integrated circuits.

Click on title for a complete paper.



Abstracts

Filled Image Guide for Millimeter-Wave Circuits

M.-Q. Shi and D.-H. Jiang. "Filled Image Guide for Millimeter-Wave Circuits." 1987 MTT-S International Microwave Symposium Digest 87.2 (1987 Vol. II [MWSYM]): 611-612.

In this paper the method of optimal design is dealt with for six parameters selected by the Orthogonal Array Table (OAT). A lot of sets of parameters are presented, by which the filled image guides have optimal propagation properties. The guiding ability is strengthened greatly as the hollow core is filled with another dielectric material.



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Abstracts

A Tunable Grating Impedence Transformer

J.D. Xu. "A Tunable Grating Impedence Transformer." 1987 MTT-S International Microwave Symposium Digest 87.2 (1987 Vol. II [MWSYM]).

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Abstracts

A Novel Technique for Evaluation and Integration of Connectorless (Drop-In) Microwave Components

D. Herstein. "A Novel Technique for Evaluation and Integration of Connectorless (Drop-In) Microwave Components." 1987 MTT-S International Microwave Symposium Digest 87.2 (1987 Vol. II [MWSYM]): 613-616.

A novel technique for evaluation and integration of connectorless (drop-in) microwave components into subsystems is proposed. This technique utilizes a quick connect-disconnect device designed in STRIPGUIDE, a modified version of strip-line. This new method is flexible and simple to use and shows very good RF performance up to 40 GHz.



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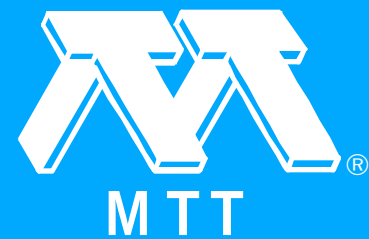
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Coupling Between Hybrid Mode Dielectric Resonators

K.A. Zaki and C. Chen. "Coupling Between Hybrid Mode Dielectric Resonators." 1987 MTT-S International Microwave Symposium Digest 87.2 (1987 Vol. II [MWSYM]): 617-620.

Methods for the rigorous numerical calculation of the coupling coefficient between dual hybrid mode dielectric resonators in a circular waveguide are developed. A simplified model for the approximate calculation of the coupling is also presented. Experimental measurements performed to verify the models are found to be in excellent agreements with the calculations.

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Exact Calculation of Scattering Parameters of the Coplanar-Slot Transition in a Unilateral Finline Technology

O. Picon, J.-P. Lefevre, V.F. Hanna and J. Citerne. "Exact Calculation of Scattering Parameters of the Coplanar-Slot Transition in a Unilateral Finline Technology." 1987 MTT-S International Microwave Symposium Digest 87.2 (1987 Vol. II [MWSYM]): 621-624.

The dominant and higher order modes, in both a unilateral finline and coupled unilateral finlines in the even and odd modes, are accurately described from a thorough spectral-domain approach. Then, coupling coefficients between eigenmodes at a coplanar-slot transition in a unilateral finline technology, which are to be used in the generalized scattering matrix formulation are directly computed in the spectral domain. Scattering parameters of the dominant mode in the Ka band are presented for both even and odd mode excitation of the coupled unilateral finlines.

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Abstracts

Analysis of VLSI Interconnect Structures

L. Carin, Q. Xu, K.J. Webb and J.A. McClintock. "Analysis of VLSI Interconnect Structures." 1987 MTT-S International Microwave Symposium Digest 87.2 (1987 Vol. II [MWSYM]): 625-628.

Theoretical and experimental results are presented for coupled microstrip structures typically used in VLSI, microwave, and millimeter-wave circuits. Full-wave data for pulse and time harmonic propagation is presented. Results from this work can be used in establishing design criteria for high-speed digital circuits.



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Abstracts

Towards an Unified Efficient Algorithm for Characterizing the Planar Periodic Waveguides

K. Wu and P. Saguet. "Towards an Unified Efficient Algorithm for Characterizing the Planar Periodic Waveguides." 1987 MTT-S International Microwave Symposium Digest 87.2 (1987 Vol. II [MWSYM]): 629-632.

A new efficient algorithm (modified three dimensional spectral domain solution with "modal spectrum" in propagation direction) applied to a variety of planar waveguides with periodic stubs is achieved. In this paper, slow-wave propagation characteristics of both symmetrically and unsymmetrically loaded periodic structures with lossy dielectric layer such as finline and coplanar waveguide (CPW) are investigated. Many important features like pass-band and stop-band related to cut-off and resonant frequencies are discussed in detail based on numerical computations which are compared with measured results obtained by transmission line experimental procedure.



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Abstracts

Centering and Tolerancing the Components of Microwave Amplifiers

A. McFarland, J. Purviance, D. Loescher, K. Diegert and T. Ferguson. "Centering and Tolerancing the Components of Microwave Amplifiers." 1987 MTT-S International Microwave Symposium Digest 87.2 (1987 Vol. II [MWSYM]): 633-636.

A simple graphical statistical method of circuit design centering and tolerancing for a desired circuit manufacturing yield is presented. The method is iterative and based on a parametric study of circuit yield estimates using Monte Carlo circuit analysis. Circuit elements including device s-parameters and distributed parameters as well as lumped components are considered. An application of this method is given in an example.



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Analysis of Discontinuities in Optical Waveguides

J.B. Davies and B.M.A. Rahman. "Analysis of Discontinuities in Optical Waveguides." 1987 MTT-S International Microwave Symposium Digest 87.2 (1987 Vol. II [MWSYM]): 637-640.

In this paper we illustrate the solution of diffused channel waveguides, the effect of electrodes for rib waveguides, and calculation of coupling length for a directional coupler problem using the vector H-field finite element method along with infinite elements and a penalty method. We also present solutions of discontinuities for optical waveguides by combining vector finite element method and least square boundary residual methods. Some basic discontinuity steps, such as vertical misalignment, change of width, and change of rib height for rib waveguides are illustrated here.

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Abstracts

Optical Crosstalk Due to Electrical Coupling in High-Speed Lithium Niobate Devices

P. Perlmutter, J.E. Baran and Y. Silberberg. "Optical Crosstalk Due to Electrical Coupling in High-Speed Lithium Niobate Devices." 1987 MTT-S International Microwave Symposium Digest 87.2 (1987 Vol. II [MWSYM]): 641-643.

Two high-speed phase modulators with traveling wave electrodes fabricated on the same lithium niobate crystal were used to measure the optical crosstalk caused by electrical coupling between the electrodes as a function of frequency up to 7 GHz.



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Abstracts

Optoelectronic Generation and Sensing of Millimeter Waves

C.R. Lutz and A.P. Defonzo. "Optoelectronic Generation and Sensing of Millimeter Waves." 1987 MTT-S International Microwave Symposium Digest 87.2 (1987 Vol. II [MWSYM]): 645-648.

Broadband tapered slot antennas, monolithically integrated with picosecond optoelectronic switches, are used to generate, control and sense millimeter wave radiation. These devices can be easily integrated with millimeter wave circuit components due to their planar geometry. This method of transmitting information eliminates many of the limitations inherent with transmission line structures and demonstrates the potential for controlling extremely wideband electrical signals.



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Abstracts

Generation of Kilowatt/Kilovolt Broadband Microwave Bursts with a Single Picosecond Photoconductive Switch

H.A. Sayadian, M.G. Li and C.H. Lee. "Generation of Kilowatt/Kilovolt Broadband Microwave Bursts with a Single Picosecond Photoconductive Switch." 1987 MTT-S International Microwave Symposium Digest 87.2 (1987 Vol. II [MWSYM]): 649-652.

A single picosecond GaAs photoconductive switch is used to pulse excite a microwave resonant cavity, generating various microwave waveforms. The generation of over 7 kW, with peak to peak voltage over 1.2 kV, of broadband microwave bursts is demonstrated.



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Abstracts

Large-Signal Modulation of Semiconductor Lasers with Optical Feedback for Millimeter Wave Applications

V.M. Contarino, A.S. Daryoush and P.R. Herczfeld. "Large-Signal Modulation of Semiconductor Lasers with Optical Feedback for Millimeter Wave Applications." 1987 MTT-S International Microwave Symposium Digest 87.2 (1987 Vol. II [MWSYM]): 653-656.

Large-signal microwave modulation of laser diodes excite harmonics which have been exploited to achieve optical injection locking of multiple millimeter wave oscillators. Experimental results of large-signal modulation of laser diodes with optical feedback are presented. The external cavity increases the optical intensity modulation depth of both the fundamental (3.456GHz) and its harmonics by approximately 20dB.



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Abstracts

Optically Controlled Millimeter Wave Phase Shifter in a Metallic Waveguide

G. Hadjicostas, M.W. Scott and J.K. Butler. "Optically Controlled Millimeter Wave Phase Shifter in a Metallic Waveguide." 1987 MTT-S International Microwave Symposium Digest 87.2 (1987 Vol. II [MWSYM]): 657-660.

Analytical and experimental results of an optically controlled millimeter wave phase shifter enclosed in a metallic waveguide are presented. The analysis predicts that large phase shifts and low attenuation can be achieved with this configuration. An experimental study of the feasibility of inducing phase shift in a 94 GHz signal propagating in a metallic waveguide inhomogeneously filled with a silicon slab, is reported.



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Abstracts

A New Generalised Approach to the Design of Microwave Oscillators

Y. Xuan and C.M. Snowden. "A New Generalised Approach to the Design of Microwave Oscillators." 1987 MTT-S International Microwave Symposium Digest 87.2 (1987 Vol. II [MWSYM]): 661-664.

A new approach to the design of microwave oscillators is presented which allows both frequency and power output to be predicted. The main feature of this technique is that it allows the optimum performance to be obtained from the MESFET. This is achieved by employing a generalised substitution theorem. A design example and experimental results are given for a J-band fixed-frequency MESFET oscillator. The experimental results were found to be within 9% of the predicted values for both frequency and output power, without any experimental adjustment.



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Abstracts

A Refractory Self-Aligned Gate Process for Monolithically Combined Microwave and Digital GaAs ICs

A. Geissberger, R. Sadler, E. Griffin, I. Bahl, H. Singh and M. Drinkwine. "A Refractory Self-Aligned Gate Process for Monolithically Combined Microwave and Digital GaAs ICs." 1987 MTT-S International Microwave Symposium Digest 87.2 (1987 Vol. II [MWSYM]): 665-668.

We present a process for monolithically fabricating microwave and DCFL digital GaAs circuits. The process employs refractory metal SAG FETs with techniques to provide low gate resistance and high output resistance and break-down voltage. Using a 1.0 μm gate length, 1.5 dB noise figure with 10.2 dB associated gain at 10 GHz analog performance and 65 ps typical propagation delay at 0.5 mW/gate (fan-in/fan-out = 2/2) DCFL digital performance have been obtained.



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Abstracts

Analysis of Multiple-Step Radial-Resonator Waveguide Diode Mounts with Application to IMPATT Oscillator Circuits

B.D. Bates. "Analysis of Multiple-Step Radial-Resonator Waveguide Diode Mounts with Application to IMPATT Oscillator Circuits." 1987 MTT-S International Microwave Symposium Digest 87.2 (1987 Vol. II [MWSYM]): 669-672.

A computer-oriented method for determining the driving-point impedance of waveguide diode mounting structures incorporating stepped radial resonators is described. Results of application of the method to the study of IMPATT oscillator circuits are also given. The method is applicable to a wide range of diode mounts including the resonant-cap mount widely used in Gunn and IMPATT circuits.



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Abstracts

Absorbed Power Distribution in Heart Lung System Due to Microwave Irradiation at 750 MHz

J. Behari. "Absorbed Power Distribution in Heart Lung System Due to Microwave Irradiation at 750 MHz." 1987 MTT-S International Microwave Symposium Digest 87.2 (1987 Vol. II [MWSYM]): 673-675.

In order to help evaluate the diagnostic potential of low energy microwave energy regarding the pathological changes associated with emphysema, electrical field distribution and hence the power deposition in organs are needed.



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Dielectric-Resonator-Stabilized Second Harmonic Ka-Band Microstrip Gunn Oscillator

S. Zhong-Liang and C. Ning. "Dielectric-Resonator-Stabilized Second Harmonic Ka-Band Microstrip Gunn Oscillator." 1987 MTT-S International Microwave Symposium Digest 87.2 (1987 Vol. II [MWSYM]): 677-680.

In the present paper a Ka-band second harmonic microstrip Gunn oscillator stabilized by a dielectric resonator at its fundamental frequency has been investigated. The stabilized second harmonic output power of more than 10mw at Ka-band is observed. Pushing figure is lower than 300KHz/V. Mechanical tuning range is greater than 500 MHz. This oscillator can be used as a local oscillator in mm-wave integrated system.

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Abstracts

Edge Corrections for Microstrip Planar Analysis Models

H.A. Burger. "Edge Corrections for Microstrip Planar Analysis Models." 1987 MTT-S International Microwave Symposium Digest 87.2 (1987 Vol. II [MWSYM]): 681-684.

Microstrip planar waveguide models of circuits that use the equivalent width and equivalent dielectric constant for each region fail to accurately predict performance. A better model is described that does not use equivalent parameters directly, but instead uses a dual fringe correction which more accurately models the real fringe fields.



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Characterization Method and Simple Design Formulas of MCS Lines Proposed for MMIC's (1987 Vol. II [MWSYM])

E. Yamashita, K.R. Li, E. Kaneko and Y. Suzuki. "Characterization Method and Simple Design Formulas of MCS Lines Proposed for MMIC's (1987 Vol. II [MWSYM])." 1987 MTT-S International Microwave Symposium Digest 87.2 (1987 Vol. II [MWSYM]): 685-688.

Micro-coplanar-strip (MCS) lines are proposed to avoid serious proximity effects between microstrip lines and ground on monolithic microwave integrated circuits and to result in high packaging density. The rectangular boundary division method is used to attain quasi-TEM wave solutions for MCS lines. Results of this analysis are expressed in simple formulas.

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Abstracts

Global Stability Analysis of Microwave Circuits by a Frequency-Domain Approach

V. Rizzoli and A. Neri. "Global Stability Analysis of Microwave Circuits by a Frequency-Domain Approach." 1987 MTT-S International Microwave Symposium Digest 87.2 (1987 Vol. II [MWSYM]): 689-692.

The paper presents a novel computer algorithm allowing a global stability analysis of any nonlinear microwave circuit to be carried out in a general-purpose CAD environment. This is obtained through a systematic application of bifurcation theory in a way compatible with the frequency-domain description of the linear subnetwork.



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Abstracts

Analysis Equations for Shielded Suspended Substrate Microstrip Line and Broadside-Coupled Stripline

Y.-H. Shu, X.-X. Qi and Y.-Y. Wang. "Analysis Equations for Shielded Suspended Substrate Microstrip Line and Broadside-Coupled Stripline." 1987 MTT-S International Microwave Symposium Digest 87.2 (1987 Vol. II [MWSYM]): 693-696.

Simple and closed-form equations for analysis of shielded suspended substrate microstrip line (SSL) and Broadside-coupled stripline (BSCL) are presented, valid over a practical application range of structural parameters and substrate dielectric constant. Comparing with the values obtained using finite-differential method, the accuracy is found to be within $\pm 2\%$ ($w < a/2$) and $\pm 3\%$ ($a/2 < w < a$) for SSL and within $\pm 4.5\%$ (odd mode) and $\pm 3.5\%$ (even mode) for BSCL.



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Abstracts

The Effectiveness of Four Direct Search Optimization Algorithms

R.W. Rhea. "The Effectiveness of Four Direct Search Optimization Algorithms." 1987 MTT-S International Microwave Symposium Digest 87.2 (1987 Vol. II [MWSYM]): 697-702.

Effective computer circuit simulation programs require efficient optimization routines. This paper describes four different direct search routines beginning with a simple random direct search and concluding with the presented algorithm. The four routines are tested on three different circuits using the same computer circuit simulation program, so that conclusions may be drawn as to the relative effectiveness of each routine.



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Abstracts

Computer Aided Design Models for Unilateral Finline with Finite Metallization Thickness and Arbitrarily Located Slot Widths

P. Pramanick, R.R. Mansour and R.H. MacPhie. "Computer Aided Design Models for Unilateral Finline with Finite Metallization Thickness and Arbitrarily Located Slot Widths." 1987 MTT-S International Microwave Symposium Digest 87.2 (1987 Vol. II [MWSYM]): 703-706.

This paper presents closed form design equations for the phase constant of unilateral finlines with finite metallization thickness and arbitrarily located slots. The equations are based on numerical data obtained using the highly accurate conservation of complex power technique.



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Abstracts

Puff, an Interactive Microwave Computer Aided Design Program for Personal Computers

R.C. Compton, W.L. Williams and D.B. Rutledge. "Puff, an Interactive Microwave Computer Aided Design Program for Personal Computers." 1987 MTT-S International Microwave Symposium Digest 87.2 (1987 Vol. II [MWSYM]): 707-708.

We will demonstrate a CAD program designed for the lay out and analysis of microstrip circuits. The program runs on the IBM PC or AT. Circuit elements are selected from a parts list and drawn on the screen using the cursor keys. The analysis may then be performed, directly from the screen drawing. Puff has been used by microwave students in classes at the California Institute of Technology and the University of California at Los Angeles.



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Abstracts

An Automatic Decomposition Technique for Device Modelling and Large Circuit Design

J.W. Bandler and Q.J. Zhang. "An Automatic Decomposition Technique for Device Modelling and Large Circuit Design." 1987 MTT-S International Microwave Symposium Digest 87.2 (1987 Vol. II [MWSYM]): 709-712.

A novel and general approach is presented utilizing automatic decomposition to solve optimization problems arising from device modelling and from design of large microwave systems. The partitioning approach proposed by Kondoh for FET modelling problems is verified. The technique was successfully tested on large scale optimization of microwave multiplexer involving 16 channels, 399 nonlinear functions and 240 variables.



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Abstracts

Modelling the Dispersion in a Suspended Microstripline

R.S. Tomar and P. Bhartia. "Modelling the Dispersion in a Suspended Microstripline." 1987 MTT-S International Microwave Symposium Digest 87.2 (1987 Vol. II [MWSYM]): 713-715.

Dispersion in an open suspended microstripline is modelled. New frequency-dependent equations for the effective dielectric constant are reported. The equations are derived for four commonly used substrates (namely RT-Duroid, Fused Quartz, Alumina, and Gallium Arsenide) and reproduce the exact fullwave data within ± 2 percent (± 1 percent for most cases).



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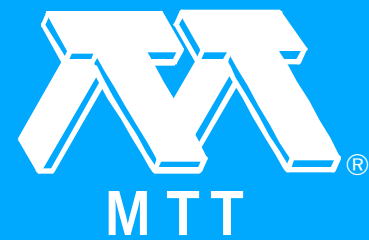


Abstracts

An Almost-Periodic Fourier Transform for Use with Harmonic Balance

G.B. Sorkin, K.S. Kundert and A. Sangiovanni-Vincentelli. "An Almost-Periodic Fourier Transform for Use with Harmonic Balance." 1987 MTT-S International Microwave Symposium Digest 87.2 (1987 Vol. II [MWSYM]): 717-720.

Harmonic balance is a powerful technique for the simulation of mildly nonlinear microwave circuits. This technique has had limited application for the analysis of almost-periodic circuits, such as mixers, due to the difficulties of transforming waveforms from the time domain to the frequency domain and vice versa. In this paper, a new Fourier transform algorithm for almost-periodic functions (APFT) is developed that is both efficient and accurate. Unlike previous attempts to solve this problem, the new algorithm does not constrain the input frequencies and uses the theoretically minimum number of time points.



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Generalized Analysis of E-Plane Septa Discontinuities

A. Rong and S. Li. "Generalized Analysis of E-Plane Septa Discontinuities." 1987 MTT-S International Microwave Symposium Digest 87.2 (1987 Vol. II [MWSYM]): 721-724.

A novel technique for analyzing generalized E-plane septa discontinuities is proposed in this paper. A set of numerical results are given. The curves for unilateral septa and symmetrical bilateral septa have agreed agreement with [3]. They show that the present method is precise and reliable. The curves for asymmetrical bilateral septa have not been revealed ever before in literatures.

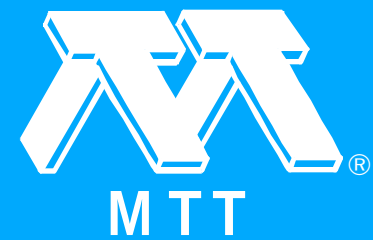
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Abstracts

Session R -- Guided Waves

"Session R -- Guided Waves." 1987 MTT-S International Microwave Symposium Digest 87.2 (1987 Vol. II [MWSYM]): 725-725.



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Abstracts

Simple Analytic Formulas for Dielectric Waveguides

S.T. Peng, S.L. Wang and F.K. Schwering. "Simple Analytic Formulas for Dielectric Waveguides." 1987 MTT-S International Microwave Symposium Digest 87.2 (1987 Vol. II [MWSYM]): 727-730.

We present here a set of simple analytic formulas for determining the propagation characteristics of multilayer dielectric structures. These formulas are particularly useful for computer-aided design of dielectric waveguides.



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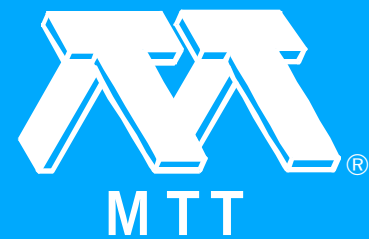
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Guidance and Leakage Properties of Offset Groove Guide

P. Lampariello, F. Frezza, H. Shigesawa, M. Tsuji and A.A. Oliner. "Guidance and Leakage Properties of Offset Groove Guide." 1987 MTT-S International Microwave Symposium Digest 87.2 (1987 Vol. II [MWSYM]): 731-734.

A new leaky-wave structure, the offset groove guide, is analyzed accurately by two completely different methods: a novel tee-junction equivalent network approach and a numerical mode-matching procedure. The new structure is discussed first, and it is then shown that the numerical values for the propagation characteristics obtained by each method agree very well with each other. When the offset metal walls are finite in height, an unexpected additional set of leaky modes is present that can couple to the expected offset-groove-guide leaky mode and produce quite complicated but interesting modal behavior. This behavior is discussed as a function of offset and wall height.

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



Abstracts

Analysis and Design of Microslab™ Waveguide

B. Young and T. Itoh. "Analysis and Design of Microslab™ Waveguide." 1987 MTT-S International Microwave Symposium Digest 87.2 (1987 Vol. II [MWSYM]): 735-738.

Microslab/sup TM/, a novel low-loss semi-planar waveguide, is studied to provide design charts for the propagation constant and characteristic impedance. A parallel-plate analysis is performed to provide design guidelines based on frequency, conductor loss, and size. A mode-matching procedure is then used to build the design charts. Results are provided for microslab implementation on GaAs substrates.



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Abstracts

Microstrip Circuit Elements on Cylindrical Substrates

A. Nakatani and N.G. Alexopoulos. "Microstrip Circuit Elements on Cylindrical Substrates." 1987 MTT-S International Microwave Symposium Digest 87.2 (1987 Vol. II [MWSYM]): 739-742.

Dynamic Models for a variety of microstrip circuits, microstrip discontinuities, and general conductor elements printed on cylindrical substrates are presented. The models accounts for radiation loss and surface wave effects. The dispersion models include the transverse current component and provide error criteria when it is omitted. Coupled lines, open ends and edge coupled resonators are also investigated.



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Abstracts

Analysis of Double-Layered Finlines Containing a Magnetized Ferrite (1987 Vol. II [MWSYM])

M. Geshiro and T. Itoh. "Analysis of Double-Layered Finlines Containing a Magnetized Ferrite (1987 Vol. II [MWSYM])." 1987 MTT-S International Microwave Symposium Digest 87.2 (1987 Vol. II [MWSYM]): 743-744.

The characteristics of propagation of the dominant mode in magnetized-ferrite-loaded double-layered finlines are studied. The analysis is based on Galerkin's method applied in the Fourier transform domain. Numerical results are presented for various values of structural and material parameters.



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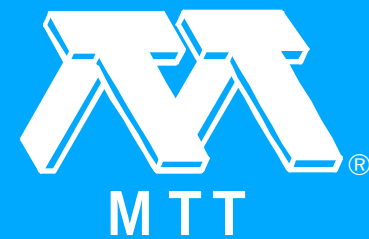
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Abstracts

Session S -- Focused Session Advances in Millimeter Wave Technology (60-230 GHz)

"Session S -- Focused Session Advances in Millimeter Wave Technology (60-230 GHz)." 1987 MTT-S International Microwave Symposium Digest 87.2 (1987 Vol. II [MWSYM]): 745-745.



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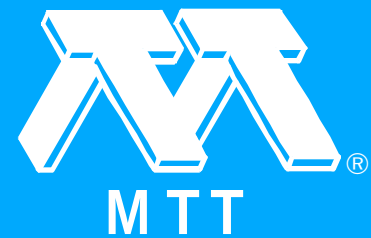


Abstracts

Millimeter-Wave Material Properties and Measurements

G.J. Simonis. "Millimeter-Wave Material Properties and Measurements." 1987 MTT-S International Microwave Symposium Digest 87.2 (1987 Vol. II [MWSYM]): 747-748.

Emerging millimeter-wave (MMW) applications require reliable data on the MMW properties of materials. An overview is given of some of these requirements, the nature and limitation of the available data, the means of obtaining such data, and the progress that is being made in characterizing the MMW properties of materials.



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Abstracts

Advances in HEMT Technology and Applications

P.M. Smith, P.C. Chao, K.H.G. Duh, L.F. Lester, B.R. Lee and J.M. Ballingall. "Advances in HEMT Technology and Applications." 1987 MTT-S International Microwave Symposium Digest 87.2 (1987 Vol. II [MWSYM]): 749-752.

High electron mobility transistors (HEMTs) have demonstrated unsurpassed transistor performance in the millimeter-wave range--at 60 GHz, results include a minimum noise figure of 2.3 dB with 4.0 dB associated gain, maximum small-signal gain of 11.7 dB, output power of 50 mW, power density of 0.43 W/mm and maximum power-added efficiency of 28%. The principles of HEMT operation and design are described, followed by a summary of the current state-of-the-art in noise and power performance, and discussion of several applications.



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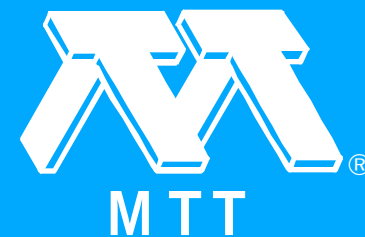


Abstracts

Imaging Antenna Arrays

D. Rutledge. "Imaging Antenna Arrays." 1987 MTT-S International Microwave Symposium Digest 87.2 (1987 Vol. II [MWSYM]).

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Abstracts

GaAs Schottky Barrier Diodes for High Sensitivity Millimeter and Submillimeter Wavelength Receivers

T.W. Crowe and R.J. Mattauch. "GaAs Schottky Barrier Diodes for High Sensitivity Millimeter and Submillimeter Wavelength Receivers." 1987 MTT-S International Microwave Symposium Digest 87.2 (1987 Vol. II [MWSYM]): 753-756.

Recent advances promise to increase the sensitivity of GaAs Schottky barrier mixer diodes for use in millimeter and submillimeter wavelength receivers. Noise properties of the diodes are now well understood, and numerical mixer analysis techniques have been extended to incorporate the new noise models. These analyses can be used to investigate the performance of receivers throughout these wavelength ranges and at cryogenic operating temperatures. Important guidelines for diode development have been developed. Alternative diode structures, which can now be fabricated by new epitaxial growth techniques, also promise to yield higher sensitivities.



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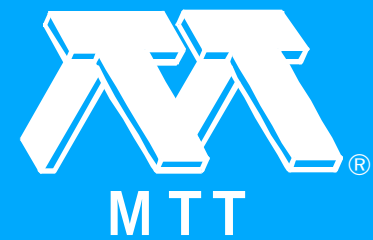
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Abstracts

Session T -- Invited European Session

"Session T -- Invited European Session." 1987 MTT-S International Microwave Symposium Digest 87.2 (1987 Vol. II [MWSYM]): 757-757.



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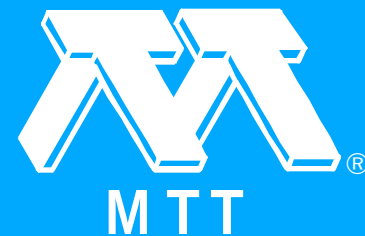


Abstracts

Detection of Millimeter and Submillimeter Waves

E.L. Kollberg. "Detection of Millimeter and Submillimeter Waves." 1987 MTT-S International Microwave Symposium Digest 87.2 (1987 Vol. II [MWSYM]): 759-762.

This paper gives an overview of research activities in Europe concerning low noise receivers for millimeter and submillimeter waves. Since radio astronomy is a driving force in this area, most of the information given is related to work done by European radio astronomy groups.



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Abstracts

State-of-the Art of MMIC Technology and Design in West Germany

E. Pettenpaul. "State-of-the Art of MMIC Technology and Design in West Germany." 1987 MTT-S International Microwave Symposium Digest 87.2 (1987 Vol. II [MWSYM]): 763-766.

The report presents advanced CAD models of lumped element MMIC's and some new technological features - a selfaligned gate process called DIOM, and the successful application of x-ray lithography. Different types of amplifier MMIC's and devices for DBS and PAR will be discussed.



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Abstracts

Modeling of New Microwave Devices

G. Salmer. "Modeling of New Microwave Devices." 1987 MTT-S International Microwave Symposium Digest 87.2 (1987 Vol. II [MWSYM]): 767-770.

The main recent evolutions of microwaves devices (MESFET, MODFET, HBT, MISFET, IMPATT diodes and TED) are presented. It appears that many new physical phenomena must be taken into account when we want to describe the behaviour of such devices and to simulate them. These effects occur not only in bulk materials but also in heterostructures. Three different types of models are presented: Monte Carlo simulation, two dimensional and one dimensional resolution of basic equations. Their respective advantages are precised.



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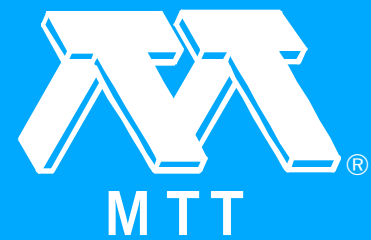
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Abstracts

Session U -- Waveguide Discontinuity Structures

"Session U -- Waveguide Discontinuity Structures." 1987 MTT-S International Microwave Symposium Digest 87.2 (1987 Vol. II [MWSYM]): 771-771.



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Abstracts

A Dynamic Model for Microstrip--Slotline Transition and Related Structures (1987 Vol. II [MWSYM])

H.Y. Yang and N.G. Alexopoulos. "A Dynamic Model for Microstrip--Slotline Transition and Related Structures (1987 Vol. II [MWSYM])." 1987 MTT-S International Microwave Symposium Digest 87.2 (1987 Vol. II [MWSYM]): 773-775.

An analysis of microstrip to slotline transition is presented. The method of moments is applied to the coupled integral equations. In the formulation, the Green's function for the grounded dielectric substrate is used, which takes into account all the radiation, surface wave and substrate effects. Meanwhile, all the mutual coupling effects are included in the method of moments solution. Certain related structures, such as slotline and microstrip discontinuities, a slot fed by a microstripline and a printed strip dipole fed by a slotline, can also be solved with this analysis. The present approach may find applications to other related transitions in MIC design.



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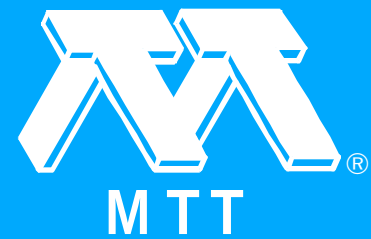


Abstracts

Characterization of Stripline Crossing by Transverse Resonance Analysis

T. Uwano, R. Sorrentino and T. Itoh. "Characterization of Stripline Crossing by Transverse Resonance Analysis." 1987 MTT-S International Microwave Symposium Digest 87.2 (1987 Vol. II [MWSYM]): 777-780.

A method of analysis is described for characterizing the discontinuities made of orthogonally crossed two striplines on a suspended structure. The method of analysis is based on generalized transverse resonant technique extended here to 4-port configurations. The technique is used for determination of resonant structure at a given frequency and subsequently the equivalent circuit parameters of the discontinuities.



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Abstracts

An Improved Multimode Small Aperture/Obstacle Theory

M. Guglielmi and A.A. Oliner. "An Improved Multimode Small Aperture/Obstacle Theory." 1987 MTT-S International Microwave Symposium Digest 87.2 (1987 Vol. II [MWSYM]): 781-784.

We present a new and improved theory for small apertures and obstacles in multimode waveguide, and we show that for transverse discontinuities the resulting equivalent network differs from that obtained from earlier theory by simple added series or shunt elements. That simple network modification, however, yields greatly improved accuracy, as demonstrated in a specific example.



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Abstracts

An Accurate Analysis of Discontinuities in Dielectric Rectangular Waveguide and its Application to Grating Filters

M. Tsuji and H. Shigesawa. "An Accurate Analysis of Discontinuities in Dielectric Rectangular Waveguide and its Application to Grating Filters." 1987 MTT-S International Microwave Symposium Digest 87.2 (1987 Vol. II [MWSYM]): 785-788.

An accurate theoretical approach for discontinuity problems in dielectric 3-D (rectangular) waveguides of open type is presented. This approach takes account of the behavior of both surface wave modes and continuous spectral waves, and is successfully applied to design dielectric image guide grating filters. Comparative data are also shown.



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Variational Bound Analysis of a Discontinuity in Nonradiative Dielectric Waveguide

J.C. Olivier and J.A.G. Malherbe. "Variational Bound Analysis of a Discontinuity in Nonradiative Dielectric Waveguide." 1987 MTT-S International Microwave Symposium Digest 87.2 (1987 Vol. II [MWSYM]): 789-790.

This paper describes the application of the variational bound method to Nonradiative Dielectric waveguide, for the analysis of scattering by a dielectric obstacle, in this case an airfilled discontinuity in the dielectric centre strip. Closed form equations are obtained that can be used directly in the design of networks using reactive components, such as filters. Measured data agrees well with the theoretical calculations.

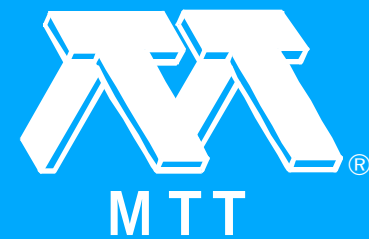
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Abstracts

Session V -- Microwave Acoustics: Developments and Applications

"Session V -- Microwave Acoustics: Developments and Applications." 1987 MTT-S International Microwave Symposium Digest 87.2 (1987 Vol. II [MWSYM]): 791-791.



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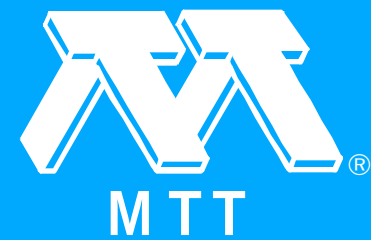


Abstracts

Applications of Custom SAW Devices

R.C. Rosenfeld. "Applications of Custom SAW Devices." 1987 MTT-S International Microwave Symposium Digest 87.2 (1987 Vol. II [MWSYM]).

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Abstracts

Evolution of SAW Technology from Discrete Devices to Functional RF Building Blocks

H.G. Vollers and D.L. Ash. "Evolution of SAW Technology from Discrete Devices to Functional RF Building Blocks." 1987 MTT-S International Microwave Symposium Digest 87.2 (1987 Vol. II [MWSYM]): 793-796.

A brief history of the advances in Surface Acoustic Wave (SAW) technology as it relates both to device design and system application is presented. The progression from discrete SAW devices to a variety of functional building blocks is demonstrated with the latest advance being the development of monolithic RF functions incorporating SAW devices.



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Miniature SAW Antenna Duplexer for Portable Telephone

M. Hikitai, Y. Ishida and T. Tabuchi. "Miniature SAW Antenna Duplexer for Portable Telephone." 1987 MTT-S International Microwave Symposium Digest 87.2 (1987 Vol. II [MWSYM]): 797-800.

A new low loss and high power SAW filter for an antenna duplexer used in a portable telephone transceiver was developed. Loss as low as 1.0 ~ 1.2dB and output power as high as 2 watts at 800 MHz were achieved. Experimental results of a miniature duplexer employing this filter were also presented.

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Abstracts

Design and Evaluation of UHF Monolithic Film Resonator - Stabilized Oscillators and Bandpass Filters

M. Driscoll, R. Moore, J. Rosenbaum, S. Krishnaswamy and J. Szedon. "Design and Evaluation of UHF Monolithic Film Resonator - Stabilized Oscillators and Bandpass Filters." 1987 MTT-S International Microwave Symposium Digest 87.2 (1987 Vol. II [MWSYM]): 801-804.

Monolithic, bulk acoustic wave resonators have been fabricated by sputter-deposition of piezoelectric films into supporting membranes formed in semiconductor substrates.



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Abstracts

Performance of Acoustic Charge Transport Chirp Filters (1987 Vol. II [MWSYM])

F. Fliegel, R. Martin and F. Guediri. "Performance of Acoustic Charge Transport Chirp Filters (1987 Vol. II [MWSYM])." 1987 MTT-S International Microwave Symposium Digest 87.2 (1987 Vol. II [MWSYM]): 805-808.

The measured performance of Acoustic Charge Transport (ACT) based linear FM dispersive delay line filters is presented and compared to modelled performance. The excellent agreement between the theoretically predicted device performance and the measured results shows clearly that apodisation of the Nondestructive Sensing Array is an effective means for achieving weighted ACT filter responses.



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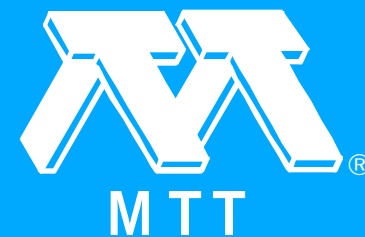
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Abstracts

Session W -- Focused Session: Optical Techniques for Microwave Applications I

"Session W -- Focused Session: Optical Techniques for Microwave Applications I." 1987 MTT-S International Microwave Symposium Digest 87.2 (1987 Vol. II [MWSYM]): 809-809.



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Abstracts

Optical Generation and Control of Microwaves and Millimeter-Waves

C.H. Lee. "Optical Generation and Control of Microwaves and Millimeter-Waves." 1987 MTT-S International Microwave Symposium Digest 87.2 (1987 Vol. II [MWSYM]): 811-814.

I report the generation and control of microwaves and millimeter-waves by optoelectronic techniques. Complete time synchronization between microwave and optical signals is achieved. RF waveform generations, ranging from one single cycle to continuous wave with peak power up to a few kilowatts, have been demonstrated. Laser controlled phase shifters, switches and modulators at 94 GHz are described. The state-of-the-art in the general area of microwave optical interactions is reviewed.



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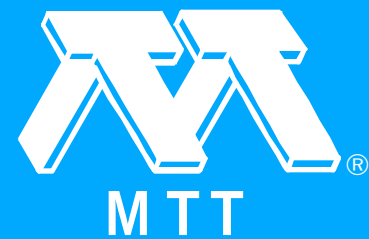
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Microwave Performance of an Optically Controlled AlGaAs/GaAs High Electron Mobility Transistor and GaAs MESFET (1987 Vol. II [MWSYM])

R.N. Simons and K.B. Bhasin. "Microwave Performance of an Optically Controlled AlGaAs/GaAs High Electron Mobility Transistor and GaAs MESFET (1987 Vol. II [MWSYM])." 1987 MTT-S International Microwave Symposium Digest 87.2 (1987 Vol. II [MWSYM]): 815-818.

Direct current and also characteristics of optically the microwave illuminated AlGaAs/GaAs HEMT are experimentally measured for the first time and compared with that of GaAs MESFET. The results showed that the average increase in the gain is 2.8 dB under 1.7 mW/cm² optical intensity at 0.83 μ m. Further, the effect of illumination on S-parameters is more pronounced when the devices are biased close to pinch-off. Novel applications of optically illuminated HEMT as a variable gain amplifier, high-speed high-frequency photo detector, and mixer are demonstrated.



Abstracts

A High-Speed Phase Shifter Based on Optical Injection

L.R. Brothers, Jr. and C.H. Cox, III. "A High-Speed Phase Shifter Based on Optical Injection." 1987 MTT-S International Microwave Symposium Digest 87.2 (1987 Vol. II [MWSYM]): 819-822.

An optoelectronic analog phase shifter has been developed exhibiting 190 degrees of phase shift, with no need for external bias. This is five times greater phase shift than previously reported for optoelectronic devices. The device characteristics are described and design considerations given. Performance data are presented demonstrating the high-speed modulation and wide-phase excursion capabilities.



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Phase and Frequency Coherency of Multiple Optically Synchronized 20GHz FET Oscillators for Satellite Communications

A.S. Daryoush, P.R. Herczfeld, R. Glatz and A.P.S. Khanna. "Phase and Frequency Coherency of Multiple Optically Synchronized 20GHz FET Oscillators for Satellite Communications." 1987 MTT-S International Microwave Symposium Digest 87.2 (1987 Vol. II [MWSYM]): 823-826.

Future generation of communication satellites are based on large aperture phased array antennas, which are composed of many active transmit/receive modules. The phase and frequency coherency of these modules are of concern. A viable technique to provide phase and frequency references for synchronization is through fiber-optic distribution and using indirect subharmonic optical injection locking techniques. Experimental results of phase and frequency coherency of two 20GHz FET oscillators are reported in this paper. Optimum performance was achieved at subharmonic factor of 1/4 with locking range of 84MHz and phase noise degradation of only 14 dB. Initial phase coherency measurements of two injection locked oscillators indicate that a phase error can be introduced due to the detuning between the slave and master oscillator signals. A scheme to correct for this phase error is also presented.

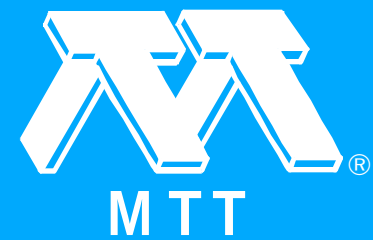
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Abstracts

Session X -- FET Amplifiers

"Session X -- FET Amplifiers." 1987 MTT-S International Microwave Symposium Digest 87.2 (1987 Vol. II [MWSYM]): 827-827.



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Design and Performance of a New Multi-Octave High-Gain Amplifier

K.B. Niclas, R.R. Pereira, A.J. Graven and A.P. Chang. "Design and Performance of a New Multi-Octave High-Gain Amplifier." 1987 MTT-S International Microwave Symposium Digest 87.2 (1987 Vol. II [MWSYM]): 829-832.

Experimental results obtained from a number of typical representatives of a new type of amplifier are discussed. Gains of $G = 16.3 \pm 0.9$ dB at a maximum reflection loss of $RL = -11.3$ dB between 2.3 GHz and 20.3 GHz and $G = 18.3 \pm 1.1$ dB between 2.5 GHz and 18 GHz were achieved in single stage units. The maximum noise figures of the respective modules are $F = 6.6$ dB and $F = 6.3$ dB from 2.5 GHz to 18 GHz. A two-stage amplifier yielded $G = 33 \pm 1.0$ dB and $RL = -10.0$ dB from 2.5 GHz to 20.5 GHz with a maximum noise figure of $F = 7.1$ dB across the 2.0 - 18.0 GHz frequency band.





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A High Performance, Quasi-Monolithic 2 to 18 GHz Distributed GaAs FET Amplifier

A. Cappello, T. Alexander, J. Calviello, D. Ward, P. Bie and R. Pomian. "A High Performance, Quasi-Monolithic 2 to 18 GHz Distributed GaAs FET Amplifier." 1987 MTT-S International Microwave Symposium Digest 87.2 (1987 Vol. II [MWSYM]): 833-836.

Design, fabrication, and performance of a quasi-monolithic distributed GaAs FET amplifier is discussed. A gain of 20 dB and noise figure of 5.8 dB over 2 to 18 GHz are achieved. The amplifier circuits, using modified commercially available GaAs FET chips, are ideal for moderate volume (less than 5000), high performance applications.

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Abstracts

Operating Characteristics of 2-8 GHz GaAs MESFET Amplifiers at Elevated Case Temperatures to 200 Degrees Centigrade

E.J. Crescenzi, Jr., J.A. Thompson, T.R. Kritzer and M.E. Kretschmar. "Operating Characteristics of 2-8 GHz GaAs MESFET Amplifiers at Elevated Case Temperatures to 200 Degrees Centigrade." 1987 MTT-S International Microwave Symposium Digest 87.2 (1987 Vol. II [MWSYM]): 837-840.

RF performance of 2-8 GHz amplifiers utilizing GaAs MESFETs which incorporate TiWN diffusion barriers is reported for a case temperature range of -54 to +200°C. Preliminary results of in-process accelerated life tests are also included.



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A 6-18 GHz MMIC Power Amplifier Module Designed for Automated Assembly Fabrication

C.A. Sapashe, D.L. Green, C.D. Palmer and J.S. Pavio. "A 6-18 GHz MMIC Power Amplifier Module Designed for Automated Assembly Fabrication." 1987 MTT-S International Microwave Symposium Digest 87.2 (1987 Vol. II [MWSYM]): 841-841.

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A 6 Watt Power GaAs FET for 14.0-14.5GHz Band

Y. Kadowaki, S. Igi, M. Wataze, T. Sonoda, K. Hayashi, M. Yamanouchi, S. Takamiya and S. Mitsui. "A 6 Watt Power GaAs FET for 14.0-14.5GHz Band." 1987 MTT-S International Microwave Symposium Digest 87.2 (1987 Vol. II [MWSYM]): 845-847.

An internally matched GaAs FET with output power above 38dBm(6.3W) and linear power gain above 5.8dB has been developed for the 14.0-14.5GHz band. These results were achieved by using high quality GaAs wafers prepared by molecular beam epitaxy (MBE) and optimizing the channel recess structure. Additionally, the package size of the FET was successfully reduced by using a high dielectric substrate for the internal matching circuits of both input and output.

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K- and Ka-Band High Efficiency Amplifier Modules Using GaAs Power FETs

D. Bechtle, J. Klatskin, G. Taylor, M. Eron, S.G. Liu, R.L. Camisa and H. Dudley. "K- and Ka-Band High Efficiency Amplifier Modules Using GaAs Power FETs." 1987 MTT-S International Microwave Symposium Digest 87.2 (1987 Vol. II [MWSYM]): 849-851.

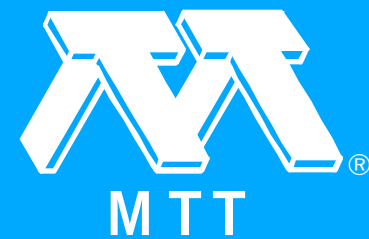
Sub-half-micrometer GaAs power FETs fabricated with a side-etched-gate technology (1-3) have been developed that exhibit low junction temperatures suitable for space application (4). With these devices high efficiency amplifier modules have been developed and will be reported on. At 20 GHz, using these devices, a high gain module was assembled that had an output power of 775 ± 75 mW from 18- to 20-GHz with 6.9 ± 0.2 dB gain, and a maximum efficiency of 20.3%. At 35 GHz, an output power of 210 mW with 3 dB gain and 22% efficiency has been obtained with one 0.6 mm width cell, and two cells were combined to obtain 300 mW with 3 dB gain and 18.8% efficiency. The power and efficiency results obtained at 35 GHz are some of the highest reported to date and indicate that Ka-band solid state power amplifiers are feasible.



Abstracts

Session Y -- Solid State Devices/Circuits I

"Session Y -- Solid State Devices/Circuits I." 1987 MTT-S International Microwave Symposium Digest 87.2 (1987 Vol. II [MWSYM]): 853-853.



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Silicon Bipolar MMIC for Frequency-Conversion Applications Up to 20 GHz

I. Kipnis. "Silicon Bipolar MMIC for Frequency-Conversion Applications Up to 20 GHz." 1987 MTT-S International Microwave Symposium Digest 87.2 (1987 Vol. II [MWSYM]): 855-858.

A simple yet versatile silicon bipolar monolithic microwave integrated circuit (MMIC) is presented that can be utilized in a variety of frequency conversion applications. With an external feedback network the MMIC functions as a regenerative frequency divider for input signals up to 20GHz. It can also be used as an unbalanced active mixer with conversion gains up to 10dB at 10GHz. With an external resonator it functions as a self-oscillating mixer (SOM) with conversion gains up to 17dB at 5GHz.

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Frequency Stability of L-Band, Two-Port Dielectric Resonator Oscillators (1987 Vol. II [MWSYM])

M.J. Loboda, T.E. Parker and G.K. Montress. "Frequency Stability of L-Band, Two-Port Dielectric Resonator Oscillators (1987 Vol. II [MWSYM])." 1987 MTT-S International Microwave Symposium Digest 87.2 (1987 Vol. II [MWSYM]): 859-862.

Dielectric resonator oscillators operating at 1.5 and 2.0 GHz, based on a two-port resonator design incorporated into a basic feedback oscillator configuration were evaluated and show state-of-the-art, close-to-carrier phase noise performance. Typically, at 1 KHz carrier offset frequency the single sideband phase noise levels were -130 dBc/Hz and -120 dBc/Hz for the 1.5 GHz and 2.0 GHz oscillators, respectively. Vibration sensitivity was also investigated and the resonators show fractional frequency changes per g in the range of 10^{-7} to 10^{-9} for the 1.5 GHz and 2.0 GHz designs, respectively.

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Abstracts

Solid State MM-Wave Oscillators with Large Tuning Range

K. Jacobs and B. Vowinkel. "Solid State MM-Wave Oscillators with Large Tuning Range." 1987 MTT-S International Microwave Symposium Digest 87.2 (1987 Vol. II [MWSYM]): 863-866.

We describe broadband mechanical tunable oscillators using GaAs and InP Gunn diodes. Tuning ranges are 72 to 102 GHz (GaAs), 115 to 138 GHz (GaAs with frequency doubler) and 76 to 113 GHz (InP). Output powers are in the range from 2 mW (GaAs-Doubler) to 54 mW (InP). Experimental results and a model calculation are presented.



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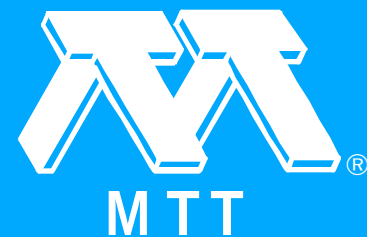


Abstracts

Varactor-Tuned Microstrip Ring Resonators

K. Chang, S. Martin and F. Wang. "Varactor-Tuned Microstrip Ring Resonators." 1987 MTT-S International Microwave Symposium Digest 87.2 (1987 Vol. II [MWSYM]): 867-870.

Varactor-tuned microstrip ring resonators have been developed. Up to 10 percent tuning bandwidth was achieved using a packaged varactor diode. The effects of the coupling gap on the ring resonant frequency were also investigated. The results should have many applications in electronically tunable stabilized oscillators and filters in both hybrid and monolithic integrated circuits.



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Abstracts

A Multi-Diode Cavity Power Combiner Using State-of-the-Art Pulsed Gunn Diodes

B.E. Sigmon and M. Ayyagari. "A Multi-Diode Cavity Power Combiner Using State-of-the-Art Pulsed Gunn Diodes." 1987 MTT-S International Microwave Symposium Digest 87.2 (1987 Vol. II [MWSYM]): 871-874.

Large area mesa pulsed Gunn diodes were developed. These diodes generated 30 to 40 watts per device. By combining multiples of these diodes in a miniature C-band cavity power combiner, 90 watts (3-diode combiner) and 150 watts (5-diode combiner) of peak power was achieved.



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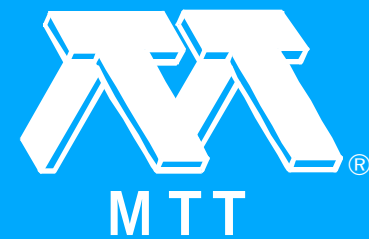
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Abstracts

Session Z -- Focused Session: Optical Techniques for Microwave Applications II

"Session Z -- Focused Session: Optical Techniques for Microwave Applications II." 1987 MTT-S International Microwave Symposium Digest 87.2 (1987 Vol. II [MWSYM]): 875-875.



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Microwave Measurements of GaAs Integrated Circuits Using Electrooptic Sampling

K.J. Weingarten, R. Majidi-Ahy, M.J.W. Rodwell, B.A. Auld and D.M. Bloom. "Microwave Measurements of GaAs Integrated Circuits Using Electrooptic Sampling." 1987 MTT-S International Microwave Symposium Digest 87.2 (1987 Vol. II [MWSYM]): 877-880.

We describe the electrooptic sampling system at Stanford with emphasis on the requirements for microwave measurements. Results presented include internal-node measurements of 20 GHz distributed amplifiers, propagation delays in GaAs frequency dividers clocked to 18 GHz, and VSWR on IC transmission lines to 40 GHz.

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Picosecond Reflectometry Technique for On-Chip Characterization of Millimeter-Wave Semiconductor Devices

C. Rauscher. "Picosecond Reflectometry Technique for On-Chip Characterization of Millimeter-Wave Semiconductor Devices." 1987 MTT-S International Microwave Symposium Digest 87.2 (1987 Vol. II [MWSYM]): 881-884.

A multi-sampler reflectometer technique is described for on-chip characterization of semiconductor devices at millimeter-wave frequencies. Focus is on enhancing measurement accuracy and frequency band coverage by augmenting photoconductive circuit elements, which perform signal generation and sampler functions, with pulse-shaping and impedance-matching networks. The approach is illustrated with a GaAs 150 GHz bandwidth example.

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Direct Fiber Optic Transmission of a Wideband Multi-Carrier Microwave Signal Spectrum to and from Satellite Earth Station Antennas

J.W. Carlin, J.E. Bowers, A.C. Chipaloski and S. Boodaghians. "Direct Fiber Optic Transmission of a Wideband Multi-Carrier Microwave Signal Spectrum to and from Satellite Earth Station Antennas." 1987 MTT-S International Microwave Symposium Digest 87.2 (1987 Vol. II [MWSYM]): 885-887.

High speed semiconductor lasers and detectors are used to transmit the 500 MHz bandwidth C-band microwave signal spectrum to and from a satellite earth station antenna over a low loss optical fiber. The optical system introduces /spl ap/1 dB or less of degradation for both low spectral density QPSK signals and high spectral density FM video signals present in typical satellite transmission systems. For FM video signals, the signal to noise after AM conversion and transmission over 20 km of fiber was 55 dB. The 20 km fiber system degraded the signal to noise ratio by 1 dB. Similar results were obtained for digital signals where 20 km of fiber caused a 1 dB reduction in the available E_b/N_0 for the digital system.





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Optical Feedback on Linearity Performance of 1.3 μm DFB and Multimode Lasers Under Deep Microwave Modulation

W.I. Way and M.M. Choy. "Optical Feedback on Linearity Performance of 1.3 μm DFB and Multimode Lasers Under Deep Microwave Modulation." 1987 MTT-S International Microwave Symposium Digest 87.2 (1987 Vol. II [MWSYM]): 889-892.

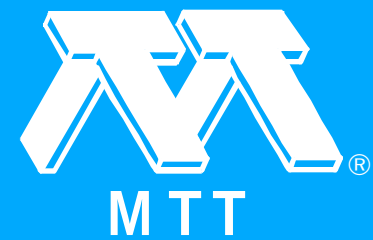
High-speed InGaAsP laser diodes (LDs) are expected to be extensively used in microwave analog fiber optic systems because of the low dispersion and attenuation in the 1.3 μm wavelength region. In this paper, we examine the effect of optical feedback on the linearity performance of both a 1.3 μm single-longitudinal-mode (SLM) distributed feedback double-channel planar buried heterostructure (DFB-DC-PBH) LD and a 1.3 μm multi-longitudinal-mode (MLM) buried heterostructure "window" LD. Both lasers are intrinsically highly linear in the absence of optical feedback. The effect of optical feedback is examined by a quantitatively controlled reflection at the end of a 1~2 meter pigtail. Particular attention is paid to cases where both lasers are intensity modulated by large signals (current modulation index 50% to 80%) with frequencies above 1 GHz. Modulation signal power level, frequency, and laser bias level that affect the light coherent property, and hence laser linearity characteristics under optical feedback, are discussed.



Abstracts

Session AA -- Non-Linear FET Applications

"Session AA -- Non-Linear FET Applications." 1987 MTT-S International Microwave Symposium Digest 87.2 (1987 Vol. II [MWSYM]): 893-893.



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A GaAs MESFET Balanced Mixer with Very Low Intermodulation

S.A. Maas. "A GaAs MESFET Balanced Mixer with Very Low Intermodulation." 1987 MTT-S International Microwave Symposium Digest 87.2 (1987 Vol. II [MWSYM]): 895-898.

A new type of balanced resistive mixer has been realized by using the unbiased channel of a GaAs MESFET as the mixing element. Because this resistance is only very weakly nonlinear, very low intermodulation results. State-of-the-art second-and third-order output intercept points of 34 and 21 dBm are achieved, with 7 dB conversion loss at X band.

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



Abstracts

A Monolithic Double Balanced Single Sideband Modulator

S.D. Thompson and A.M. Pavio. "A Monolithic Double Balanced Single Sideband Modulator." 1987 MTT-S International Microwave Symposium Digest 87.2 (1987 Vol. II [MWSYM]): 899-902.

A novel approach to single sideband modulation is presented which employs two differential FET pairs to obtain carrier and undesired sideband cancellation throughout a broad frequency range. This double balanced structure is also space thrifty and contains only MESFETs as active elements, thus lending itself to a monolithic implementation.



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Passive GaAs FET Switch Models and Their Application in Phase Shifters

L.C. Upadhyayula, R.L. Camisa, G. Taylor, S.N. Subbarao and S.G. Liu. "Passive GaAs FET Switch Models and Their Application in Phase Shifters." 1987 MTT-S International Microwave Symposium Digest 87.2 (1987 Vol. II [MWSYM]): 903-906.

A new device model is proposed for the zero bias ($V_{gs} = 0$) and pinch off ($V_{gs} - V_{p}$) states for GaAs MESFETs operated in a passive mode ($I_{ds} = 0$). The agreement between measurements and predicted S-parameter data is better than 90% which is 40-50% improvement over previously published models. The FET switch model will be discussed. The fabrication and performance of 12 GHz MMIC phase shifters designed using this new model will be described.

Click on title for a complete paper.



Abstracts

A Non-Linear Design and Optimization Procedure for GaAs MESFET Oscillators

T.J. Brazil and J.O. Scanlan. "A Non-Linear Design and Optimization Procedure for GaAs MESFET Oscillators." 1987 MTT-S International Microwave Symposium Digest 87.2 (1987 Vol. II [MWSYM]): 907-910.

An approximate but successful non-linear design/ optimisation procedure is described for a GaAs MESFET oscillator, based on initial availability of an appropriate device model and a large-signal simulation analysis tool. A number of variations of the design procedure are compared, and each is checked against a full self-consistent solution for the optimized oscillator.



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High Performance GaAs C-Band and Ku-Band MMIC Oscillators

S. Moghe and T. Holden. "High Performance GaAs C-Band and Ku-Band MMIC Oscillators." 1987 MTT-S International Microwave Symposium Digest 87.2 (1987 Vol. II [MWSYM]): 911-914.

A number of monolithic single-ended and push-pull oscillator chips were developed for C-band and Ku-band applications. The chips were used to build dielectric resonator oscillator (DROs) and voltage controlled oscillators (VCOs) in both frequency bands. These MMICs also have integrated a buffer amplifier at the oscillator output to provide better load isolation and power output stability. The oscillators demonstrated performance similar to conventional hybrid circuitry however, the MMIC circuits will provide circuit simplicity with improved reliability, decreased size and reduced manufacturing cost.

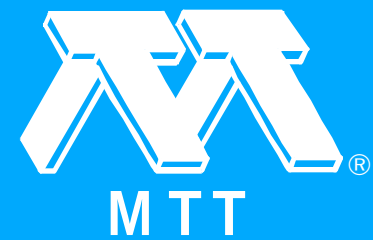
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Abstracts

Session BB -- Solid State Devices/Circuits II

"Session BB -- Solid State Devices/Circuits II." 1987 MTT-S International Microwave Symposium Digest 87.2 (1987 Vol. II [MWSYM]): 915-915.



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Multi-Watt Power Generation at Millimeter-Wave Frequencies Using Epitaxially-Stacked Varactor Diodes

P.W. Staecker, M.E. Hines, F. Occhiuti and J.F. Cushman. "Multi-Watt Power Generation at Millimeter-Wave Frequencies Using Epitaxially-Stacked Varactor Diodes." 1987 MTT-S International Microwave Symposium Digest 87.2 (1987 Vol. II [MWSYM]): 917-920.

High power varactor diodes capable of generating watts of power at frequencies as high as 100 GHz are described. These devices show cutoff frequencies in excess of 900 GHz and breakdown voltages greater than 100V. Output powers (and associated efficiencies) of frequency doublers built with these devices are 9W at 22 GHz (60%), 5.5W at 35 GHz (60%), 5W at 44 GHz (50%) and 280 mW at 88 GHz (14%). The last result is nearly 10 dB better than any previously reported multiplier power in that frequency range, but is preliminary in the sense that it is new data with an as yet non-optimal circuit. Thermal response simulations reported here show low operating junction temperatures for these devices.

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Abstracts

A New Reversible Varactor Frequency Halver/Doubler Device

Z. Nativ. "A New Reversible Varactor Frequency Halver/Doubler Device." 1987 MTT-S International Microwave Symposium Digest 87.2 (1987 Vol. II [MWSYM]): 921-924.

A new reversible varactor frequency Halver/Doubler device is presented for the first time. The design approach is based on the analogy between frequency multipliers and dividers at the same steady state conditions, Hence, the well known design techniques for varactor doublers may be used for designing frequency halvers. Using this method a 8GHz to 4GHz halver was design and built. When reversed, the circuit functions as a doubler.



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Abstracts

Measurements and Modeling of Kinetic Inductance Microstrip Delay Lines (1987 Vol. II [MWSYM])

J.M. Pond, J.H. Claassen and W.L. Carter. "Measurements and Modeling of Kinetic Inductance Microstrip Delay Lines (1987 Vol. II [MWSYM])." 1987 MTT-S International Microwave Symposium Digest 87.2 (1987 Vol. II [MWSYM]): 925-928.

Microstrip, with phase velocities of about $0.01c$, employing kinetic inductance have been fabricated using niobium nitride and a silicon dielectric. Delay linea employing the phenomenon of kinetic inductance have several advantages for analog signal processing, including low loss and very compact size. An analysis of kinetic inductance microstrip delay lines has been made in the frequency domain and the time domain. The results were compared to theoretical predictions and an accurate circuit model was developed.



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Abstracts

A 100 GHz SIS Quasiparticle Mixer with 10 dB Coupled Gain

A.V. Raisanen, D.G. Crete, P.L. Richards and F.L. Lloyd. "A 100 GHz SIS Quasiparticle Mixer with 10 dB Coupled Gain." 1987 MTT-S International Microwave Symposium Digest 87.2 (1987 Vol. II [MWSYM]): 929-930.

We have tested a superconducting quassiparticle mixer for 85-110 GHz which gives much larger coupled gain than has been previously observed. When operated with a negative dynamic resistance of about 2000 Ω , the maximum coupled gain was $G_{\text{sub M}}(\text{DSB}) = 12.5 \pm 0.5 \text{ dB}$ [$G_{\text{sub M}}(\text{SSB}) = 9.5 \pm 2.5 \text{ dB}$]. The associated mixer noise temperature was 15.9 K (DSB). Large gain was also observed with large positive dynamic resistance, giving the lowest mixer noise temperature of 12.4 K (DSB).



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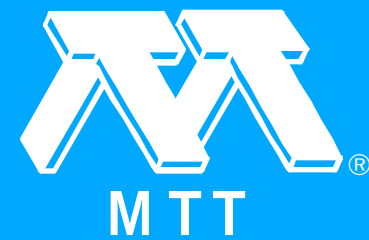
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Abstracts

Session CC -- Phased and Active Array Techniques

"Session CC -- Phased and Active Array Techniques." 1987 MTT-S International Microwave Symposium Digest 87.2 (1987 Vol. II [MWSYM]): 931-931.



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A 2 Watt GaAs TX/RX Module with Integral Control Circuitry, for S-Band Phased Array Radars

C.R. Green, A.A. Lane, P.N. Tombs, R. Shukla, J.R. Suffolk, J.A. Sparrow and P.D. Cooper. "A 2 Watt GaAs TX/RX Module with Integral Control Circuitry, for S-Band Phased Array Radars." 1987 MTT-S International Microwave Symposium Digest 87.2 (1987 Vol. II [MWSYM]): 933-936.

This paper describes measured results for a TX/RX module operating in S-band over a 20% bandwidth. The module contains 8 GaAs devices, 5 of which are MMICS. The module has an integral thick film hybrid control circuit containing custom silicon ICs. Transmit powers of 2.0 watts are reported together with receive gains of ≥ 20 dB and noise figures of ≤ 4.0 dB. The module has very accurate 4-bit phase shifting in both TX and RX modes.



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Abstracts

A 35 GHz Electronically Steered Line Array

R.J. Lang and B.J. Edward. "A 35 GHz Electronically Steered Line Array." 1987 MTT-S International Microwave Symposium Digest 87.2 (1987 Vol. II [MWSYM]): 937-940.

This paper details the design and evaluation of a Ka-band hybrid PIN diode phase shifter and its subsequent assembly into a phase steered line array with printed dipole radiating elements. Measured data are presented indicating a 3.9 dB phase shifter insertion loss at 35 GHz and beam-steering characteristics for the line-array that are commensurate with the phase shifter performance. The power handling capability is estimated to be in excess of 29 Watts CW. This work, we believe, demonstrates the feasibility of millimeter wave phased arrays based on solid-state technology.



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Abstracts

An Ultraminiature 5-10 GHz, 2-W Transmit Module for Active Aperture Application

J. Pierro and R. Clouse. "An Ultraminiature 5-10 GHz, 2-W Transmit Module for Active Aperture Application." 1987 MTT-S International Microwave Symposium Digest 87.2 (1987 Vol. II [MWSYM]): 941-944.

An ultraminiature 5-10 GHz, 2-w transmit module with integral 3-bit phase shifter has been developed for active aperture applications. The module provides nearly 35 dB of gain and occupies a volume of only 0.25 cubic inch! This high degree of miniaturization has been achieved by using a blend of lumped-element and distributed thin film circuits in combination with advanced packaging techniques. The MTTF of the amplifier was an overriding concern and was enhanced by constraining the FET channel temperature rise to 65°C maximum by optimizing the thermal and circuit designs.



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Microstrip FED Planar Frequency-Multiplying Space Combiner

S. Nam, T. Uwano and T. Itoh. "Microstrip FED Planar Frequency-Multiplying Space Combiner." 1987 MTT-S International Microwave Symposium Digest 87.2 (1987 Vol. II [MWSYM]): 945-948.

A frequency-multiplying power combining array has been made of slots in the ground plane on a substrate with a microstrip feed line on the backside. The second harmonic generated by diode in each slot is combined in free space. A design procedure and experimental results are presented.



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Low Cost Cartop Phased Array Steering

G. Schaffner. "Low Cost Cartop Phased Array Steering." 1987 MTT-S International Microwave Symposium Digest 87.2 (1987 Vol. II [MWSYM]): 949-952.

Under J. P. L. and NASA we are developing a cartop phased array antenna for MSAT auto transceivers. The beamsteering system consisting of eighteen 3 bit phase shifters and a nineteen way divider operating from 1545 to 1660 mhz is described. Criteria for material and part selection is discussed. An overall schematic for both circuits is given. The phase shifter development is illustrated with a schematic, predicted performance and measured performance. The nineteen way divider, presenting a greater challenge, is also discussed. Schematic, layout, predicted and measured performances are also given. The technology being evolved appears promising for achieving an affordable mobile communications system for rural areas.

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Abstracts

Session DD -- HEMT/MESFET Applications

"Session DD -- HEMT/MESFET Applications." 1987 MTT-S International Microwave Symposium Digest 87.2 (1987 Vol. II [MWSYM]): 953-953.



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Abstracts

Bias-Dependent Microwave Characteristics of an Atomic Planar-Doped AlGaAs/InGaAs/GaAs Double Heterojunction MODFET

Y.K. Chen, D.C. Radulescu, G.W. Wang, A.N. Lepore, P.J. Tasker and L.F. Eastman. "Bias-Dependent Microwave Characteristics of an Atomic Planar-Doped AlGaAs/InGaAs/GaAs Double Heterojunction MODFET." 1987 MTT-S International Microwave Symposium Digest 87.2 (1987 Vol. II [MWSYM]).

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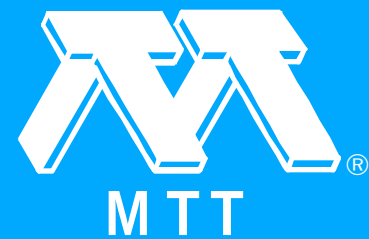


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FET's and HEMT's at Cryogenic Temperatures - Their Properties and Use in Low-Noise Amplifiers (1987 Vol. II [MWSYM])

M.W. Pospieszalski and S. Weinreb. "FET's and HEMT's at Cryogenic Temperatures - Their Properties and Use in Low-Noise Amplifiers (1987 Vol. II [MWSYM])." 1987 MTT-S International Microwave Symposium Digest 87.2 (1987 Vol. II [MWSYM]): 955-958.

This paper reviews the performance of a number of FET's and HEMT's at cryogenic temperatures. Typical d.c. characteristics and X-band noise parameters are presented and qualitatively correlated wherever possible with other technological or experimental data. While certain general trends can be identified, further work is needed to explain a number of observed phenomena. Design examples of three-stage, X-band HEMT and FET amplifiers are briefly discussed. Typical noise temperatures at 8.4 GHz are $T_{\text{sub n}} = 22\text{K}$, for all FET amplifiers and 11K for amplifier with HEMT's in the input stage.

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Abstracts

Reliability of Low-Noise Microwave HEMT Using by MOCVD

K. Tanaka, H. Takakuwa, K. Togashi, Y. Kato and S. Watanabe. "Reliability of Low-Noise Microwave HEMT Using by MOCVD." 1987 MTT-S International Microwave Symposium Digest 87.2 (1987 Vol. II [MWSYM]).

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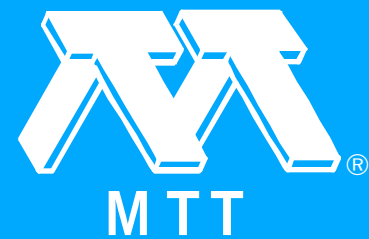
Predicting Long-Term Frequency Drift in FET Oscillators Using Device Modeling

K.K. Agarwal and C. Ho. "Predicting Long-Term Frequency Drift in FET Oscillators Using Device Modeling." 1987 MTT-S International Microwave Symposium Digest 87.2 (1987 Vol. II [MWSYM]): 959-962.

This paper analyzes, using device modeling, the long-term frequency drifts observed in GaAs FET oscillators stabilized by a dielectric resonator. The dominant contributor to the long-term frequency drift was found to be the change in gate-to-source channel capacitance of the FET. Excellent correlation between theory and measured data was achieved. The method is general and, to our knowledge, is the first analytical effort to explain long-term frequency drifts in this type of oscillator.

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Harmonic Reaction Amplifier - A Novel High-Efficiency and High-Power Microwave Amplifier

S. Nishiki and T. Nojima. "Harmonic Reaction Amplifier - A Novel High-Efficiency and High-Power Microwave Amplifier." 1987 MTT-S International Microwave Symposium Digest 87.2 (1987 Vol. II [MWSYM]): 963-966.

A newly proposed high efficiency amplifier, the Harmonic Reaction Amplifier (HRA), is presented. Power-added efficiency of 75°A (85% drain efficiency) is achieved with a 3-W HRA using GaAs FETs in the 1.7 GHz band. The operation principle is derived from a novel second-harmonic injection technique enabling purely class-B biased operation. Amplifier circuits for attaining high efficiency operation can easily be constructed with ordinary microstrip circuits. Besides, precise circuit adjustment is available to maximize the efficiency. The HRA makes high power and high efficiency microwave power amplifiers with zero quiescent current possible. Experimental test results show the feasibility of a quasi-microwave transmitting amplifier for the next generation mobile radio system. However, the HRA can be applied to radio equipment of various fields such as terrestrial microwave radio systems and satellite communications systems using microwave frequency bands.

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Abstracts

Session EE -- Solid State Devices/Circuits III

"Session EE -- Solid State Devices/Circuits III." 1987 MTT-S International Microwave Symposium Digest 87.2 (1987 Vol. II [MWSYM]): 967-967.



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AlGaAs/GaAs Heterojunction Bipolar Transistors with 4W/mm Power Density at X-Band

B. Bayraktaroglu, N. Camilleri, H.D. Shih and H.Q. Tserng. "AlGaAs/GaAs Heterojunction Bipolar Transistors with 4W/mm Power Density at X-Band." 1987 MTT-S International Microwave Symposium Digest 87.2 (1987 Vol. II [MWSYM]): 969-972.

Fabrication and microwave characterization of X-band AlGaAs/GaAs heterojunction bipolar transistors are described. MBE was used to prepare the device structure with heavily doped (1×10^{19} /cm³) 1000 Å thick base layers. Two 2 μm x 10 μm emitter fingers separated by 2 μm (total emitter periphery of 40 μm) were used in a self-aligned emitter-base configuration. From the S-parameter measurements $f_{sub\ t/}$ and $f_{sub\ max/}$ values of 25 and 20 GHz respectively were determined. Devices operating under CW conditions produced 80 mW CW output power (2W/mm of emitter periphery) with 4 dB gain and 23% power added efficiency at 10 GHz. Under 0.25 μs pulses, 160 mW output power (4 W/mm) was obtained with 4 dB gain and 35% power added efficiency.





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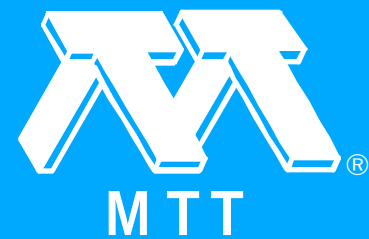
Millimeter Wave Heterojunction MITATT Diodes

N.S. Dogan, J.R. East, M.E. Elta and G.I. Haddad. "Millimeter Wave Heterojunction MITATT Diodes." 1987 MTT-S International Microwave Symposium Digest 87.2 (1987 Vol. II [MWSYM]): 973-976.

This paper presents a design theory, fabrication procedure and experimental results for heterojunction millimeter wave transit time devices operating in the IMPATT, MITATT or TUNNETT mode. The results show that significant improvements in the efficiency can be achieved by heterojunction structures. The diodes were operated as oscillators between 65 and 93 GHz. A pulsed power output of 50mw and RF conversion efficiency of 2.4 percent was achieved at 72 GHz.

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Improved Performance of Fundamental and Second Harmonic MMW Oscillators through Active Device Doping Concentration Contouring

J. Ondria and R.L. Ross. "Improved Performance of Fundamental and Second Harmonic MMW Oscillators through Active Device Doping Concentration Contouring." 1987 MTT-S International Microwave Symposium Digest 87.2 (1987 Vol. II [MWSYM]): 977-980.

The overall performance of mmW Gunn oscillators operating in their fundamental and second harmonic modes has been significantly enhanced as a result of several active device design improvements. The effects of altering the active layer doping concentration are compared with standard n^+nn^+ flat profile GaAs Gunn structures. The standard integral heat sink (IHS) process was used to permit substrate thinning to the extent that overall device thickness was reduced to 10 μm nominally. Profile tailoring to minimize temperature gradients and to permit device operation in the more efficient heat sink-anode configuration resulted in an output power of 325 mW near 34 GHz with 6.6 percent efficiency. An output power of 90 mW at 2.75 percent efficiency was achieved at the second harmonic frequency near 68 GHz.

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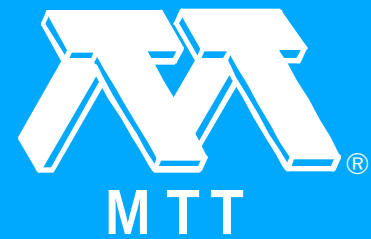


Abstracts

W-Band Microstrip Oscillator Using InP Gunn Diode

D.R. Singh. "W-Band Microstrip Oscillator Using InP Gunn Diode." 1987 MTT-S International Microwave Symposium Digest 87.2 (1987 Vol. II [MWSYM]): 981-982.

A low cost, light weight, rugged microstrip oscillator with a very simple structure has been developed in W-Band (34 GHz). The active element is an InP Gunn device operating in its fundamental mode of oscillation. The oscillator provides 35 mW of CW output power and a bias tuning bandwidth of 400 MHz.



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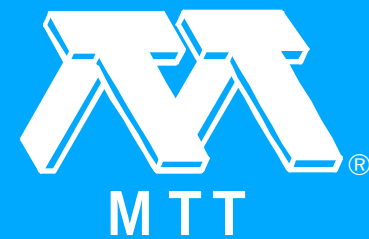
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Abstracts

Session FF -- Microwave Ferrites

"Session FF -- Microwave Ferrites." 1987 MTT-S International Microwave Symposium Digest 87.2 (1987 Vol. II [MWSYM]): 983-983.



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Abstracts

A New Type of Fast Switching Dual-Mode Ferrite Phase Shifter

W.E. Hord, C.R. Boyd, Jr. and D. Diaz. "A New Type of Fast Switching Dual-Mode Ferrite Phase Shifter." 1987 MTT-S International Microwave Symposium Digest 87.2 (1987 Vol. II [MWSYM]): 985-988.

This paper describes a new type of dual-mode phase shifter which uses a variable transverse magnetic field. The device retains the features of the conventional longitudinal field dual-mode phase shifter - low insertion loss, moderate amplitude modulation, moderate frequency bandwidth, simple physical geometry - which allow it to be considered for use in two-dimensional scanning phased-array antennas. However, the transverse magnetic field configuration yields a smaller shorted-turn damping time constant, which results in either reduced switching time or reduced switching energy when compared with the conventional longitudinal field dual-mode arrangement.



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Impact of Dielectric Loss Tangent on the Performance of Millimeter Wave Ferrite Circulators

G.R. Harrison, S.B. Thompson and J.T. Vaughn. "Impact of Dielectric Loss Tangent on the Performance of Millimeter Wave Ferrite Circulators." 1987 MTT-S International Microwave Symposium Digest 87.2 (1987 Vol. II [MWSYM]): 989-991.

A ferrite circulator can be modeled as a dielectric resonator whose unloaded Q is a function of dielectric loss. This model predicts that when loss tangents of ferrite materials are increased from 0.0002 to 0.002, circulator insertion loss increases by about 0.14 dB. Experimental measurements confirm that loss tangents significantly less than 0.001 are required to achieve low insertion loss, high performance, millimeter wave circulators.

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



Abstracts

Full Wave Analysis of Slot Line and Coplanar Waveguide on a Magnetic Substrate

E.-B. El-Sharawy and R.W. Jackson. "Full Wave Analysis of Slot Line and Coplanar Waveguide on a Magnetic Substrate." 1987 MTT-S International Microwave Symposium Digest 87.2 (1987 Vol. II [MWSYM]): 993-996.

An analysis is presented for slot line and coplanar waveguide (CPW) on magnetized substrate. The moment method procedure is used to solve for nonreciprocal phase shift of these structures. Plots of calculated and measured phase shift for CPW on ferrite are presented.



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Magnetostatic Waves in a Normally Magnetized Waveguide Structure (1987 Vol. II [MWSYM])

M. Radmanesh, C.M. Chu and G.I. Haddad. "Magnetostatic Waves in a Normally Magnetized Waveguide Structure (1987 Vol. II [MWSYM])." 1987 MTT-S International Microwave Symposium Digest 87.2 (1987 Vol. II [MWSYM]): 997-1000.

In this paper, the propagation of magnetostatic waves (MSW) in a normally magnetized low-loss ferrite slab (such as a yttrium iron garnet (YIG) slab), placed inside a waveguide is investigated theoretically. This case has not been studied before, and is analyzed here for the first time. The ferrite slab is placed inside and along the waveguide in contact with the two side walls. The external dc magnetic field is assumed to be perpendicular to the plane of the ferrite slab (see Fig. 1). A dispersion relation for the modes of propagation in terms of an infinite determinant can be obtained. With proper truncation procedures, sample numerical calculations for dispersion relations and group time delay per unit length were obtained and are presented hereafter. The general formulation in this paper contains all the information provided by the degenerate cases previously published. One special case of interest, i.e., that of a multilayer planar structure, is derived from our general formulation. The derivation of other special cases follow the same procedure.

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Energy Storage Effect in MSSW Metal-Finger Reflectors

T.S. Cheng, J.P. Parekh and H.S. Tuan. "Energy Storage Effect in MSSW Metal-Finger Reflectors." 1987 MTT-S International Microwave Symposium Digest 87.2 (1987 Vol. II [MWSYM]): 1001-1004.

Experimental results are presented on the magnetostatic-surface wave (MSSW) scattering properties of a grating of metal fingers placed at a variable height above the YIG film and compared with theory. The agreement with theory is excellent if one takes into account energy storage at the metal-finger edges and if the width of the metal fingers is larger than the YIG-film thickness. It is concluded that, for smaller finger widths, the interaction between the edges of a metal finger must additionally be incorporated into the theory. The present results are significantly different from those for the scattering of magnetostatic forward volume waves (MSFVW's) by a grating of metal fingers. In the latter case, the scattered modes are propagating MSFVW's so that the problem of interaction between the edges of metal fingers is not present, i.e., the theory is valid for all widths of the metal fingers.

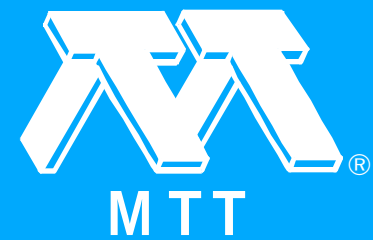
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Session GG -- HEMT Amplifiers and Devices

"Session GG -- HEMT Amplifiers and Devices." 1987 MTT-S International Microwave Symposium Digest 87.2 (1987 Vol. II [MWSYM]): 1005-1005.



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HEMT Low-Noise Amplifier for Ka-Band

M.A.G. Upton, P.M. Smith and P.C. Chao. "HEMT Low-Noise Amplifier for Ka-Band." 1987 MTT-S International Microwave Symposium Digest 87.2 (1987 Vol. II [MWSYM]): 1007-1010.

Using 0.25 micron gate-length High Electron Mobility Transistors (HEMTs), a two-stage amplifier has been developed that demonstrates the potential for high-gain, low-noise pre-amplification at K/sub a/ -band. The amplifier exhibits a noise figure of 4.0 dB with 16.5 dB gain at 37.5 GHz and under slightly different bias conditions shows flat gain of around 11.0 dB from 30.5-37.5 GHz.

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



Broadband HEMT Amplifier for 26.5 - 40.0 GHz

K. Shibata, B. Abe, S. Hori and K. Kamei. "Broadband HEMT Amplifier for 26.5 - 40.0 GHz." 1987 MTT-S International Microwave Symposium Digest 87.2 (1987 Vol. II [MWSYM]): 1011-1014.

A broadband amplifier operating over 26.5 to 40 GHz has been developed by using 0.25- μ m gate HEMTs. The amplifier has been fabricated by cascading five unit amplifiers. Two balanced-type unit amplifiers are used in an input and an output stages to realize good input/output VSWRs. Three single-ended unit amplifiers are installed in the intermediate stages to achieve higher gain. The developed amplifier shows a noise figure of ≤ 7.0 dB, a gain of 18.2 ± 1.6 dB and input/output VSWRs of ≤ 2.0 over 26.5 to 40 GHz.



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A Four Stage V-Band MOCVD HEMT Amplifier

W. Yau, E.T. Watkins, S.K. Wang, K. Wang and B. Klatskin. "A Four Stage V-Band MOCVD HEMT Amplifier." 1987 MTT-S International Microwave Symposium Digest 87.2 (1987 Vol. II [MWSYM]): 1015-1018.

V-band multi-stage Low Noise Amplifiers (LNA) were developed utilizing MOCVD High Electron Mobility Transistors (HEMTs). The amplifiers have demonstrated 16.57 dB gain with an associated noise figure of 5.65 dB and over 19 dB gain with 7.91 dB noise figure at 60.4 GHz. Another amplifier achieved over 5GHz bandwidth with greater than 14dB gain. The amplifier is integrated in a single housing that is 1.75 inch long.

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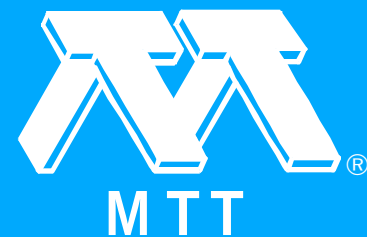


Abstracts

Super Low-Noise HEMTs with a T-Shaped Gate Structure

S. Asai, K. Joshin, Y. Hirachi and M. Abe. "Super Low-Noise HEMTs with a T-Shaped Gate Structure." 1987 MTT-S International Microwave Symposium Digest 87.2 (1987 Vol. II [MWSYM]): 1019-1022.

The low noise property of HEMTs was studied, based on the noise power generated in the devices. 0.5 μm - and 0.25 μm -gate HEMTs were fabricated, to study the noise power generated in the intrinsic region of the devices. In order to leave the extrinsic noise power out of consideration, a T-shaped gate structure was developed to make equal the gate-resistances of these devices. It was shown that the noise power was independent of frequency and strongly dependent on the gate length. The resultant quarter micron gate HEMTs achieved the noise figures of 1.0 dB at room temperature and 0.5 dB at 100K at 20 GHz.



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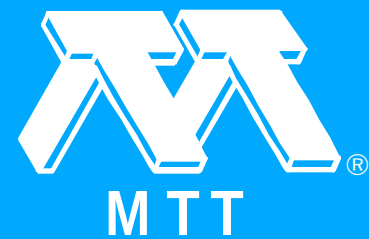
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Reliability of Super Low Noise HEMTs

K. Hayashi, T. Sonoda, T. Yamaguchi, K. Nagahamar, M. Yamanouchi, S. Takamiya and S. Mitsui. "Reliability of Super Low Noise HEMTs." 1987 MTT-S International Microwave Symposium Digest 87.2 (1987 Vol. II [MWSYM]): 1023-1026.

The first report on a comprehensive study of the reliability of super low noise HEMTs with a typical noise figure of 1.2 dB at 12GHz is presented. No failure was observed in both DC running and high temperature storage tests during 2000 hours. These successful results were achieved by a newly developed low temperature ohmic sintering technology and a novel Ni/Al gate.

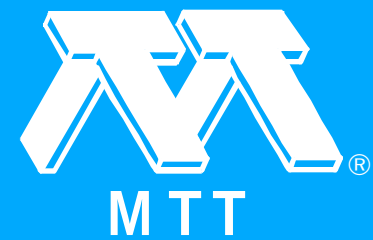
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Index of Authors (1987 Vol. II [MWSYM])

"Index of Authors (1987 Vol. II [MWSYM])." 1987 MTT-S International Microwave Symposium Digest 87.2 (1987 Vol. II [MWSYM]): 1027-1030.



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Exhibition Guide (1987 Vol. II [MWSYM])

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Front Cover (1987 [MCS])

"Front Cover (1987 [MCS])." 1987 Microwave and Millimeter-Wave Monolithic Circuits Symposium Digest 87.1 (1987 [MCS]): f1-f1.



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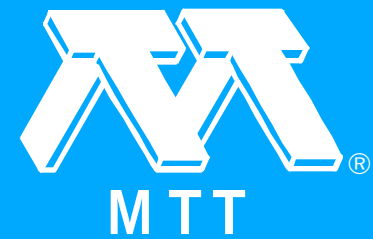
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"Copyright (1987 [MCS])." 1987 Microwave and Millimeter-Wave Monolithic Circuits Symposium Digest 87.1 (1987 [MCS]): i-ii.



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Message from the General Chairman (1987 [MCS])

Y. Ayasli. "Message from the General Chairman (1987 [MCS])." 1987 Microwave and Millimeter-Wave Monolithic Circuits Symposium Digest 87.1 (1987 [MCS]): iii-iii.

On behalf of the Steering Committee, I wish to welcome you to the 1987 IEEE Microwave and Millimeter Wave Monolithic Circuits Symposium, held at the Bally's Grand Hotel, Las Vegas, Nevada, June 8th and 9th, 1987. This year our Symposium is extended to two full days and an additional parallel session is added on the first day's afternoon. The two day Symposium opens on Monday, June 8 and continues on Tuesday, June 9. The Tuesday sessions are held jointly with the 1987 IEEE MTT-S Symposium following the Plenary Session on Tuesday morning. In addition, on Monday afternoon two parallel sessions are scheduled.

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Committees (1987 [MCS])

"Committees (1987 [MCS])." 1987 Microwave and Millimeter-Wave Monolithic Circuits Symposium Digest 87.1 (1987 [MCS]): iv-iv.



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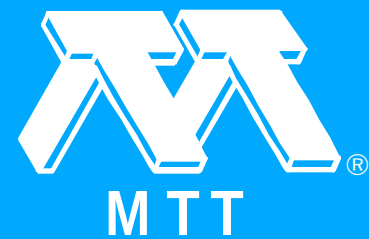
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Message from the Technical Program Chairman (1987 [MCS])

D. Hornbuckle. "Message from the Technical Program Chairman (1987 [MCS])." 1987 Microwave and Millimeter-Wave Monolithic Circuits Symposium Digest 87.1 (1987 [MCS]): v-v.

Welcome to the 1987 IEEE Microwave and Millimeter Wave Monolithic Circuits Symposium. In the Symposium's sixth year, interest is still growing in monolithic GaAs IC's, as evidenced by the record number of papers submitted. This year's program has been expanded in two ways: It has been lengthened from one-and-one-half to one-and-three-quarter days, by adding a third session in joint sponsorship with MTT on Tuesday, June 9th. And, for the first time, a portion of the Symposium will be run in two parallel, simultaneous sessions, on Monday afternoon, June 8th. Despite these expansions, we regretfully were unable to include a number of worthy papers; less than half those submitted could be accepted by the Technical Program Committee. Our thanks to all the authors in this country and overseas who took the time and effort to prepare material for consideration.

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Committee Photographs (1987 [MCS])

"Committee Photographs (1987 [MCS])." 1987 Microwave and Millimeter-Wave Monolithic Circuits Symposium Digest 87.1 (1987 [MCS]): vi-vii.



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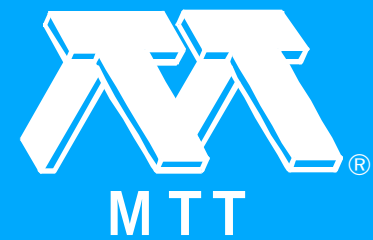
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Heterojunction Bipolar Transistors for Microwave and Millimeter-Wave Integrated Circuits (1987 [MCS])

P.M. Asbeck, M.F. Chang, K.C. Wang, D.L. Miller, G.J. Sullivan, N.H. Sheng, E.A. Sovero and J.A. Higgins. "Heterojunction Bipolar Transistors for Microwave and Millimeter-Wave Integrated Circuits (1987 [MCS])." 1987 Microwave and Millimeter-Wave Monolithic Circuits Symposium Digest 87.1 (1987 [MCS]): 1-5.

This paper reviews the present status of GaAlAs/ GaAs HBT technology and projects the impact of these devices on microwave and millimeter-wave integrated circuits. Devices with $f_{\text{sub max}}$ above 100 GHz are described. Differential amplifiers are shown to have offset voltages with standard deviation below 2 mV and voltage gain of 200 per stage. Breakdown voltages ($BV_{\text{sub CBO}}$) above 20 V are demonstrated. Frequency dividers operating above 20 GHz are described.



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W-Band GaAs MESFET Frequency Doubler

J. Geddes, V. Sokolov and A. Contolatis. "W-Band GaAs MESFET Frequency Doubler." 1987 Microwave and Millimeter-Wave Monolithic Circuits Symposium Digest 87.1 (1987 [MCS]): 7-10.

A monolithic W-band frequency doubler has been developed using submicron gate length GaAs MESFETs fabricated on ion implanted material. The frequency doubler provides a power output of over 4.0 mW at 94 GHz with an input drive of 70 mW at 47 GHz. To of a MESFET our knowledge this is the first report frequency doubler operating at W-band.

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Millimeter-Wave Monolithic Gunn Oscillators

J.C. Chen, C.K. Pao and D.W. Wong. "Millimeter-Wave Monolithic Gunn Oscillators." 1987 Microwave and Millimeter-Wave Monolithic Circuits Symposium Digest 87.1 (1987 [MCS]): 11-13.

A millimeter-wave monolithic GaAs Gunn oscillator has been designed, fabricated and tested. Epitaxial layers were grown by conventional vapor phase epitaxy on semi-insulating substrate. The matching circuit and bias circuitry were monolithically fabricated on the same chip as the active device. With no external tuning, the oscillator chip delivers 1 mW and 1.5 mW at 68.4 GHz and 44.9 GHz, respectively. The best performance was achieved at 41.6 GHz with 4 mW output power. This is the first fully monolithic Gunn oscillator ever reported at these frequencies.

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44 GHz Monolithic Low Noise Amplifier

J. Berenz, H.C. Yen, R. Esfandiari, K. Nakano, T. Sato, J. Velebir and K. Ip. "44 GHz Monolithic Low Noise Amplifier." 1987 Microwave and Millimeter-Wave Monolithic Circuits Symposium Digest 87.1 (1987 [MCS]): 15-18.

The design, fabrication, and performance of a single-stage 44 GHz monolithic HEMT low noise amplifier are described. The chip includes a single heterojunction HEMT with matching and biasing circuits. Greater than 5 dB gain was measured from 43.5 to 45.5 GHz and a noise figure of 5 dB with the associated gain of 5.5 dB was achieved at 44.5 GHz. The chip size is 1.25mm x 1.0mm.



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A Producible 2 to 20 GHz Monolithic Power Amplifier

R. Halladay, M. Jones and S. Nelson. "A Producible 2 to 20 GHz Monolithic Power Amplifier." 1987 Microwave and Millimeter-Wave Monolithic Circuits Symposium Digest 87.1 (1987 [MCS]): 19-21.

The design, fabrication, and performance of a 0.4-W, 2 to 20 GHz distributed amplifier are described in this paper. Small-signal gain is 5 dB and power-added efficiency is 15%. The amplifier is fabricated on ion-implanted GaAs, and achieves excellent performance through use of series gate capacitors and a tapered drain line. Circuit layout and optimization to obtain process insensitivity and first-pass design success are discussed. A comparison is made to a commercially available state-of-the-art 6 to 18 GHz amplifier designed using conventional (lossy-mismatch) topology. The distributed amplifier is shown to have much improved bandwidth, SWR, gain flatness, and insensitivity to process variations, while retaining similar output power and efficiency.

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A Low Current, High Gain Monolithic Amplifier Covering 5-20 GHz Bandwidth

H.-J. Sun and P.A. Terzian. "A Low Current, High Gain Monolithic Amplifier Covering 5-20 GHz Bandwidth." 1987 Microwave and Millimeter-Wave Monolithic Circuits Symposium Digest 87.1 (1987 [MCS]): 23-26.

A monolithic amplifier has been developed using a three-stage structure with feedback input/output stages and a reactively matched middle stage. The amplifier has exhibited greater than 12dB gain across 5-20 GHz bandwidth at a bias current of 40mA. The current to gain efficiency of 3.3mA/dB is the highest ever reported for a monolithic amplifier covering this bandwidth. The VSWR is less than 2.0:1 at input and less than 2.5:1 at output. The middle stage also provides a separate gain control with greater than 10dB dynamic range.

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Abstracts

A Distributed Monolithic 2-18 GHz Dual-Gate FET Mixer

T.S. Howard and A.M. Pavio. "A Distributed Monolithic 2-18 GHz Dual-Gate FET Mixer." 1987 Microwave and Millimeter-Wave Monolithic Circuits Symposium Digest 87.1 (1987 [MCS]): 27-30.

A novel broadband mixer topology, which can be implemented using either monolithic or discrete integrated circuit methods, has been developed using distributed design techniques. The MMIC mixer exhibits excellent 2-18 GHz conversion gain performance with signal handling capabilities and LO drive requirements similar to conventional diode double-balanced circuits.



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An 8-15 GHz GaAs Monolithic Frequency Converter (1987 [MCS])

R. Ramachandran, S. Moghe, P. Ho and A. Podell. "An 8-15 GHz GaAs Monolithic Frequency Converter (1987 [MCS])." 1987 Microwave and Millimeter-Wave Monolithic Circuits Symposium Digest 87.1 (1987 [MCS]): 31-34.

An MMIC frequency converter with an RF bandwidth of 8-15 GHz and an IF bandwidth of 1.5 GHz has been designed and built. The MMIC chip has 15 dB conversion gain and includes a two-stage RF amplifier, a two-stage LO buffer amplifier, a double-balanced mixer and a three-stage IF amplifier. This high level of integration is realized on a 48 x 96 mil area, resulting in good RF yields. The circuit employs a push-pull configuration to eliminate the need for vias (low-inductance grounds) and facilitate a compact layout.





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Monolithic MBE GaAs Pin Diode Limiter

D.J. Seymour, D.D. Heston and R.E. Lehmann. "Monolithic MBE GaAs Pin Diode Limiter." 1987 Microwave and Millimeter-Wave Monolithic Circuits Symposium Digest 87.1 (1987 [MCS]): 35-37.

A broadband MBE GaAs PIN/NIP diode limiter has demonstrated 15 dB of isolation with a +32.5 dBm input signal while maintaining less than 0.25 dB of small-signal insertion loss from 0.05 GHz to 14 GHz. These results were obtained by incorporating vertical GaAs PIN/NIP diodes in a shunt-loaded microstrip configuration.

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Abstracts

A New Method of Analyzing and Modeling Integrated Optoelectronic Components

N. Dagli and C.G. Fonstad. "A New Method of Analyzing and Modeling Integrated Optoelectronic Components." 1987 Microwave and Millimeter-Wave Monolithic Circuits Symposium Digest 87.1 (1987 [MCS]): 39-41.

Using a mode matching technique, a modular microwave equivalent circuit incorporating both guided and continuum spectra has been developed to model integrated optoelectronic components accurately with limited computational effort. The analysis is verified with experiments on GaAs rib waveguides and directional and three guide couplers.



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Abstracts

A Monolithic GaAs 3-Bit Phase Quantization Sampler

T. Vu and J. Hattis. "A Monolithic GaAs 3-Bit Phase Quantization Sampler." 1987 Microwave and Millimeter-Wave Monolithic Circuits Symposium Digest 87.1 (1987 [MCS]): 43-47.

This paper describes the analysis, design, and development of a high-speed A/D and D/A converter using phase-quantization sampling. A monolithic GaAs A/D and D/A converter has been demonstrated within a RF signal acquisition system. Performance data on the monolithic IC reveals that the 3-bit quantization system exhibits signal reconstruction with harmonic suppression exceeding -25 dB across an IF bandwidth of greater than 900 MHz.



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Stability and Reliability Investigation on Fully ECL Compatible High Speed GaAs Logic ICs

Y. Hosono, H. Sato, Y. Mima, S. Ichikawa, H. Hirayama, K. Katsukawa, K. Ueda, K. Uetake, T. Noguchi and H. Kohzu. "Stability and Reliability Investigation on Fully ECL Compatible High Speed GaAs Logic ICs." 1987 Microwave and Millimeter-Wave Monolithic Circuits Symposium Digest 87.1 (1987 [MCS]): 49-52.

The electrical characteristics stability and reliability were investigated on newly developed high speed GaAs logic ICs. A resistor-loaded source-coupled FET logic (SCFL) was employed as a basic circuit architecture. The selectively epitaxial grown n/sup +/- GaAs layers were adopted for the contact regions of the WSi self-aligned gate FET. Maximum operating data rate of more than 2.6 Gb/s was achieved in these devices, guaranteeing sufficient supply voltage and phase margin. No failure has been observed in DC bias test for 3,000 hours and in RF operational test at 2 Gb/s for 7,000 hours.

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GaAs MMIC for Digital Radio Frequency Memory (DRFM) Subsystems

G.K. Lewis, I.J. Bahl and E.L. Griffin. "GaAs MMIC for Digital Radio Frequency Memory (DRFM) Subsystems." 1987 Microwave and Millimeter-Wave Monolithic Circuits Symposium Digest 87.1 (1987 [MCS]): 53-56.

A DRFM analog subsystem comprising of 10 GaAs MMIC chips (six limiting amplifiers, one quadrature IF downconverter, two IF amplifiers, and one quadrature upconverter) has been developed and integrated into an 11.8cm³ (.72 in³) module. The input signal dynamic range for the module is 50 dB from 2-6 GHz, the image sideband rejection is 20 dB typical, and the LO to RF isolation is 27 dB minimum. The quadrature IF downconverter and quadrature upconverter in MMIC form are reported for the first time and operated as designed with good performance.



Reliability Investigation on S- Band GaAs MMIC

K. Katsukawa, T. Kimura, K. Ueda and T. Noguchi. "Reliability Investigation on S- Band GaAs MMIC." 1987 Microwave and Millimeter-Wave Monolithic Circuits Symposium Digest 87.1 (1987 [MCS]): 57-61.

Accelerated life tests and radiation hardness tests have been conducted on GaAs MMICs and tie constituent elements. 0.35 to 1.3×10^8 hours MTF (Median Time to Failure) at 130°C Tch were estimated for a wide band amplifier up to S-band. No failure has been observed on RF operation tests for 3000 hours at Tch of 180°C and 205°C values for 12 samples, respectively. No degradation in the electrical performance was observed up to 1×10^7 rad gamma-ray irradiation with 5% criteria for the the S-band two-stage amplifiers, two-modulus prescalers and their FETs. It has been confirmed that the MMICs prduced, using NEC's $0.8 \mu\text{m}$ long T-shaped WSi gate FET manufacturing process, are sufficiently reliable for practical applications.



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Low Cost Millimeter Wave Monolithic Receivers

A. Chu, L. Chu, D. Sloat, M. Theobald, J. Teunas, T. Litchfield and W. Moroney. "Low Cost Millimeter Wave Monolithic Receivers." 1987 Microwave and Millimeter-Wave Monolithic Circuits Symposium Digest 87.1 (1987 [MCS]): 63-67.

A 35 GHz receiver using GaAs monolithic and hybrid circuits has been developed for low cost manufacture. The receiver is comprised of a downconverter, an If amplifier and voltage regulators. This paper will report on the design, fabrication, integration, packaging and testing of a monolithic mixer, a monolithic Gunn Diode Oscillator and a GaAs Downconverter circuit which has exhibited a SSB receiver noise figure of 9.5dB.

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Development of Key Monolithic Circuits to Ka-Band Full MMIC Receivers

T. Ohira, T. Tokumitsu, T. Hiraoka, Y. Kihata, K. Araki and H. Kato. "Development of Key Monolithic Circuits to Ka-Band Full MMIC Receivers." 1987 Microwave and Millimeter-Wave Monolithic Circuits Symposium Digest 87.1 (1987 [MCS]): 69-74.

Key monolithic circuits to Ka-band full MMIC receivers have been designed and fabricated. Conventional hybrid-oriented elements such as RF image-rejection filters, LO dielectric resonators and IF hybrid couplers have been eliminated for the full MMIC configuration. Prospects have been obtained for realization of very-small-size microwave communication receivers.

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Two Stage Dual Gate MESFET Monolithic Gain Control Amplifier for Ka-Band

V. Sokolov, J. Geddes and A. Contolatis. "Two Stage Dual Gate MESFET Monolithic Gain Control Amplifier for Ka-Band." 1987 Microwave and Millimeter-Wave Monolithic Circuits Symposium Digest 87.1 (1987 [MCS]): 75-79.

A monolithic two stage gain control amplifier has been developed using submicron gate length dual gate MESFETs fabricated on ion implanted material. The amplifier has a gain of 12 dB at 30 GHz with a gain control range of over 30 dB. This ion implanted monolithic IC is readily integrable with other phased array receiver functions such as low noise amplifiers and phase shifters.

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A Three-Bit Monolithic Phase Shifter at V-Band

A.W. Jacomb-Hood, D. Seielstad and J.D. Merrill. "A Three-Bit Monolithic Phase Shifter at V-Band." 1987 Microwave and Millimeter-Wave Monolithic Circuits Symposium Digest 87.1 (1987 [MCS]): 81-84.

This paper describes the design and performance of a three-bit monolithic phase shifter at V-band. The selected circuit approach was a reflection phase shifter with switched delay lines. Schottky diodes were used as the switching elements. Tested at 62.5 GHz, the RMS phase error was 2.7° , the insertion loss 10.8 ± 1.8 dB (including fixture loss), and the VSWR was better than 2.1:1. The maximum DC power requirement was 40 mW.

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DC-40 GHz and 20-40 GHz MMIC SPDT Switches (1987 [MCS])

M.J. Schindler and A.M. Morris. "DC-40 GHz and 20-40 GHz MMIC SPDT Switches (1987 [MCS])." 1987 Microwave and Millimeter-Wave Monolithic Circuits Symposium Digest 87.1 (1987 [MCS]): 85-88.

Monolithic GaAs SPDT switches operating from dc to 40 GHz and 20 to 40 GHz have been demonstrated. The switches use MESFETs with the same characteristics as a mm-wave amplifier to allow for ease of integration in the future. The gate length is 0.35 microns, and ion implanted material is used. The 20-40 GHz switch uses a combination of shunt FETs and quarter-wave transformers. Better than 2 dB insertion loss and 25 dB isolation have been achieved. The dc-40 GHz switch uses a combination of series and shunt FETs. Better than 3 dB insertion loss and 23 dB isolation have been achieved. Power handling and switching speed have also been measured for both switch types.

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Ion Implanted W-Band Monolithic Balanced Mixers for Broadband Applications

T.N. Trinh, W.S. Wong, D. Li and J.R. Kessler. "Ion Implanted W-Band Monolithic Balanced Mixers for Broadband Applications." 1987 Microwave and Millimeter-Wave Monolithic Circuits Symposium Digest 87.1 (1987 [MCS]): 89-92.

An all ion-implanted monolithic broadband balanced mixer fabricated on a GaAs substrate for operation at W-band frequencies is described. A deep implanted buried n+ layer was used to minimize the diode series resistance. Ohmic contacts were formed by standard alloying of planar eutectic AuGe metallization into the n+ layer. The mixer diode structure is completely compatible with GaAs MESFET-based monolithic integrated circuit processing techniques. A conversion loss from 6.8 to 10 dB has been measured over an RF range of 75 to 88 GHz, with a LO drive of 10 dBm at 92 GHz.

Click on title for a complete paper.



Abstracts

Nonlinear Modeling for MMIC's (1987 [MCS])

D. Estreich. "Nonlinear Modeling for MMIC's (1987 [MCS])." 1987 Microwave and Millimeter-Wave Monolithic Circuits Symposium Digest 87.1 (1987 [MCS]): 93-96.

Nonlinear microwave CAD as applied to GaAs MMIC's is still in its infancy. A brief review is given of some of the work on modeling the nonlinear or "large-signal" behavior of the GaAs FET and nonlinear microwave circuit simulation. This is an important topic to the future success of GaAs MMIC's. Several important issues are raised with respect to nonlinear CAD for GaAs MMIC's.



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K/sub a/-Band Monolithic GaAs Power FET Amplifiers (1987 [MCS])

H.-L.A. Hung, A. Ezzeddine, L.B. Holdeman, F.R. Phelleps, J.F. Allison, A.B. Cornfeld, T. Smith and H.C. Huang. "K/sub a/-Band Monolithic GaAs Power FET Amplifiers (1987 [MCS])." 1987 Microwave and Millimeter-Wave Monolithic Circuits Symposium Digest 87.1 (1987 [MCS]): 97-100.

GaAs power MMIC amplifiers with an optimized FET structure operating at K/sub a/-band have achieved a small-signal gain of 4.3 dB and an output power of 481 mw. These 1.7 x 0.9-mm MMICs include DC-blocking capacitors and bias networks. A cascaded four-stage amplifier has achieved a power gain of 18.9 dB and output power of 437 mw at 28 GHz. These results may represent the highest power/gain yet demonstrated from cascaded stages of MMICs with on-chip bias and DC blocking at K/sub a/-band.



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Wideband GaAs MMIC Receiver (1987 [MCS])

D.C. Yang, R. Esfandiari, T.S. Lin and T. O'Neill. "Wideband GaAs MMIC Receiver (1987 [MCS])." 1987 Microwave and Millimeter-Wave Monolithic Circuits Symposium Digest 87.1 (1987 [MCS]): 101-103.

A wideband GaAs MMIC receiver module has been developed using half-micron gate MESFET technology. The fabrication process used is optical lithography with ion-implanted undoped LEC GaAs wafers. The module consists of three generic monolithic chips: an RF amplifier, an IF amplifier, and an image rejection filter which is integrated on a dual-gate MESFET mixer chip. The RF input frequency is 6 to 10 GHz and the IF output is at 3 GHz. Test results have shown an overall conversion gain of more than 20 dB, and less than a 5.5 dB noise figure. The isolation between RF and IF ports is better than 22 dB, between LO and IF is more than 30 dB, and between LO and RF isolation is 20 dB. The DC functional yield of more than 70-80% has also been achieved for each chip type.

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1-6 GHz GaAs MMIC Linear Attenuator with Integral Drivers (1987 [MCS])

G. Lizama, T. Andrade and R. Benton. "1-6 GHz GaAs MMIC Linear Attenuator with Integral Drivers (1987 [MCS])." 1987 Microwave and Millimeter-Wave Monolithic Circuits Symposium Digest 87.1 (1987 [MCS]): 105-107.

This paper describes the performance of a voltage-controlled attenuator with a 12 dB linear attenuation vs. control voltage range. This linear attenuator greatly facilitates the realization of both closed and open loop gain compensation networks. Over the -55°C to 85°C range the attenuator recorded a 7.2 ± 1 dB/V linear transfer function while using only 25 mW from a single 4 V power supply.



Abstracts

A 2-20 GHz, High-Gain, Monolithic HEMT Distributed Amplifier (1987 [MCS])

C. Nishimoto, R. LaRue, S. Bandy, M. Day, J. Eckstein, C. Webb, C. Yuen and G. Zdasiuk. "A 2-20 GHz, High-Gain, Monolithic HEMT Distributed Amplifier (1987 [MCS])." 1987 Microwave and Millimeter-Wave Monolithic Circuits Symposium Digest 87.1 (1987 [MCS]): 109-113.

A low-noise 2-20 GHz monolithic distributed amplifier utilizing 0.3-micron gate-length HEMT devices has achieved $11\text{-dB} \pm 0.5\text{ dB}$ of gain. This represents the highest gain reported for a distributed amplifier using single FET gain cells. A record low noise figure of 3 dB was achieved mid-band (7-12 GHz). The circuit design utilizes five HEMT transistors of varying width with gates fabricated by E-beam lithography.



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State-of-the-Art Ion-Implanted Low-Noise GaAs MESFET and Monolithic Amplifier (1987 [MCS])

K.G. Wang and S.K. Wang. "State-of-the-Art Ion-Implanted Low-Noise GaAs MESFET and Monolithic Amplifier (1987 [MCS])." 1987 Microwave and Millimeter-Wave Monolithic Circuits Symposium Digest 87.1 (1987 [MCS]): 115-117.

State-of-the-art GaAs low-noise MESFET and monolithic amplifier have been fabricated using a high yield, planar, ion-implantation process. A 0.5 μm -gate FET has achieved 1.2 dB noise figure with 8.8 dB associated gain at 12 GHz and 1.7 dB noise figure with 6.6 dB associated gain at 18 GHz. A two-stage monolithic amplifier using this FET process has achieved 1.8 dB noise figure with 23.6 dB associated gain at 9.5 GHz. The dc yield of the amplifier chips is better than 40 percent.

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Abstracts

A Low Noise Distributed Amplifier with Gain Control (1987 [MCS])

C. Hutchinson and W. Kennan. "A Low Noise Distributed Amplifier with Gain Control (1987 [MCS])." 1987 Microwave and Millimeter-Wave Monolithic Circuits Symposium Digest 87.1 (1987 [MCS]): 119-122.

A 2 to 18GHz monolithic GaAs distributed amplifier has been developed with 17dB nominal gain, less than 2.0:1 input and output VSWR, less than 6.0dB noise figure, and greater than 40dB gain control. The chip size at 3.0 sq. mm. (1.63mm by 1.88mm) makes it cost effective for a wide variety of applications.



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Wide-Band Monolithic GaAs Phase Detector for Homodyne Reception (1987 [MCS])

P. Jean, V. Pauker and P. Dautriche. "Wide-Band Monolithic GaAs Phase Detector for Homodyne Reception (1987 [MCS])." 1987 Microwave and Millimeter-Wave Monolithic Circuits Symposium Digest 87.1 (1987 [MCS]): 123-125.

A multipurpose, 0, 04 - 4 GHz, monolithic GaAs detector circuit has been fabricated. It shows a sensitivity of 2.5 V/rad with a DC offset of 300 mV for a differential dynamic range of 8V. It has been successfully tested as a phase detector in a homodyne receiver over L and S bands.





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Successful Automated Alloy Attachment of GaAs MMIC's (1987 [MCS])

J.S. Pavio. "Successful Automated Alloy Attachment of GaAs MMIC's (1987 [MCS])." 1987 Microwave and Millimeter-Wave Monolithic Circuits Symposium Digest 87.1 (1987 [MCS]): 127-129.

Automated alloy attachment of GaAs MMIC's is presented utilizing a reflow furnace for attachment of multiple devices at one time rather than manual scrub of each monolithic separately. Reflow characteristics of a variety of solders were analyzed as well as behavior of those solders during long term temperature bake and during 1000 cycles of thermal cycling. RF and thermal impedance data was measured through 600 thermal cycles in order to verify long term electrical performance. Finally, the study addressed fractures in GaAs due to thermal expansion differences between the alloy and the GaAs MMIC itself. The main objective for the monolithic attachment study was to identify alloy materials and to develop processes which provide the following characteristics.

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Abstracts

Low Cost MMIC Insertion Using Thick Film Processing (1987 [MCS])

A. Bettner, B. Hundley and P. Salisbury. "Low Cost MMIC Insertion Using Thick Film Processing (1987 [MCS])." 1987 Microwave and Millimeter-Wave Monolithic Circuits Symposium Digest 87.1 (1987 [MCS]): 131-133.

Multilayer thick-film circuits have been developed to provide single supply biasing and reactive matching to MMIC chips. The result is a method of achieving large amounts of gain at extremely low cost.



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A Low Cost Packaging/Testing Procedure for Manufacturing GaAs MMIC (1987 [MCS])

R. Esfandiari, D. Yang, S. Chan, S. Lin and R.K. Ellis. "A Low Cost Packaging/Testing Procedure for Manufacturing GaAs MMIC (1987 [MCS])." 1987 Microwave and Millimeter-Wave Monolithic Circuits Symposium Digest 87.1 (1987 [MCS]): 135-137.

The development of a low cost, high throughput testing/package procedure for GaAs MMIC is described. Automated on-wafer RF and DC testing is essential for volume production of MMIC chips. However most MMIC circuits cannot be tested at wafer level due to lack of proper RF test environment. The proposed frame tape chip carrier approach takes full advantage of the RF probe system. This technique reduces the high cost of RF package measurements and reliability testing. The measurement and packaging is demonstrated on several MMIC chips. It can easily be automated for high volume production.

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A Low Noise GaAs MMIC Satellite Downconverter for the 6 to 4 GHz Band (1987 [MCS])

A.R. Harvey, F.J. Cotton, D.C. Pennington, R.M. Eaton and P.D. Cooper. "A Low Noise GaAs MMIC Satellite Downconverter for the 6 to 4 GHz Band (1987 [MCS])." 1987 Microwave and Millimeter-Wave Monolithic Circuits Symposium Digest 87.1 (1987 [MCS]): 139-142.

An all GaAs MMIC wideband 6 to 4 GHz downconverter technology demonstrator has been designed, developed, fabricated and tested. The module achieves an overall conversion gain of 67 dB with a 3.2 dB noise figure. The MMIC chip set developed includes an LNA, an active splitter, phase shifters, a mixer, broadband power combiners and an IF amplifier. The assembly represents a significant size and weight reduction compared to conventional hybrid units.

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Back Cover (1987 [MCS])

"Back Cover (1987 [MCS])." 1987 Microwave and Millimeter-Wave Monolithic Circuits Symposium Digest 87.1 (1987 [MCS]): b1-b1.



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