

Microwave Digital Archive

IEEE Microwave Theory and Techniques Society

1962-1967

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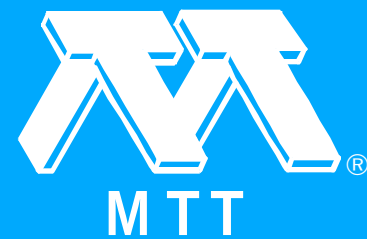
The Microwave Theory and Techniques Society of the IEEE has finished a complete archive of all reviewed and published material since 1953. Yearly updates of the published material will be compiled in the future. As digital media changes over the years, it will be necessary to update the format of the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

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

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

All papers were electronic files or images scanned from hard copy and converted to Adobe Acrobat PDF file format for cross-platform access. Since some of the papers were scanned from hard copy, the viewing quality will vary with the size and quality of fonts used. Even though the viewing quality on your monitor may vary, all papers print clearly.

Thank You and Enjoy!



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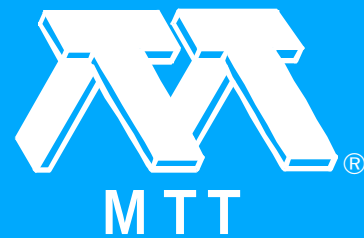
ACKNOWLEDGMENTS

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.

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ISBN: 0-7803-9906-4



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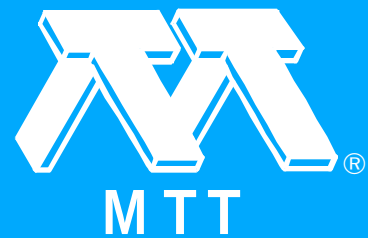
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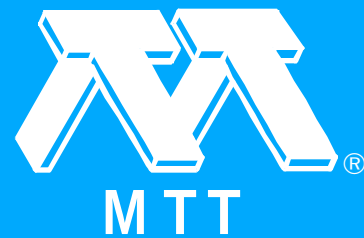
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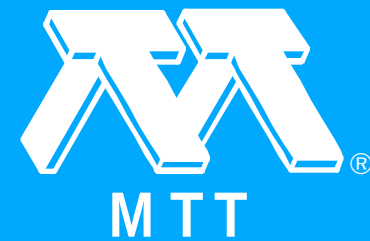
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INTRODUCTION

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.)



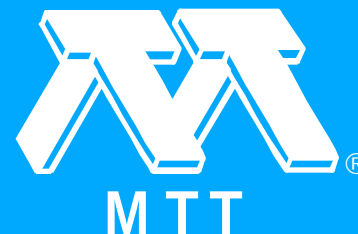
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In the dialog box shown for **General** Preferences, turn OFF the “Open Cross-Document Links in Same Window” option; this will keep the Guide file open when you view article files and allows you to return to the same page in the Guide when you close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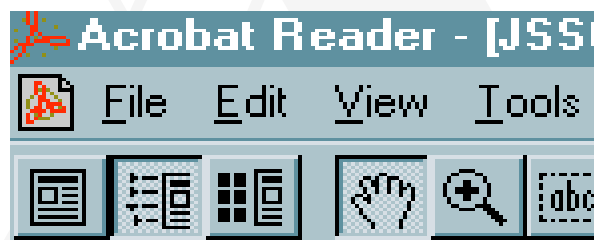
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USING BOOKMARKS

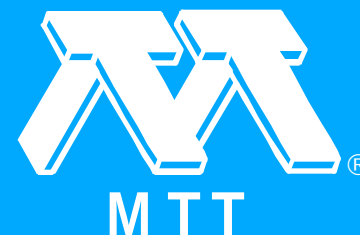
In addition to links, you can navigate through the Electronic Guide using Bookmarks. If they are not already visible, choose View > Bookmarks and Page from the menu bar or press the “Display Page and Bookmarks” button on the tool bar. A panel opens on the left side of the screen displaying Bookmarks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

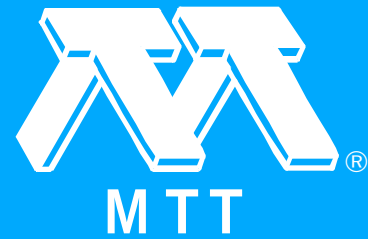
Articles may have text outside normal print-area defaults. We recommend selecting “Shrink to Fit” in the print menu (File > Print) to capture the complete image for your printout. This setting will become your new default.

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.

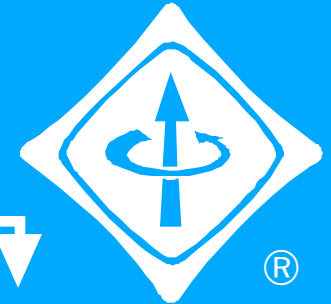
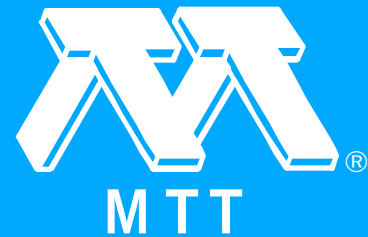
Next Page button

Click to advance to the next page in the section.

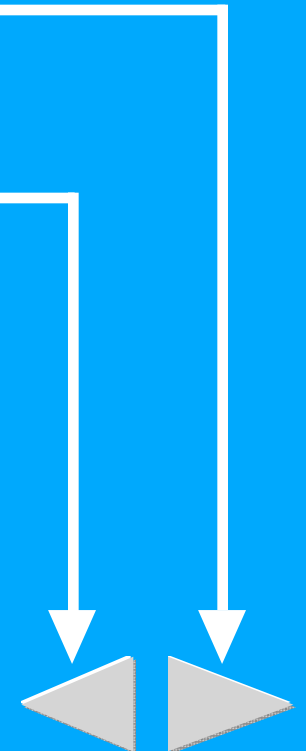
Previous Page button

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.

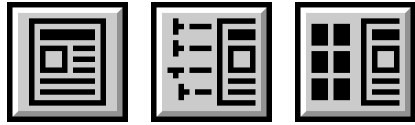


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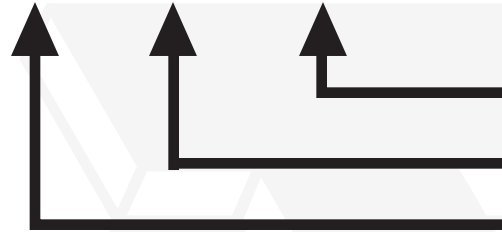


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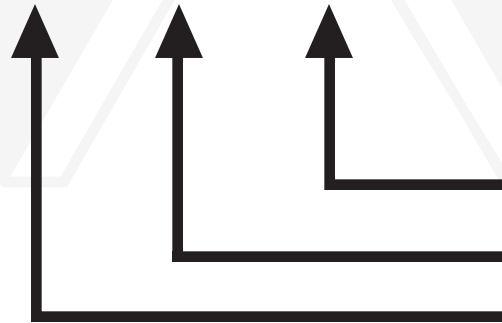
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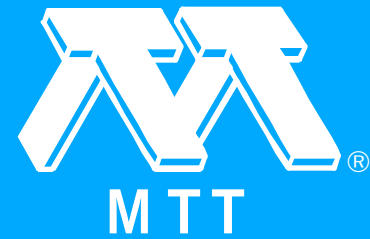
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Display Page



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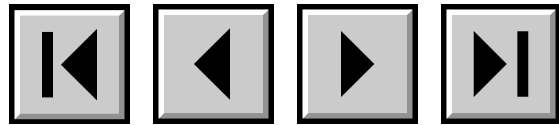
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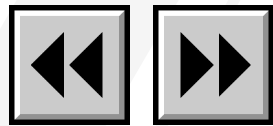
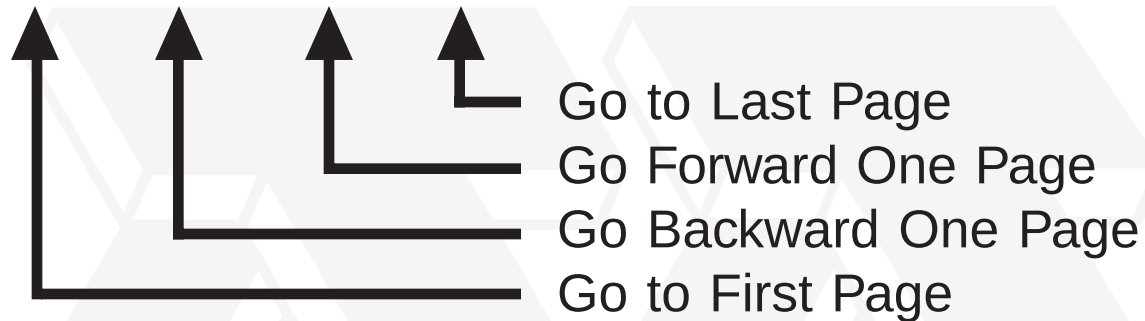


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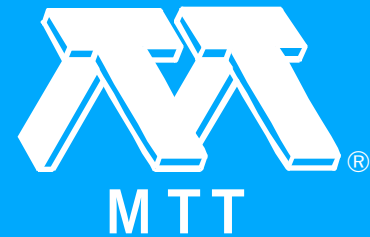
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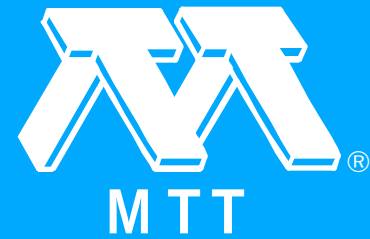
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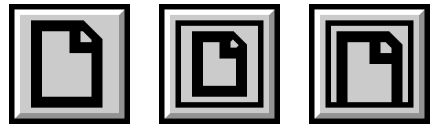
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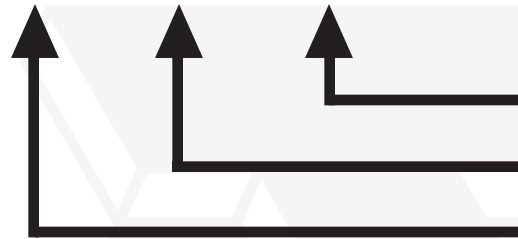
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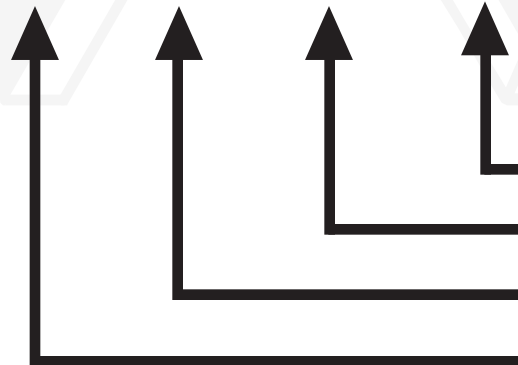
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Fit Page
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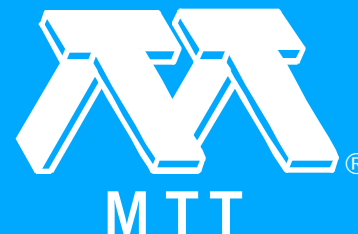
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SEARCHING

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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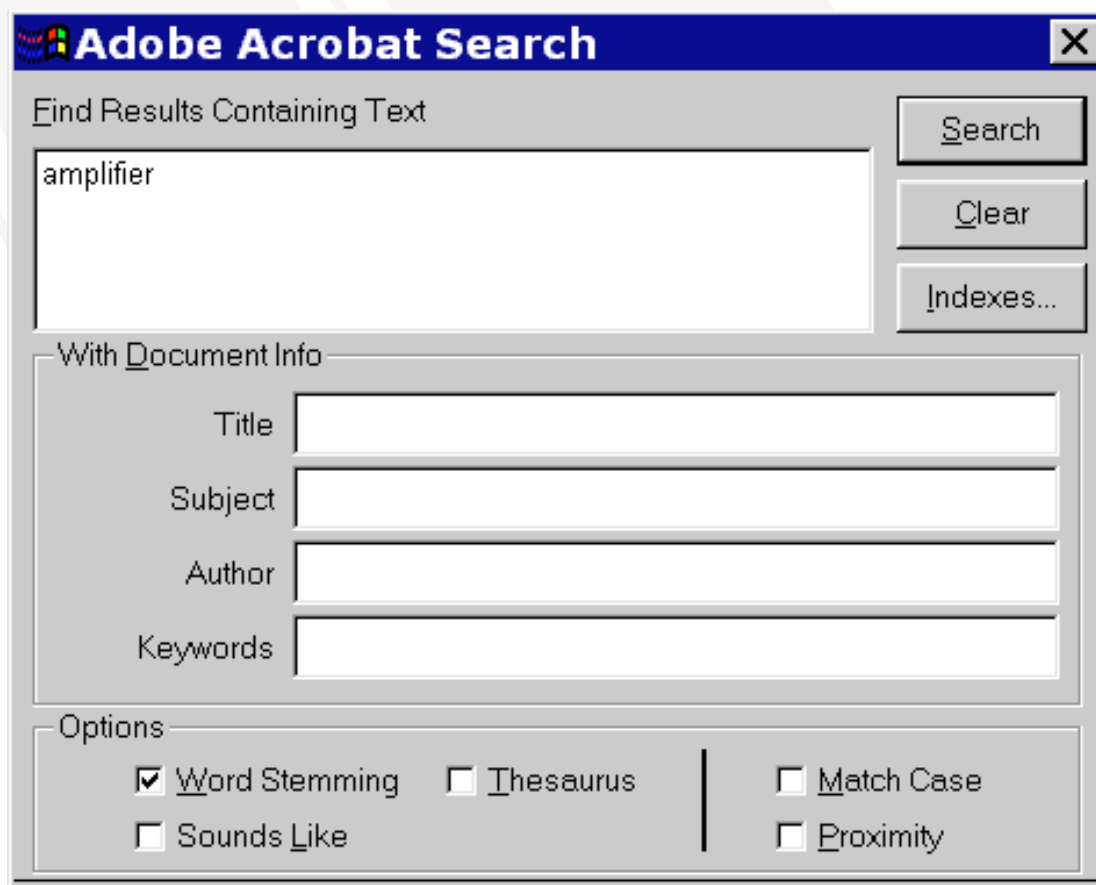
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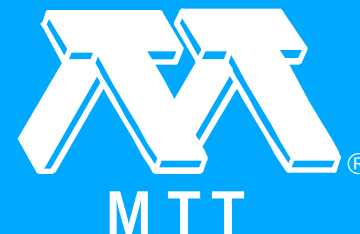
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If you are not finding files you think should show in the results list, Acrobat may not be attached to the correct index file. To check, press the “Indexes...” button for a list of available indexes. If this title is not listed, press the “Add...” 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 five checkboxes: 'Word Stemming' (checked), 'Thesaurus' (unchecked), 'Match Case' (unchecked), 'Sounds Like' (unchecked), and 'Proximity' (unchecked).

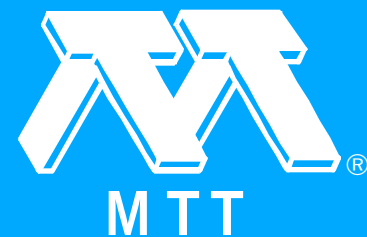


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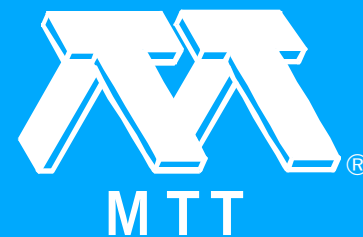
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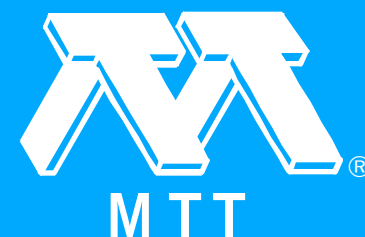
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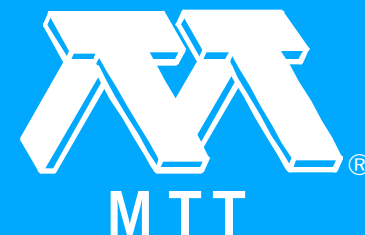
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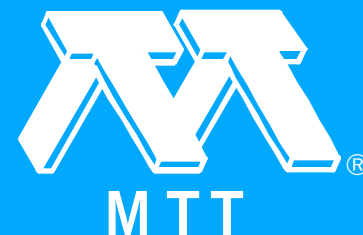
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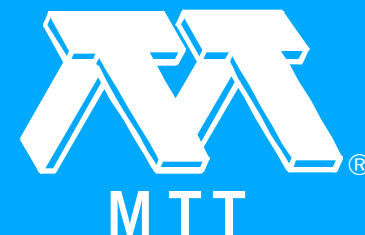
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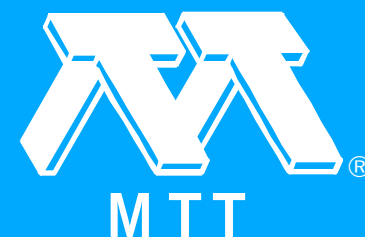
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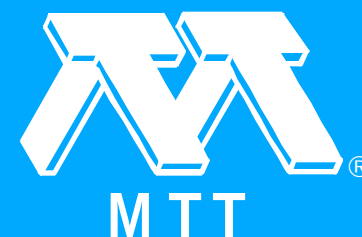
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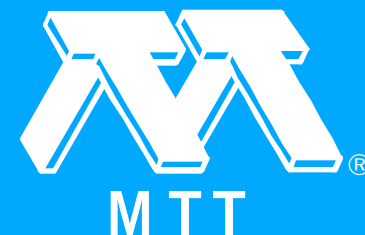
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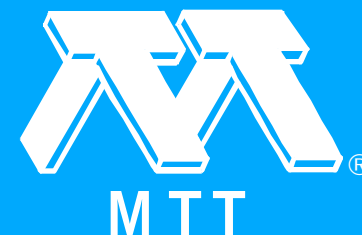
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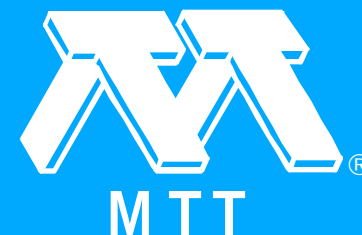
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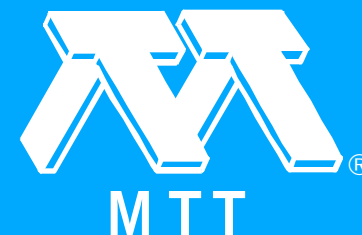
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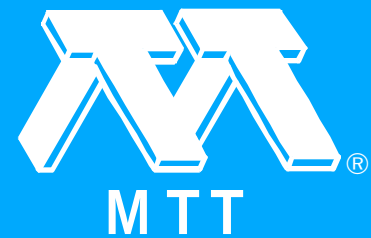
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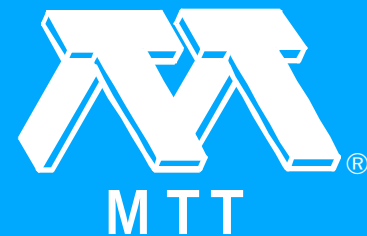
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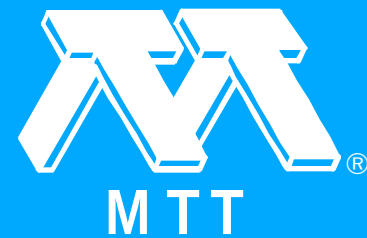
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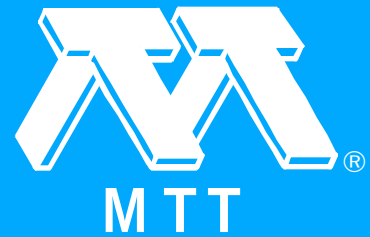
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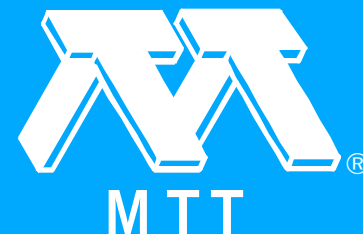
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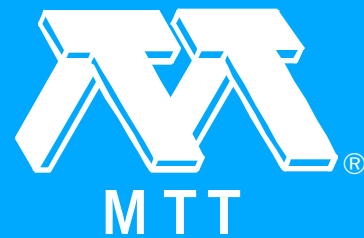
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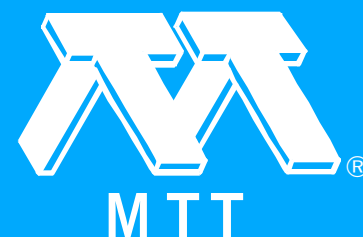
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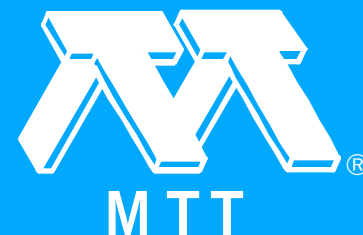
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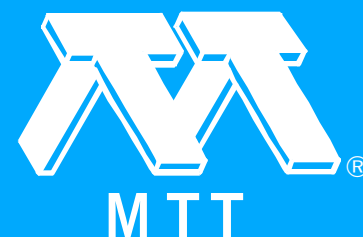
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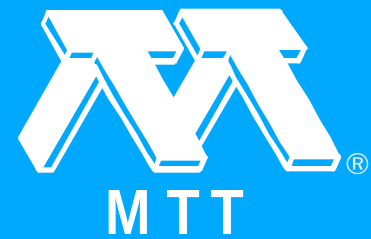
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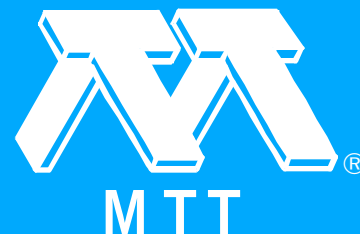


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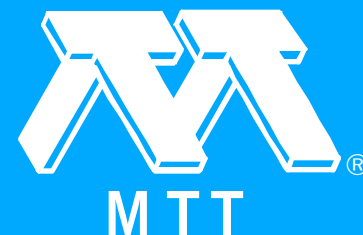
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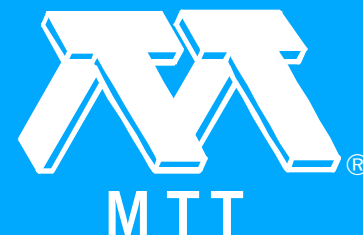
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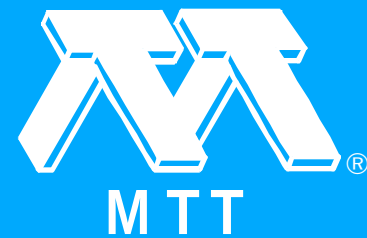
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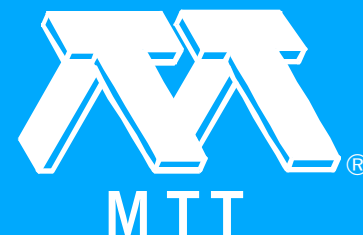
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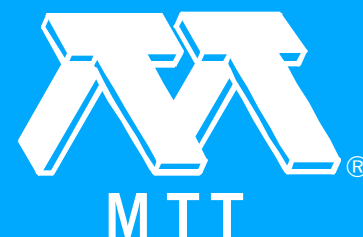
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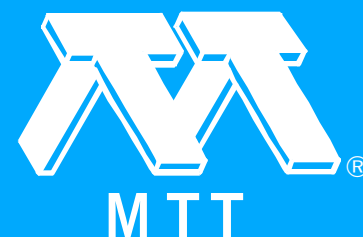
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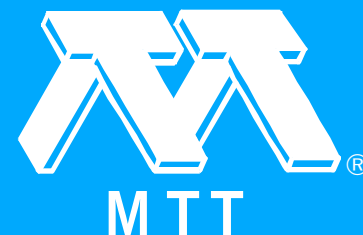
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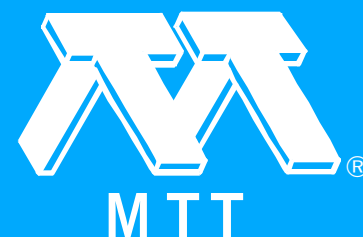
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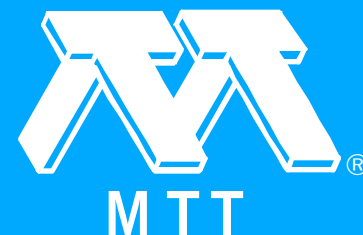
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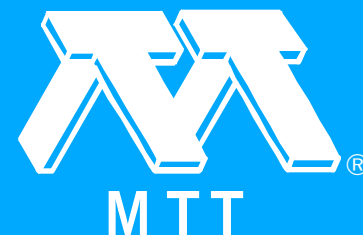
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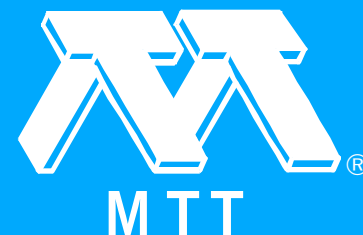
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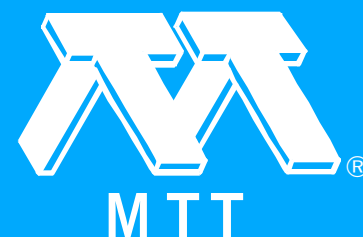
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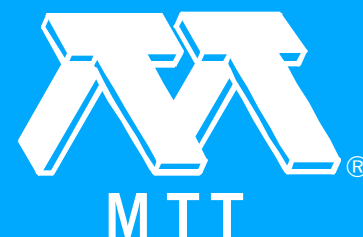
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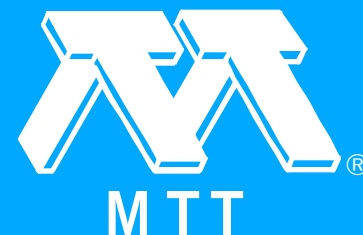
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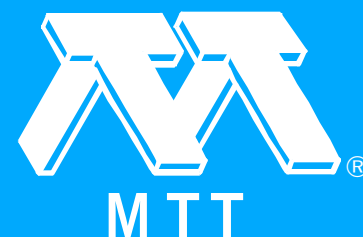
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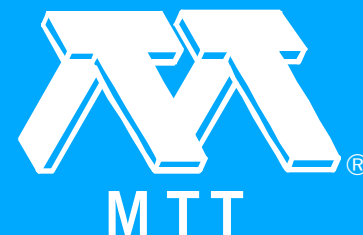
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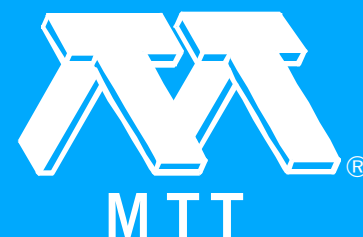
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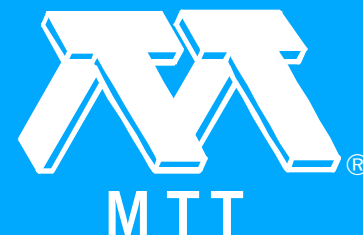
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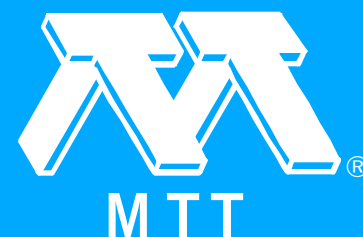
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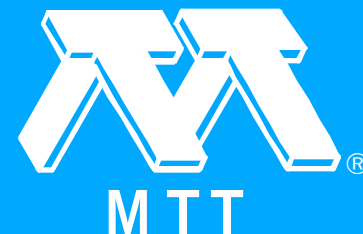
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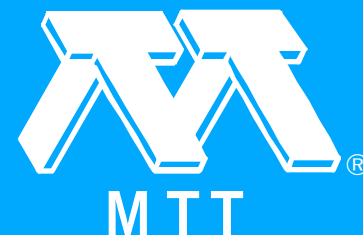
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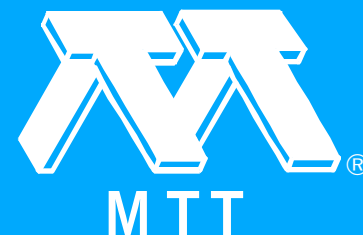
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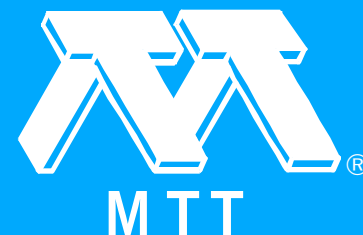
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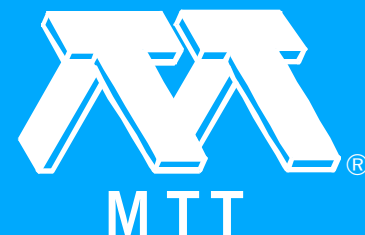
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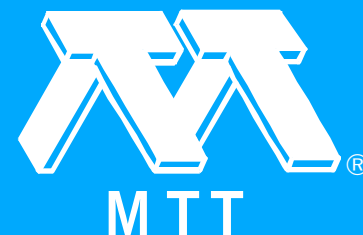
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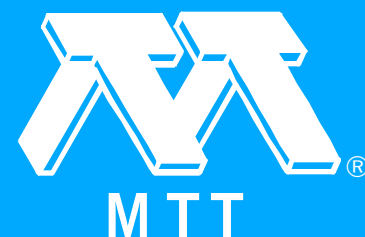
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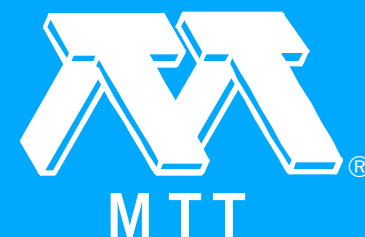
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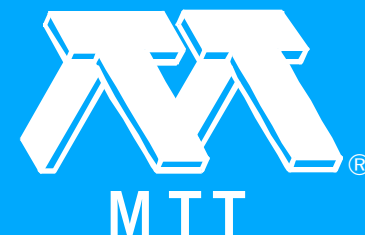
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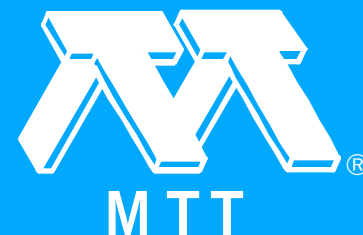
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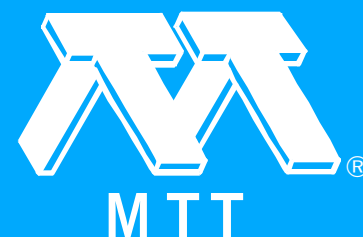
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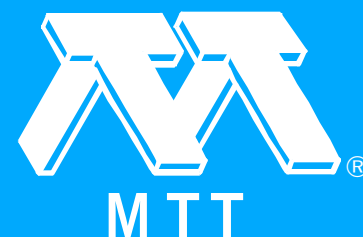
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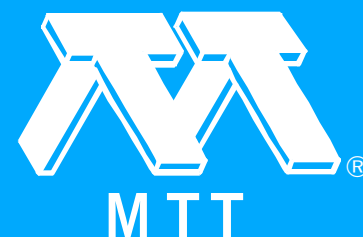
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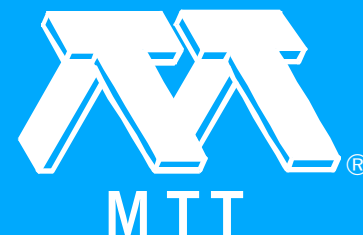


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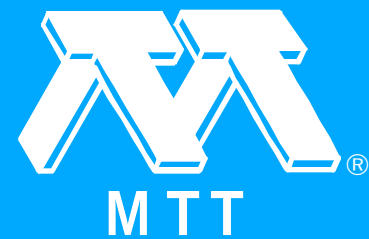
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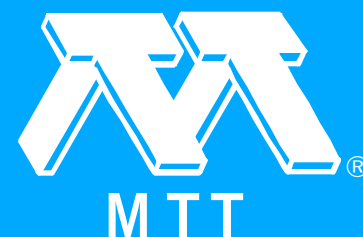
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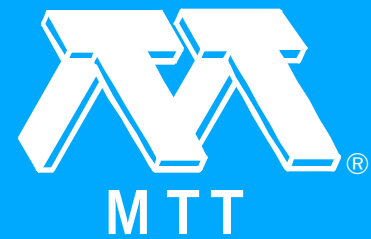
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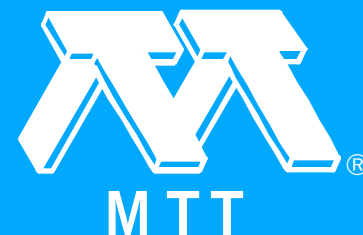
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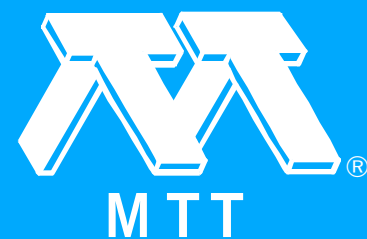
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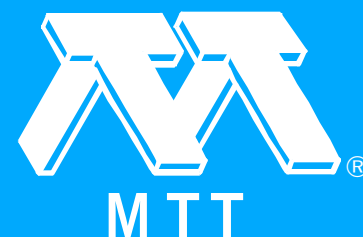
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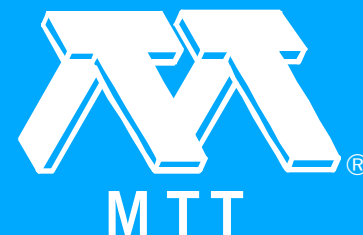
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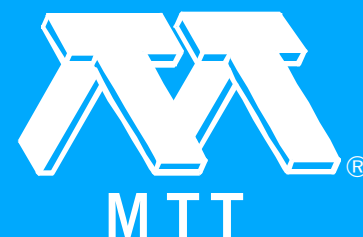
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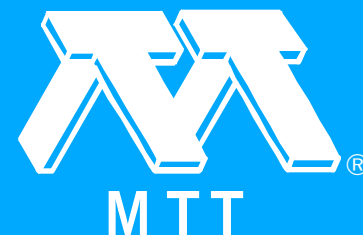
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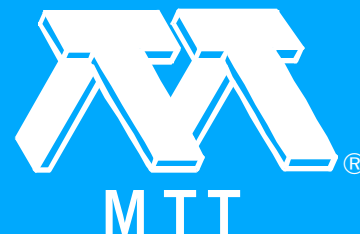


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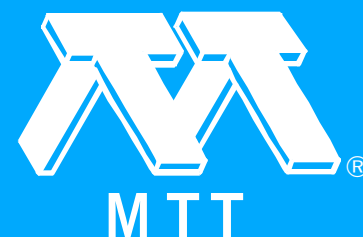
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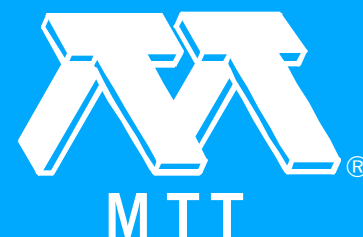
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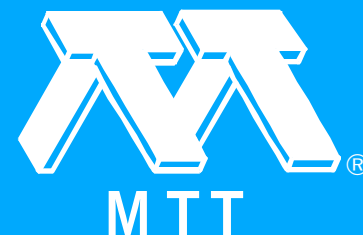
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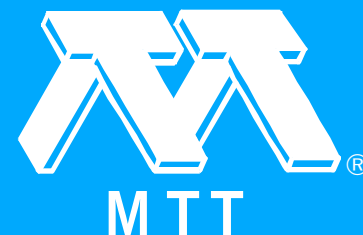
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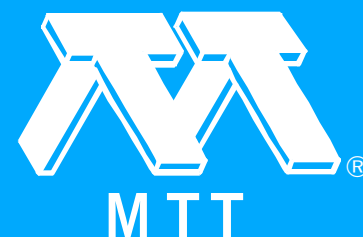
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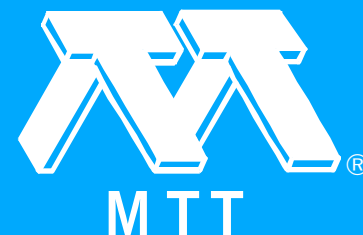
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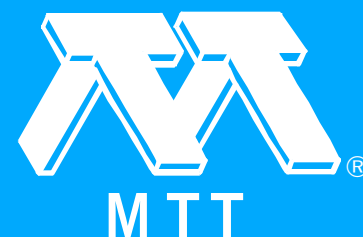
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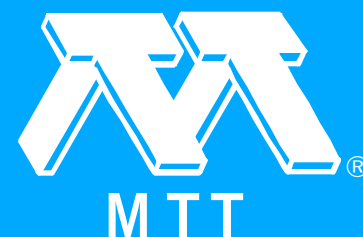
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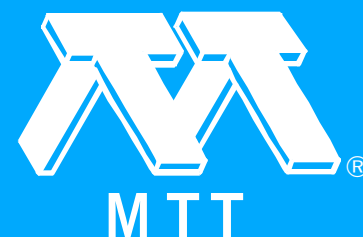
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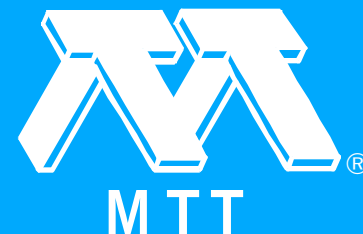
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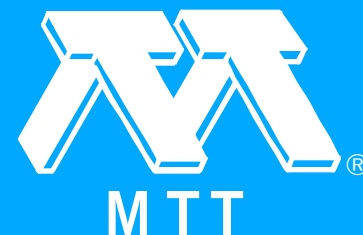
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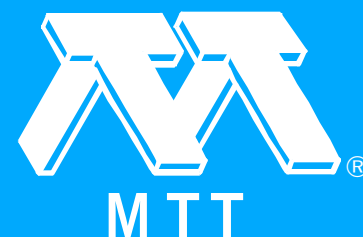
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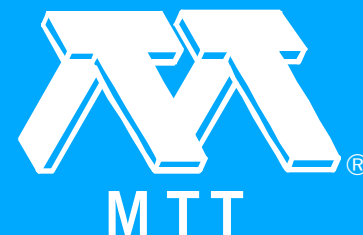
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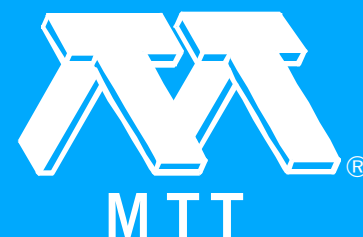
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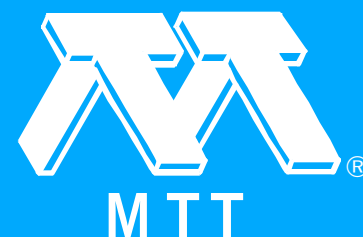
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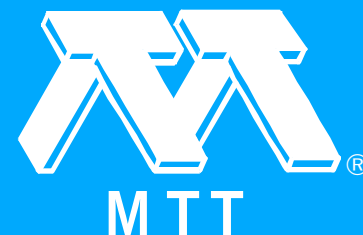
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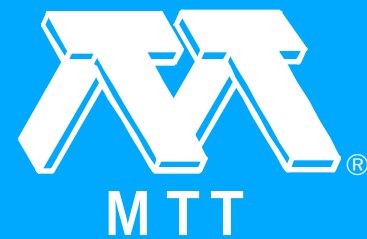
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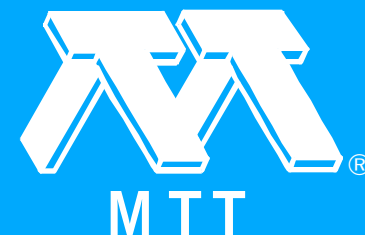
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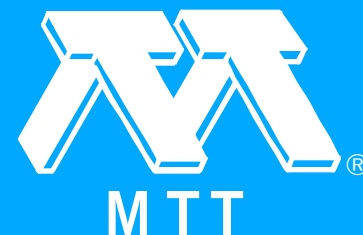
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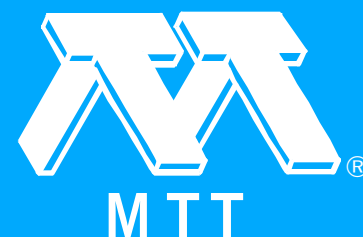
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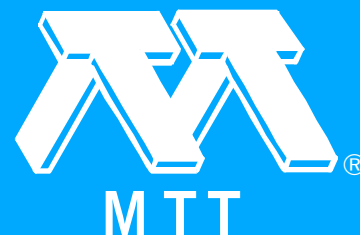
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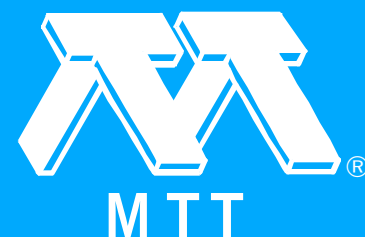
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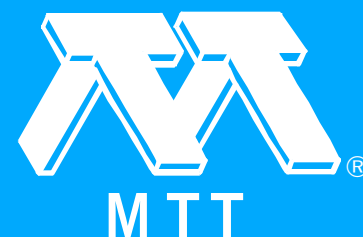
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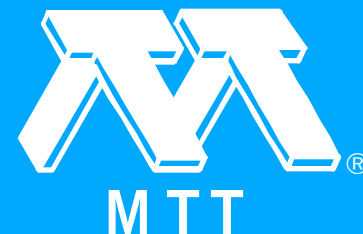
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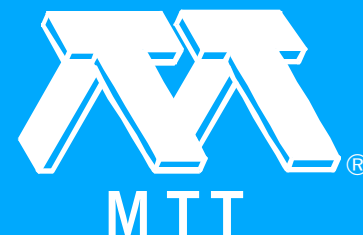
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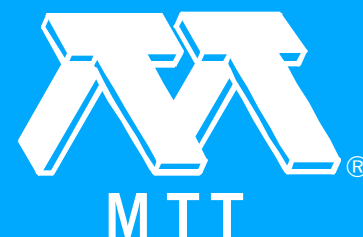
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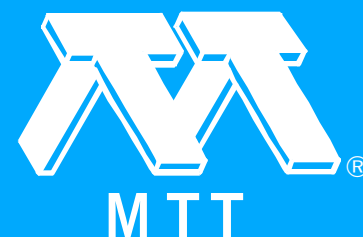
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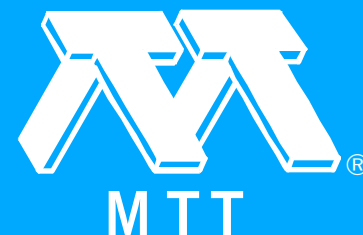
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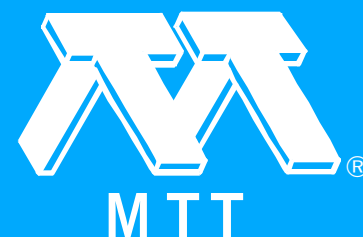
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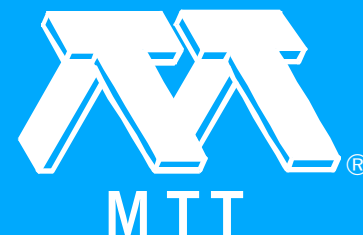


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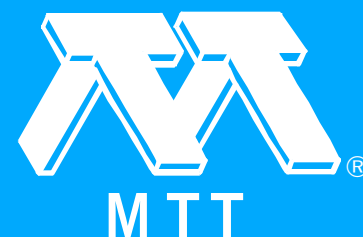
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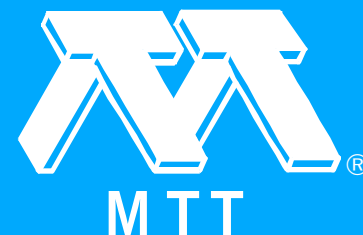
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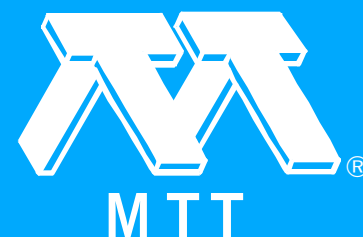
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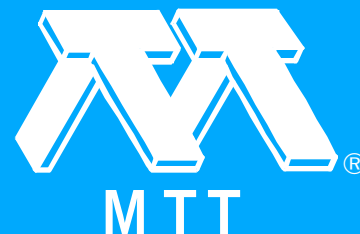


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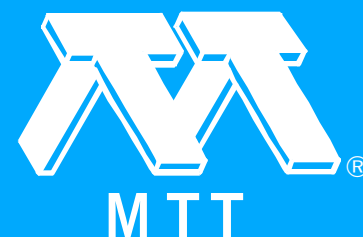
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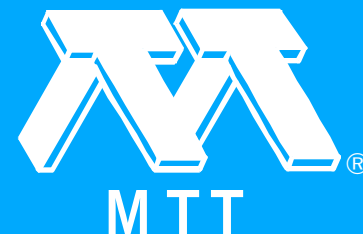
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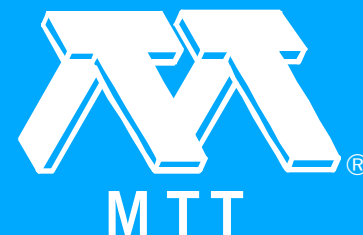
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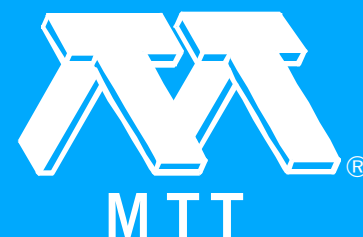
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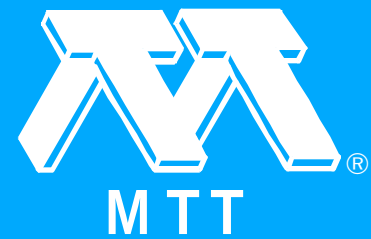
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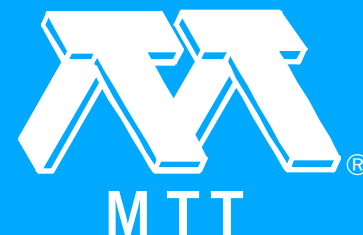


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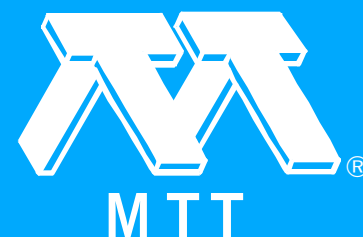
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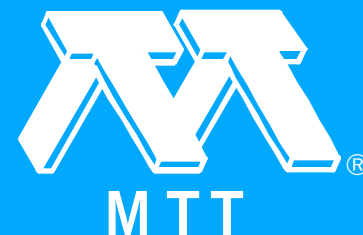
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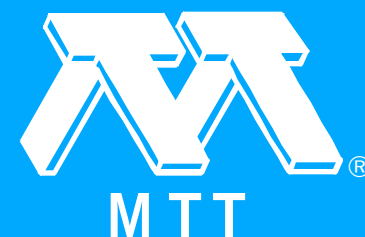
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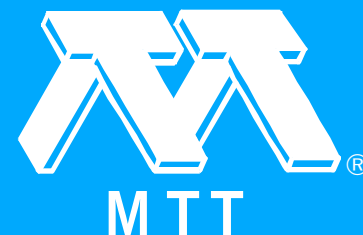
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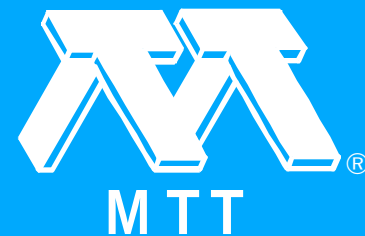
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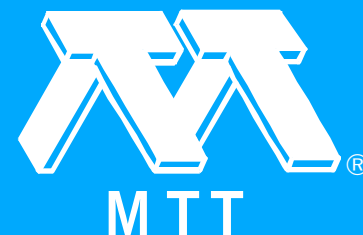
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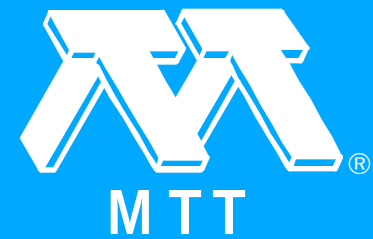
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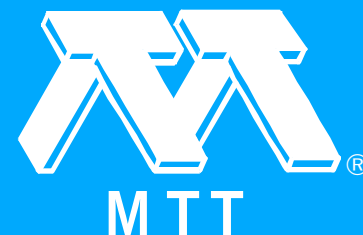
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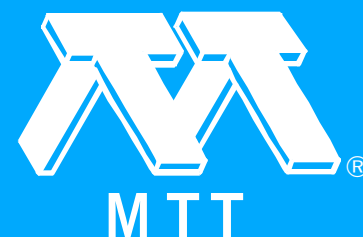
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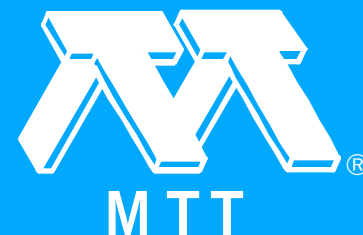
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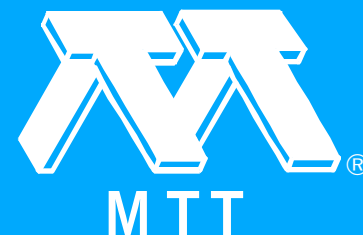
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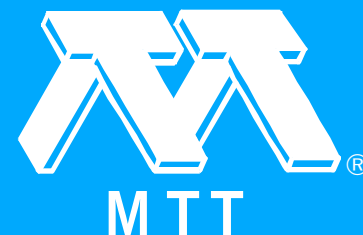
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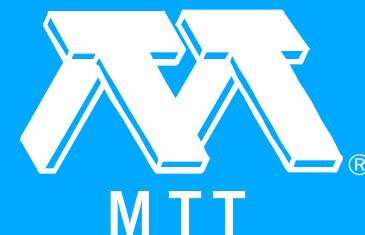
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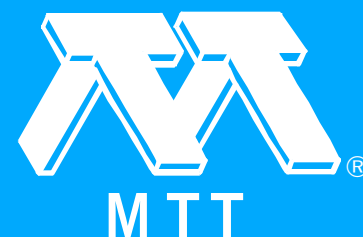
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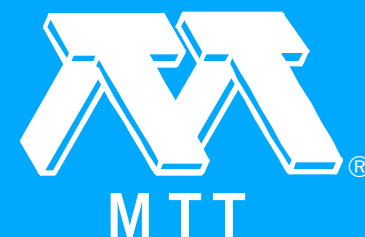
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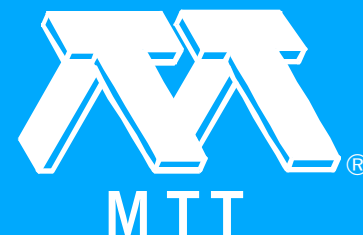
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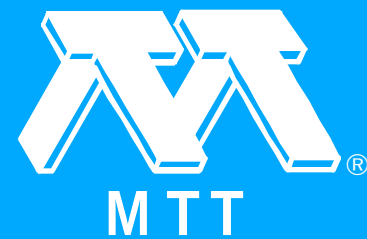
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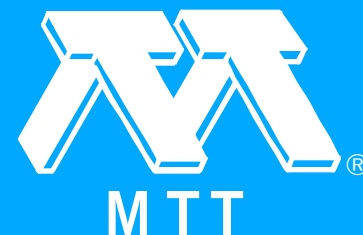
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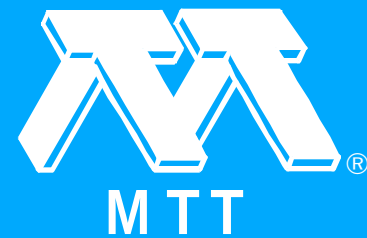
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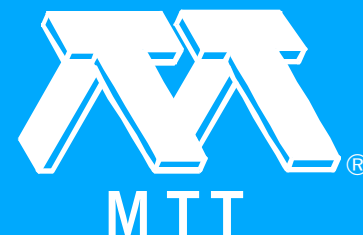
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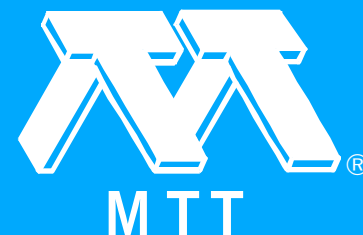
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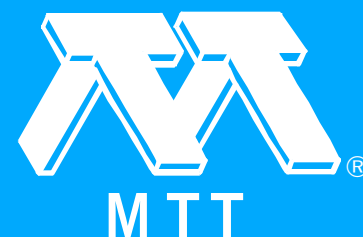
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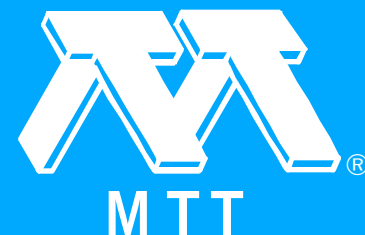
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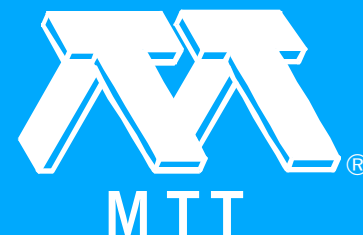
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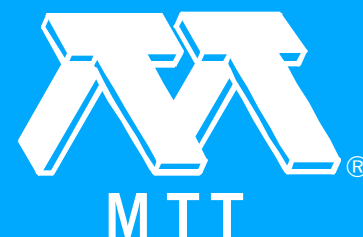
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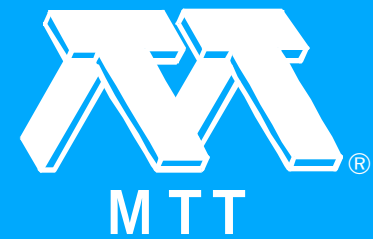
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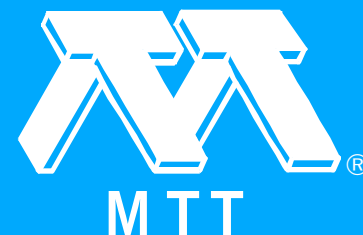
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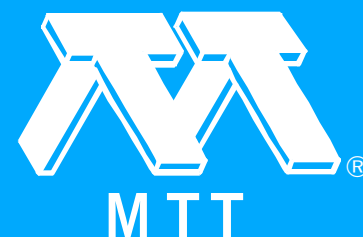
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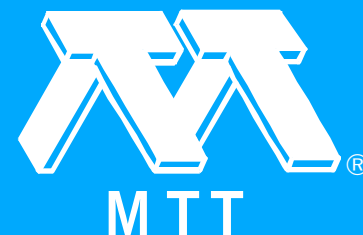
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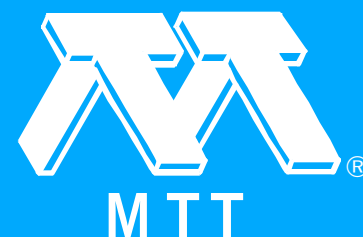
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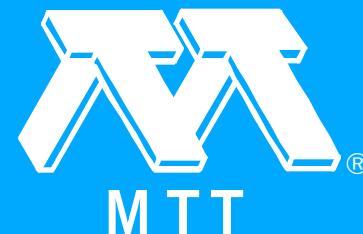
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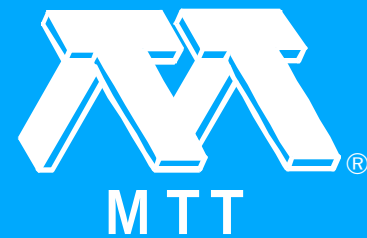
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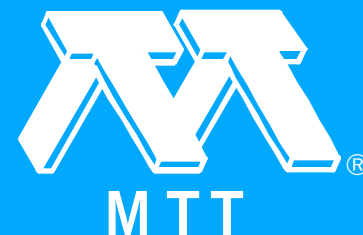
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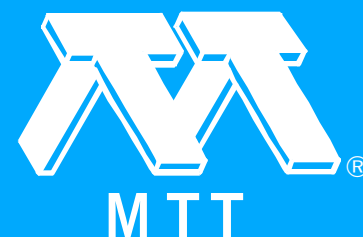
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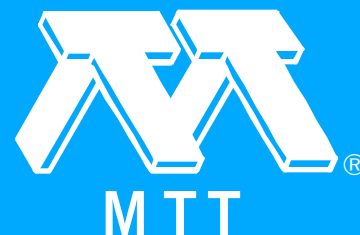


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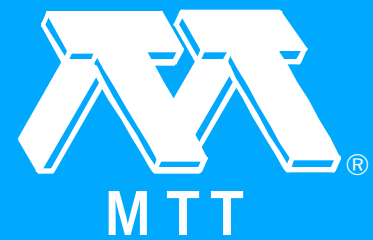
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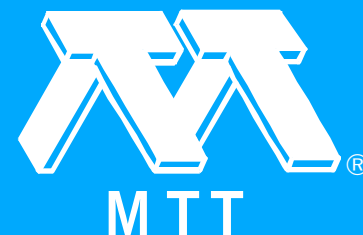
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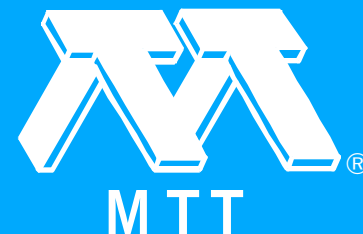
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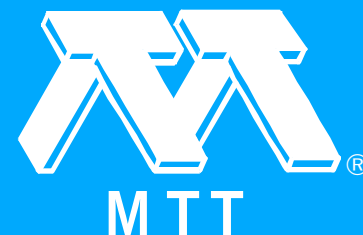
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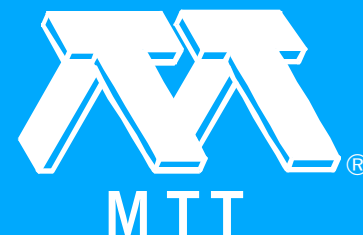
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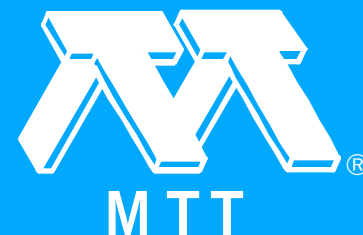
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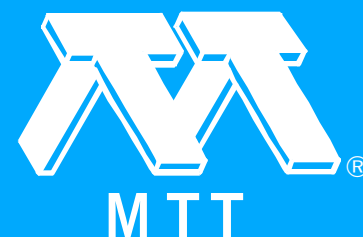
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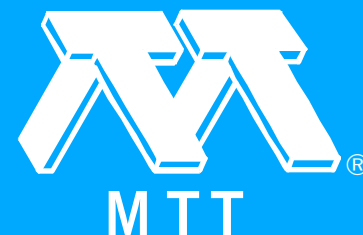
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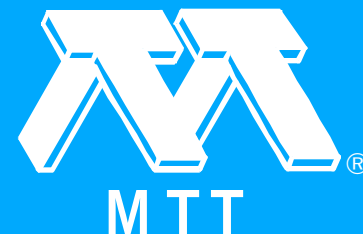
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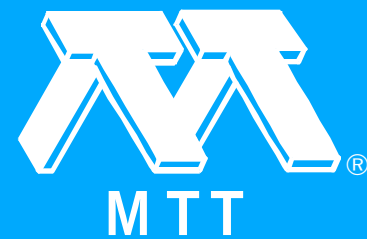
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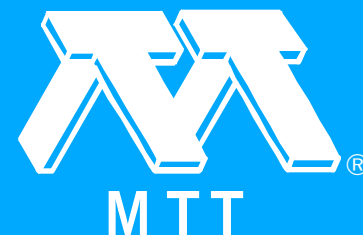
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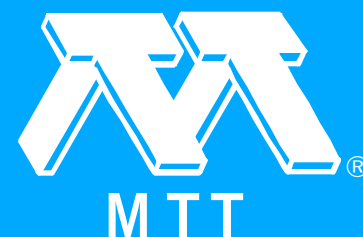
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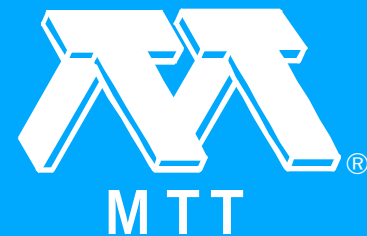
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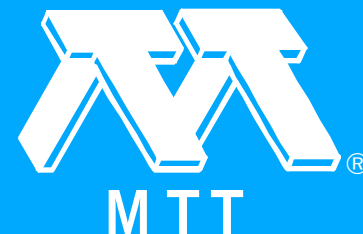


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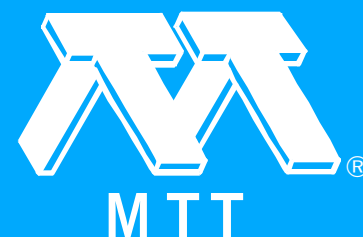
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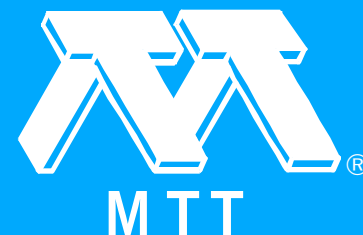
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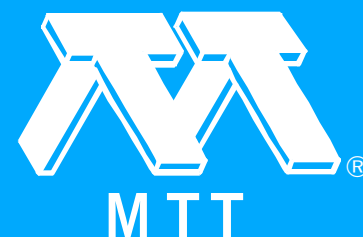
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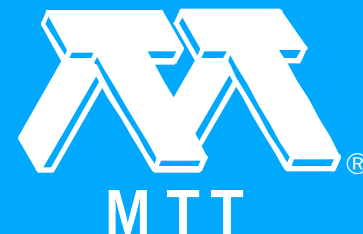
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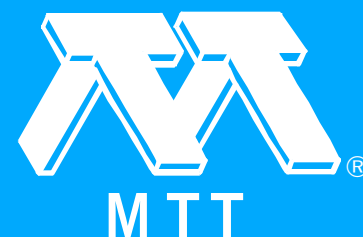
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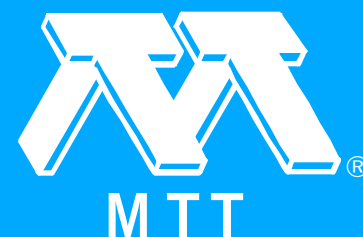
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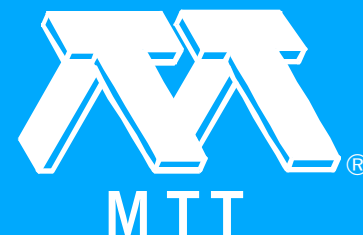
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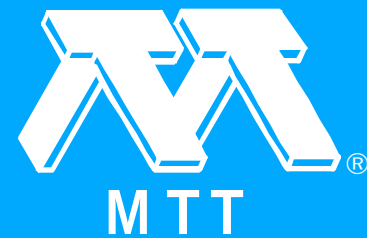
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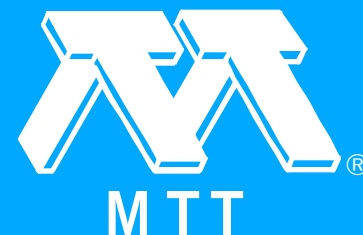
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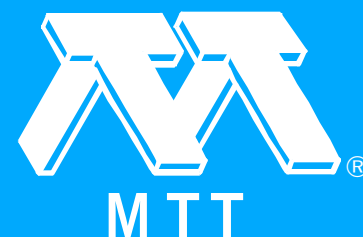
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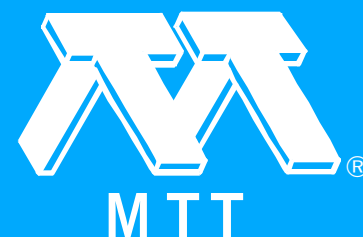
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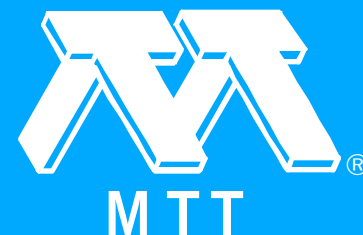
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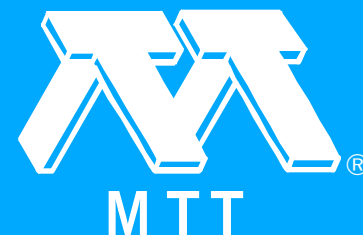
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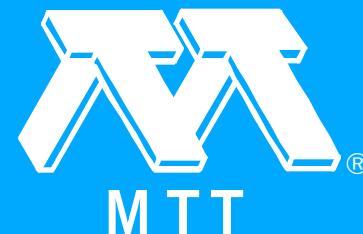
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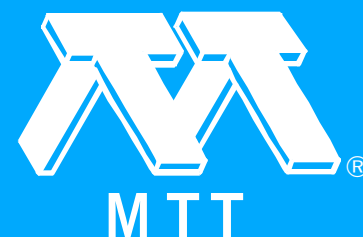
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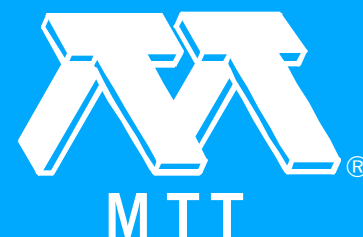
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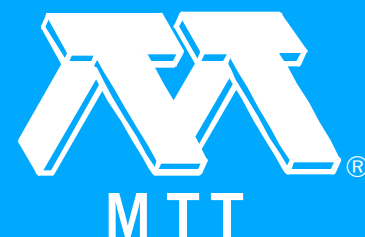
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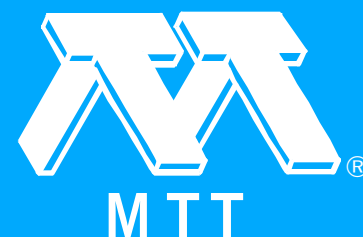
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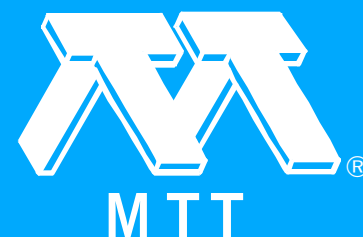
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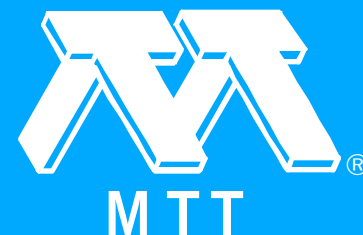
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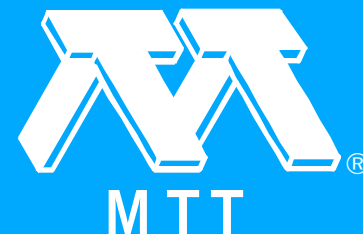
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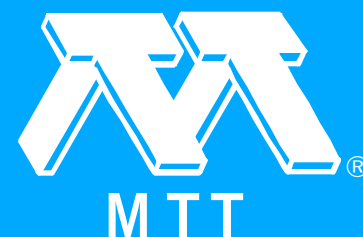
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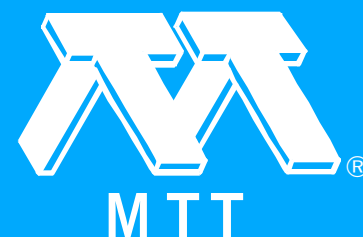
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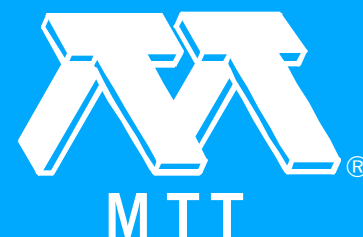
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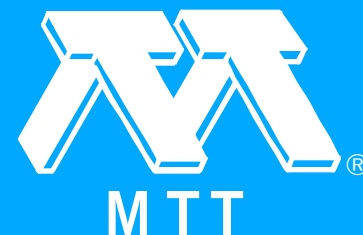
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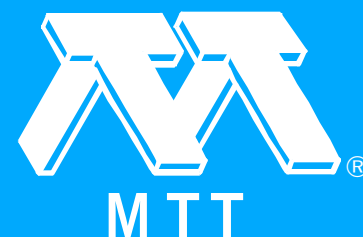
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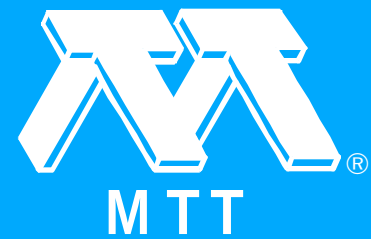
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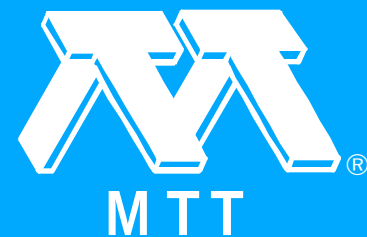
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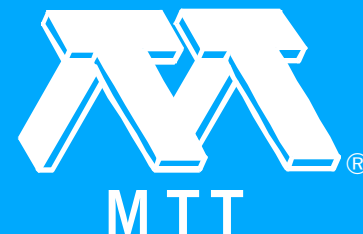
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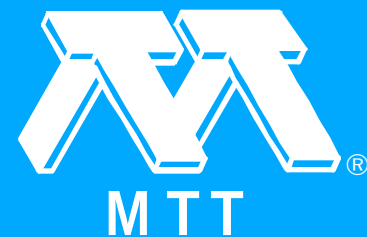
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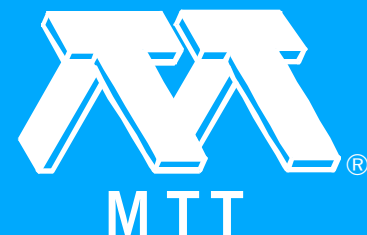
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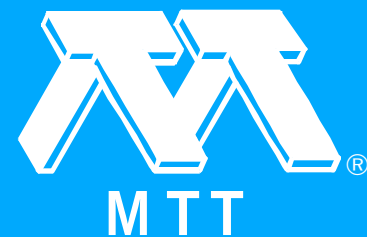
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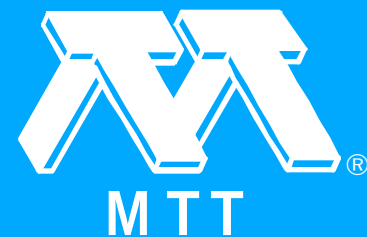
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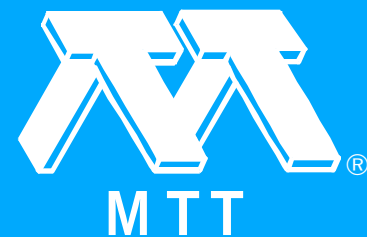
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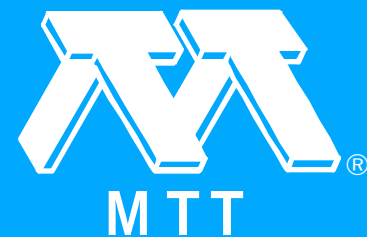
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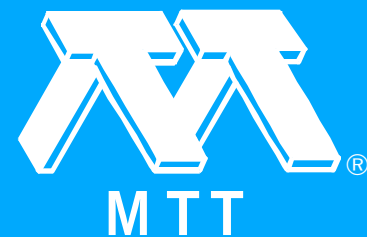
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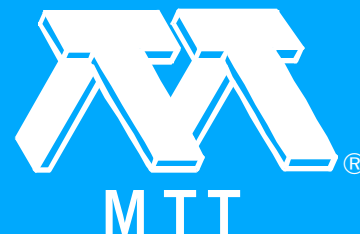
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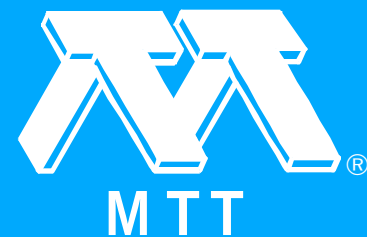
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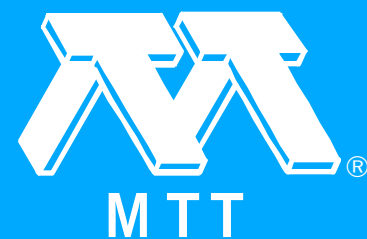
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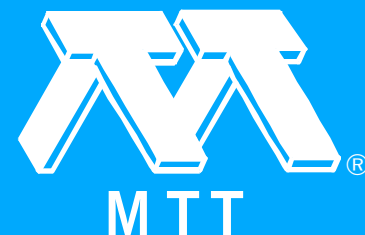
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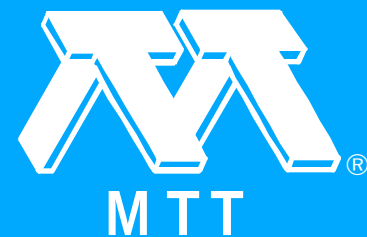
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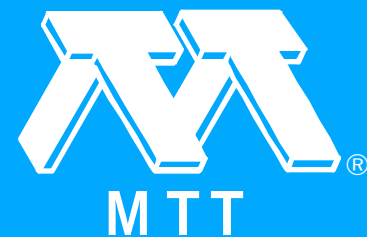
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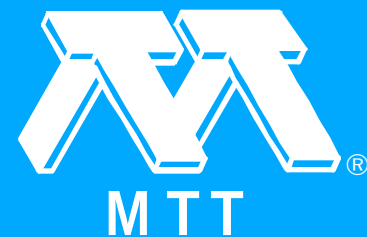
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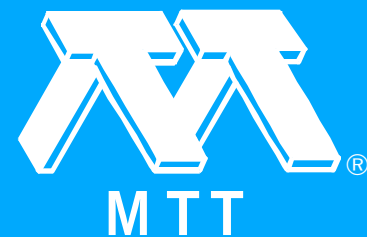
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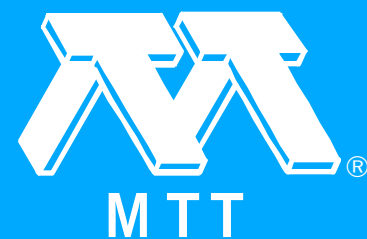
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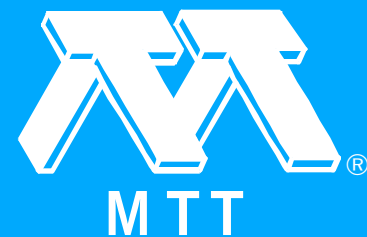
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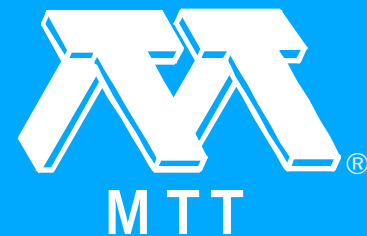
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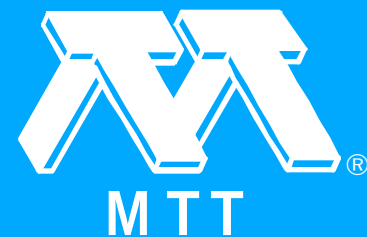
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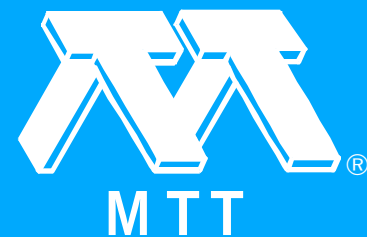
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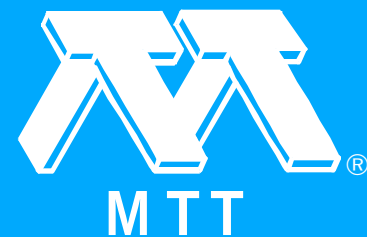
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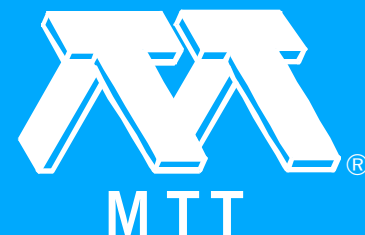
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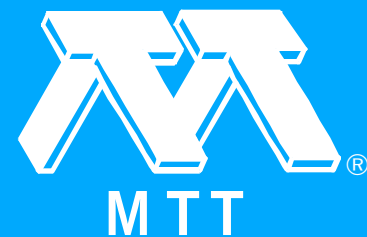
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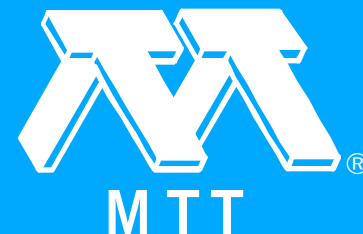
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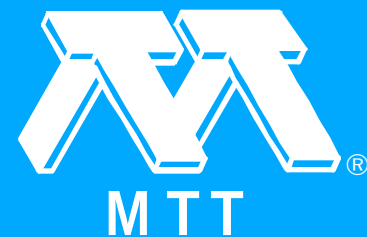
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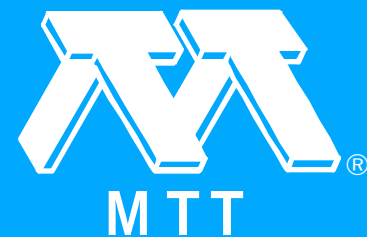
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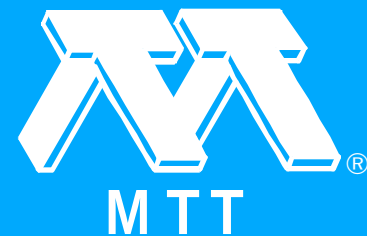
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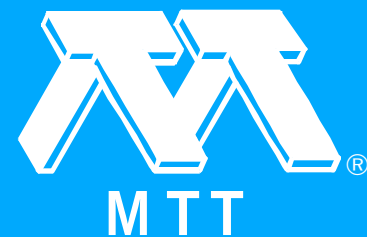
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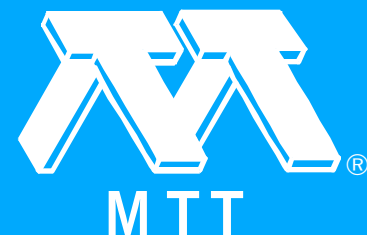
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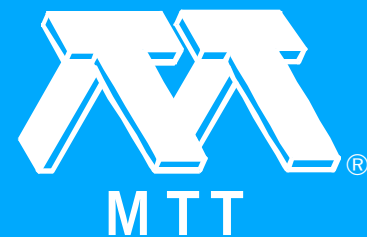
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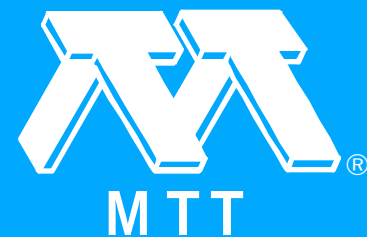
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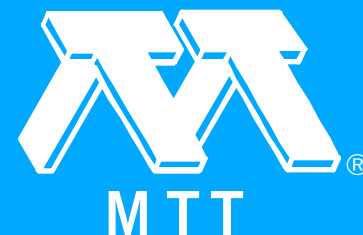


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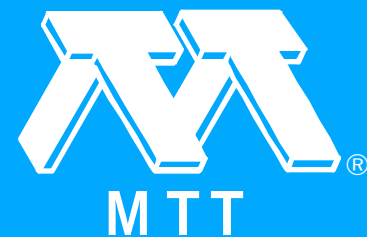
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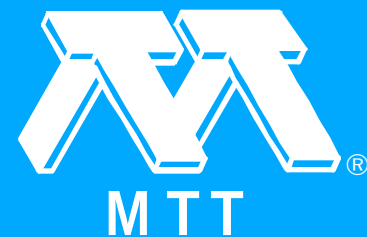
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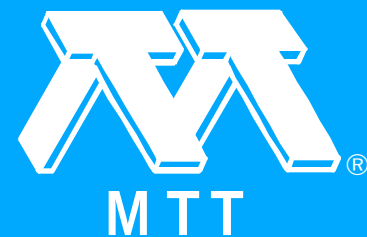
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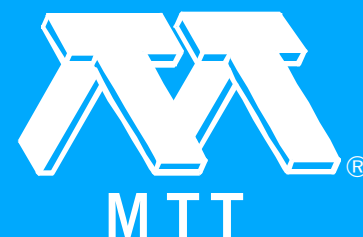
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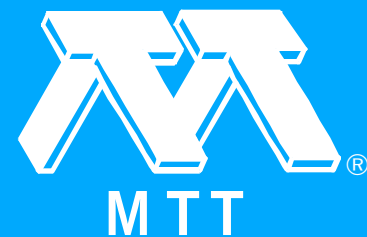
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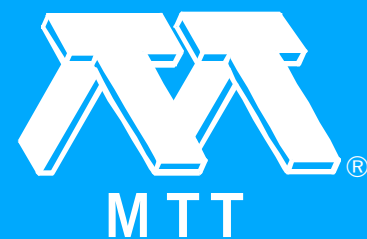
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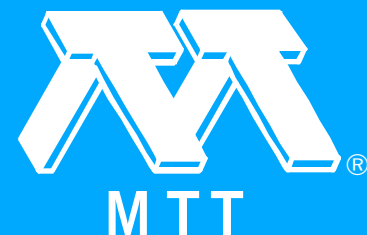
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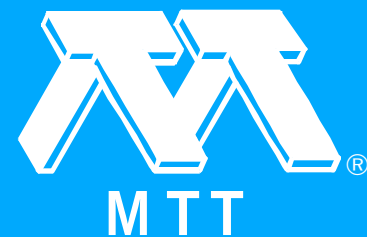
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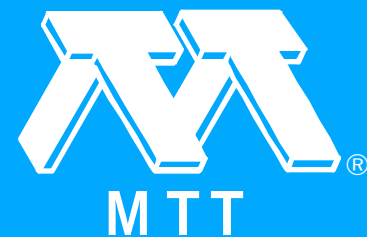
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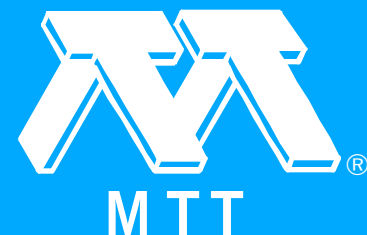
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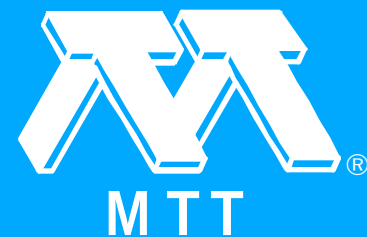
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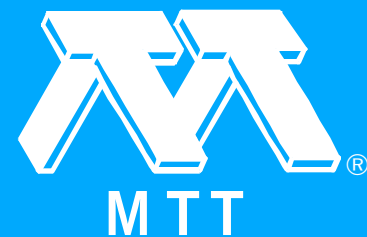
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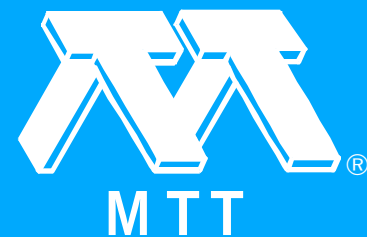
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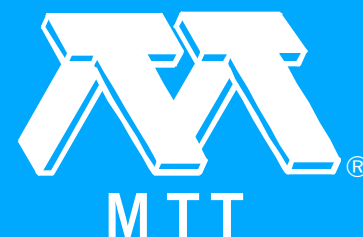
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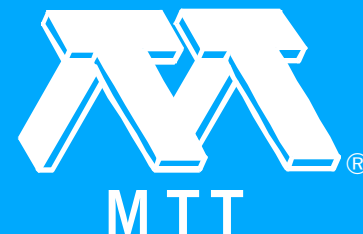
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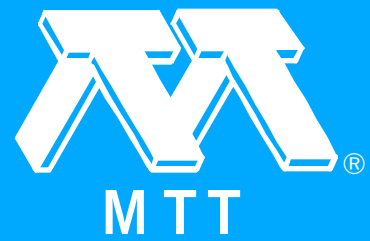
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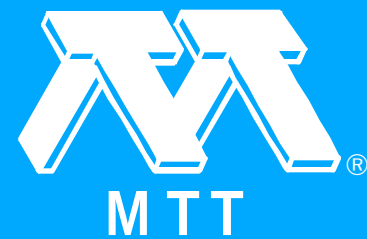
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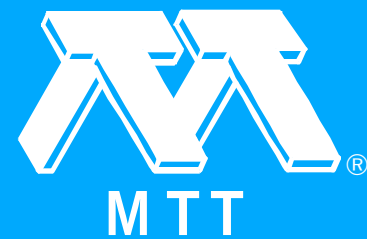
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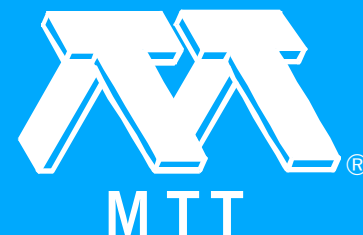
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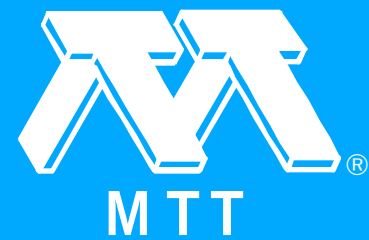
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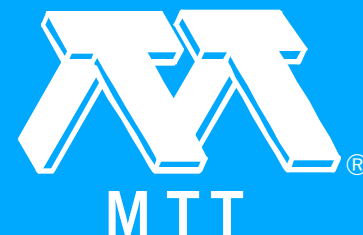
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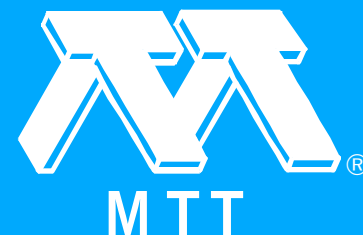
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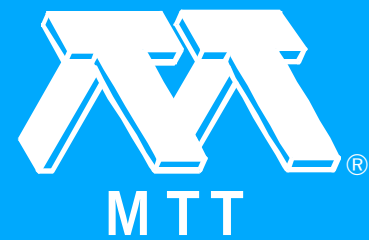
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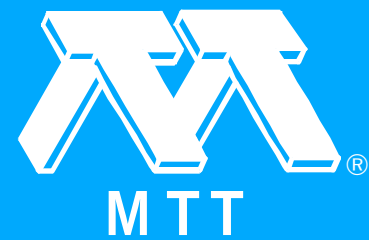
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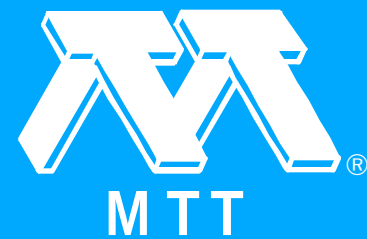
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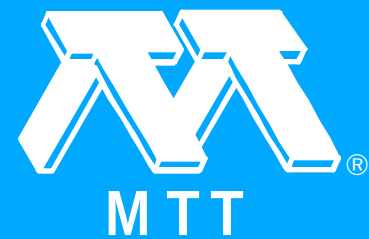
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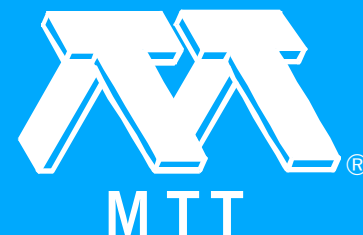
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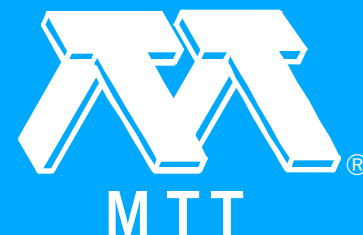
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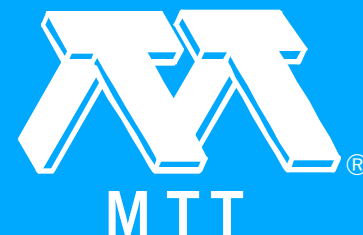
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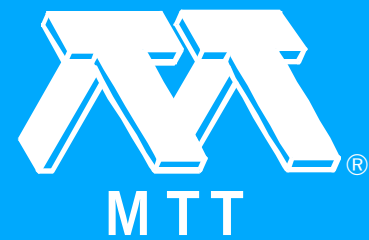
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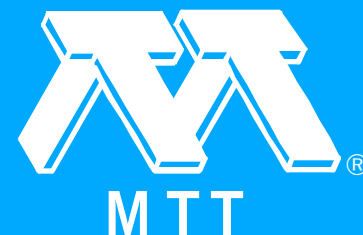
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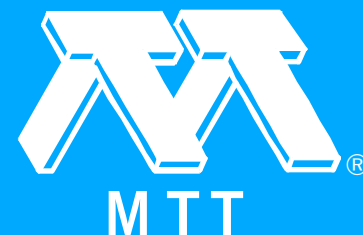
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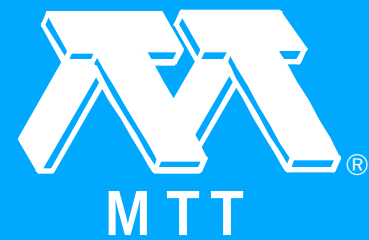
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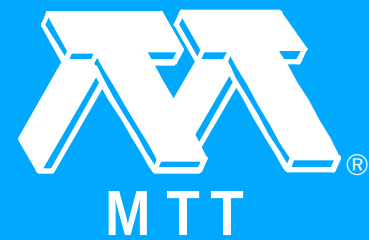
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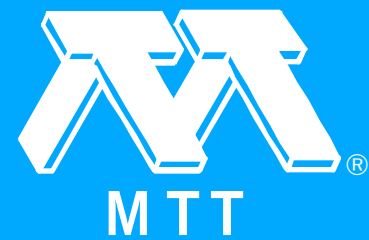
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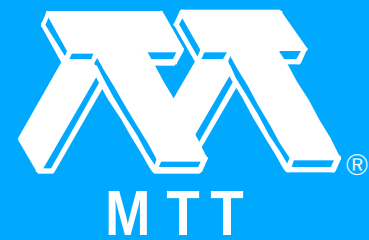
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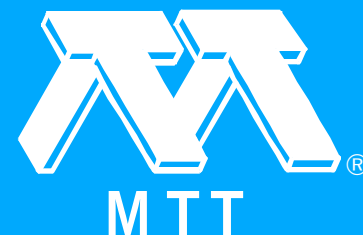
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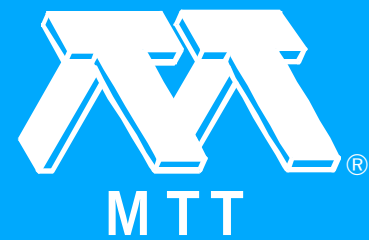
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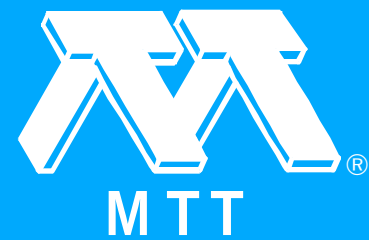
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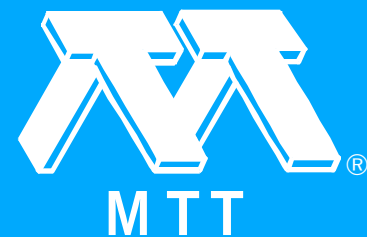
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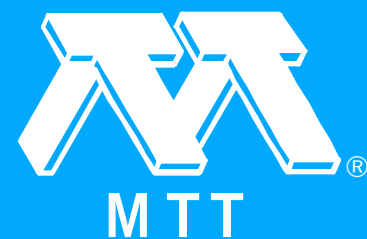
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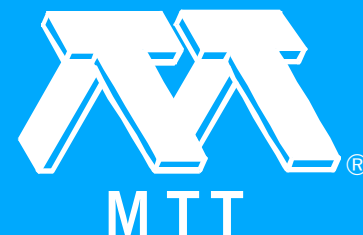
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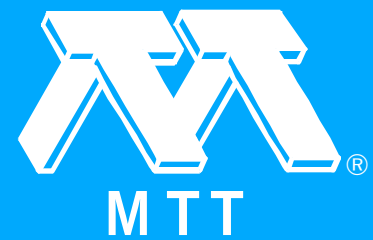
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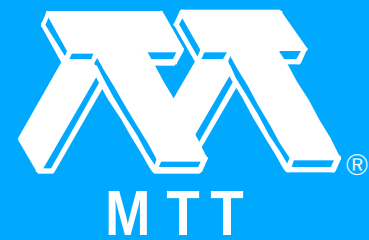
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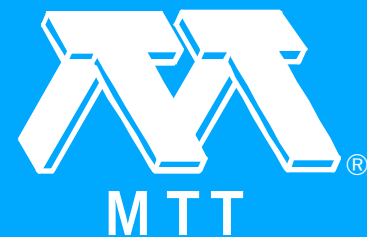
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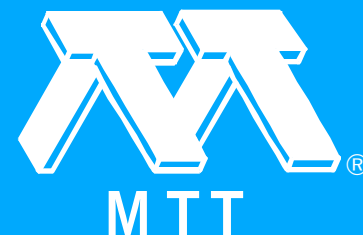
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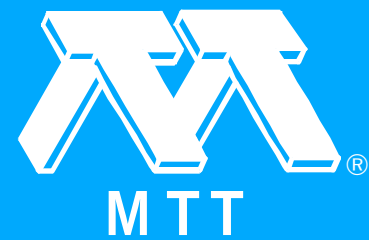
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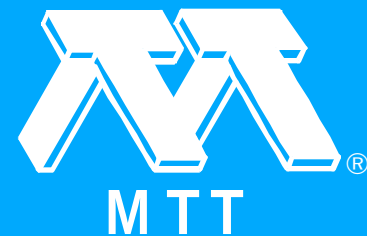
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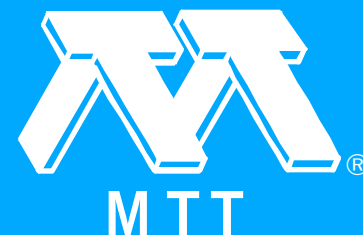
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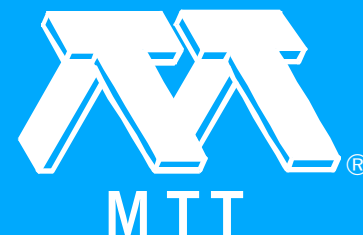


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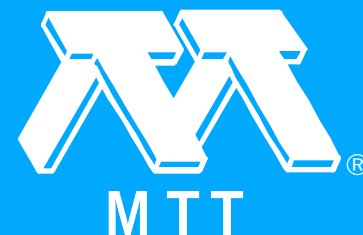
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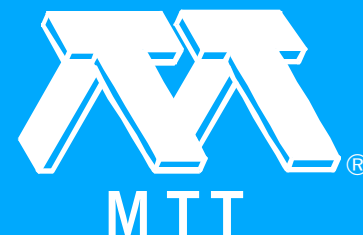
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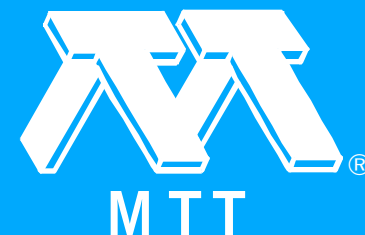
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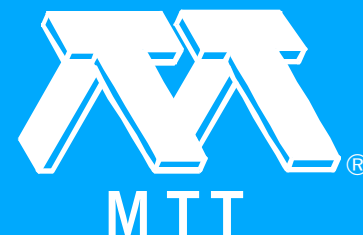


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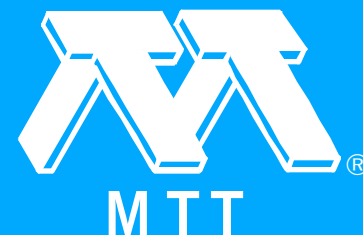
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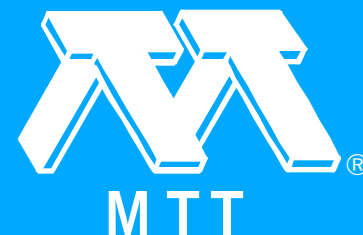
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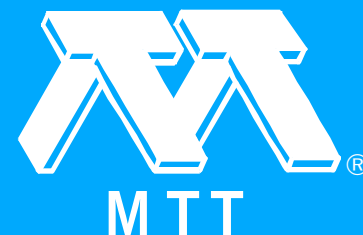
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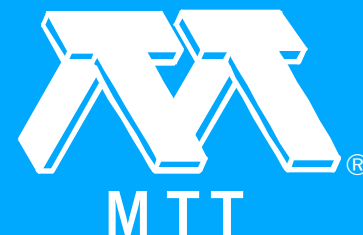
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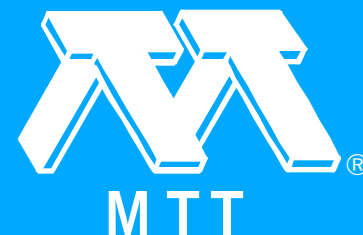
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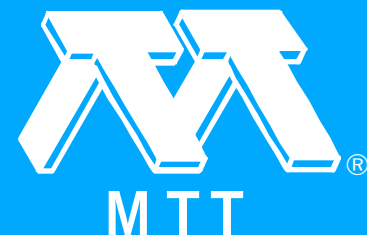
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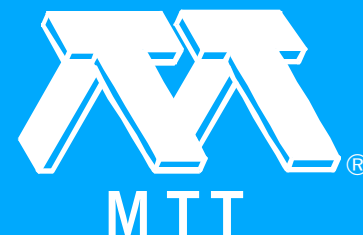


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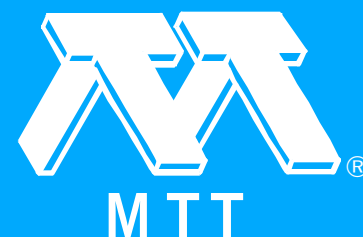
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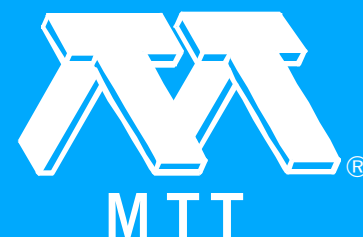


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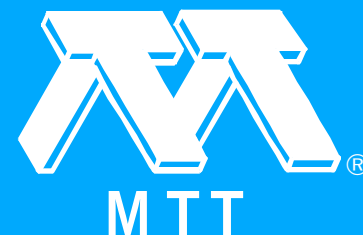
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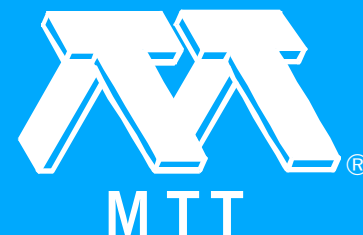
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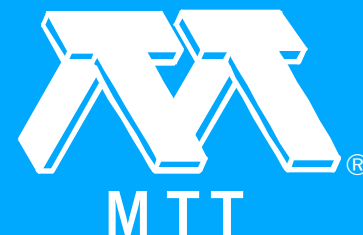
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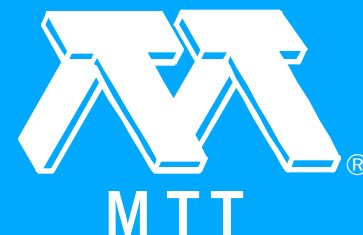
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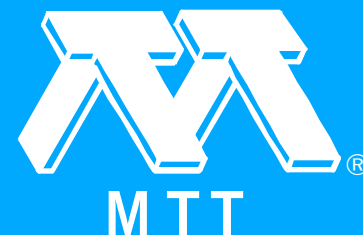
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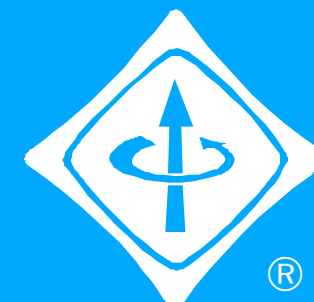
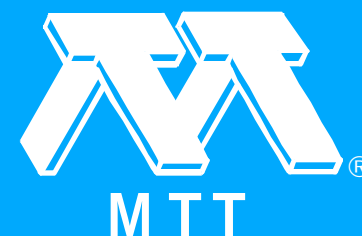
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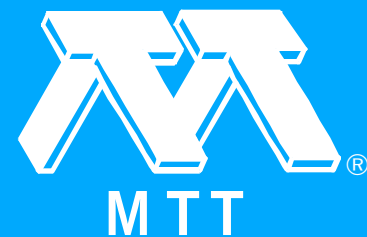
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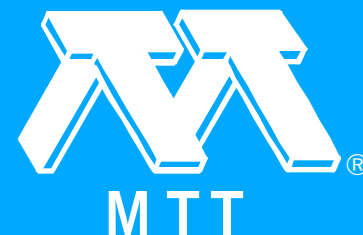
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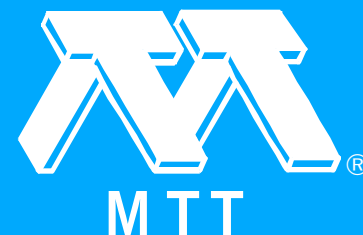
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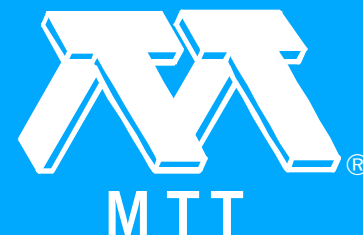
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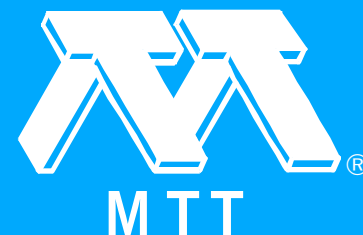
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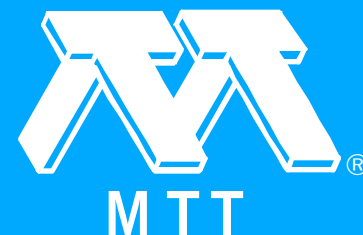
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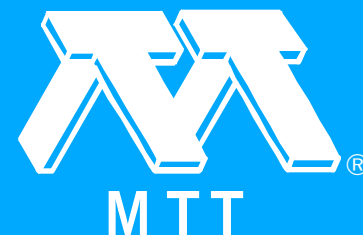
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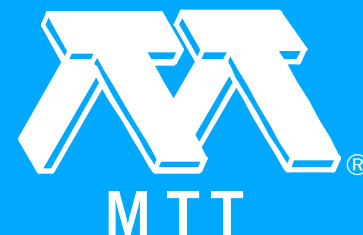
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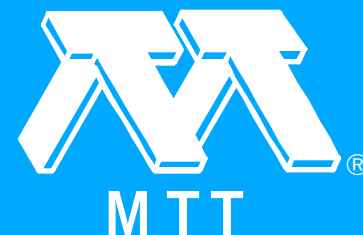
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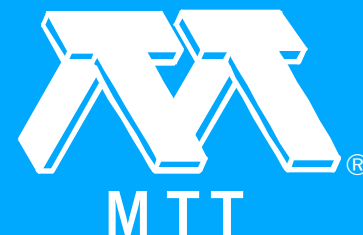
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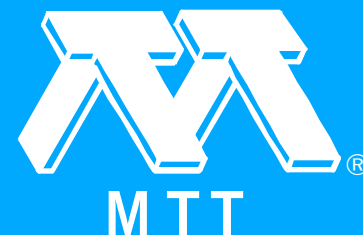
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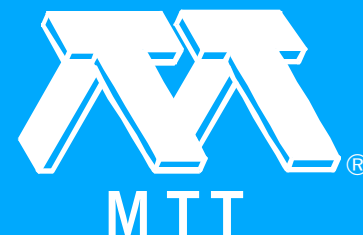
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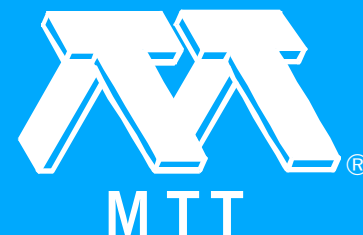
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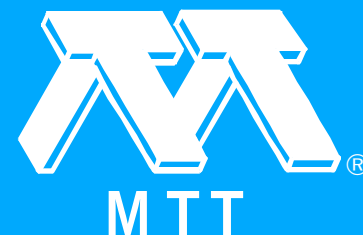
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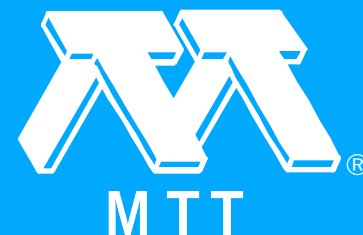
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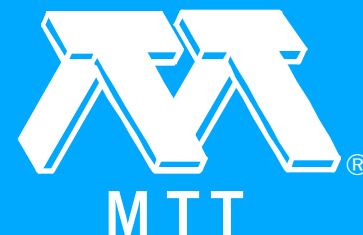
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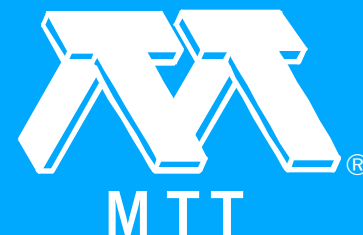
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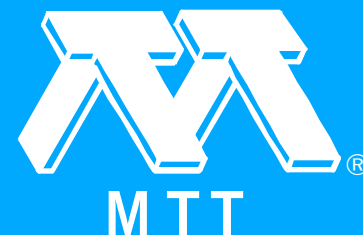
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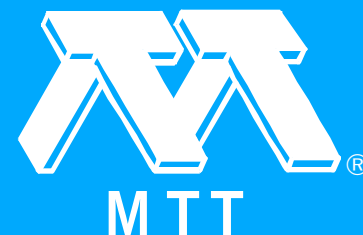
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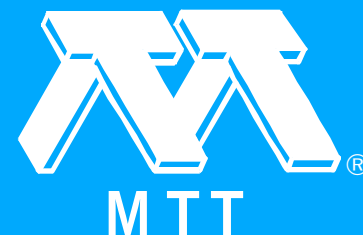
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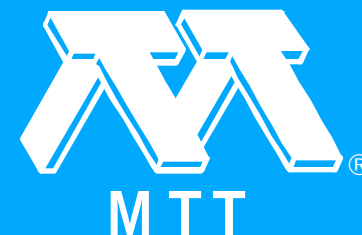
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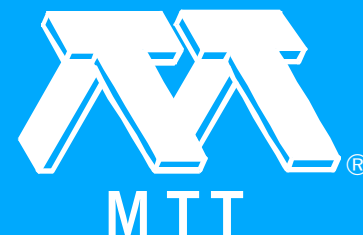
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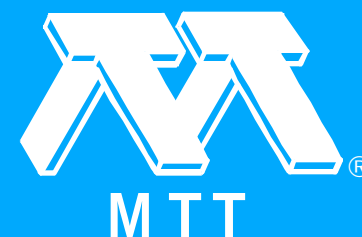
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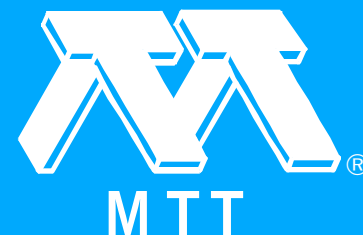
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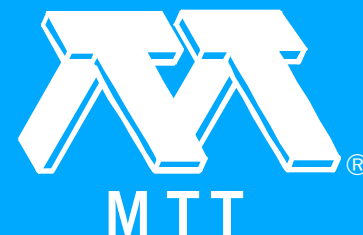
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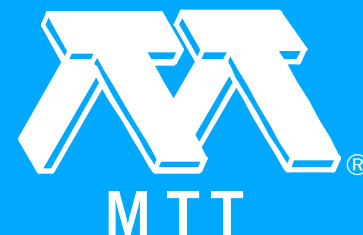
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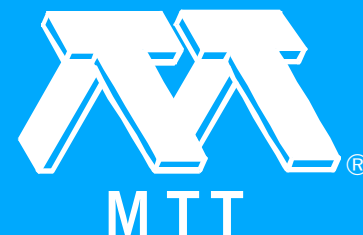
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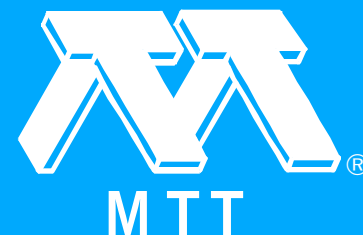
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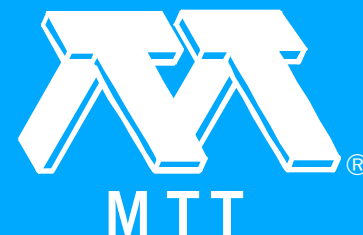
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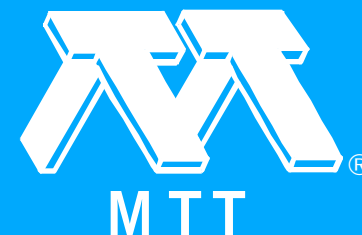
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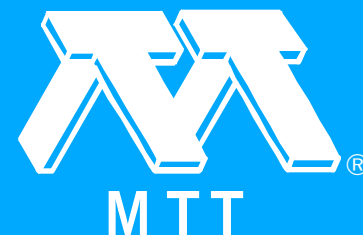
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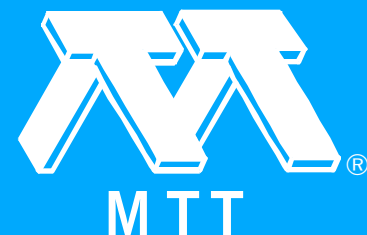
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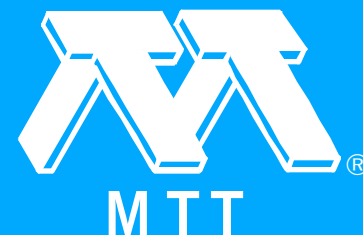
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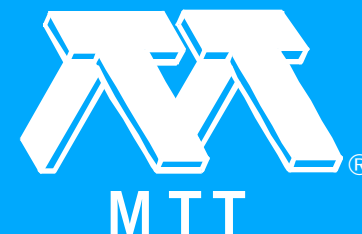
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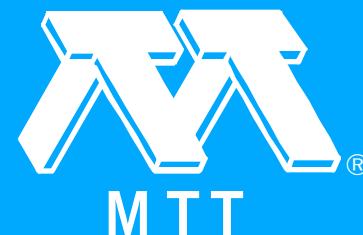
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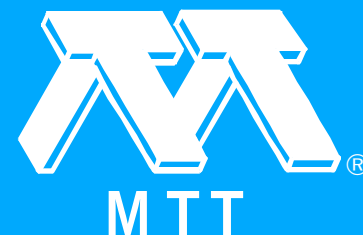
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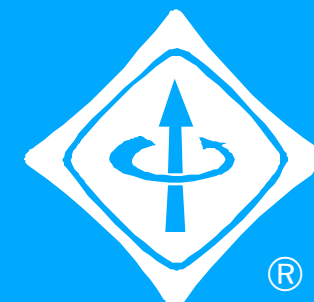
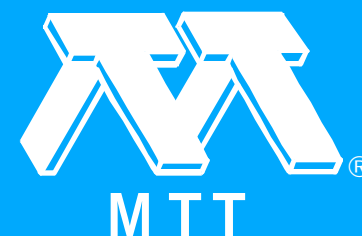
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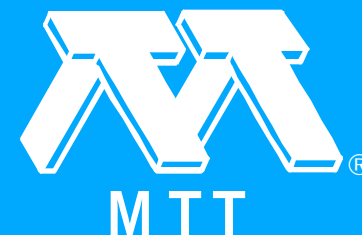
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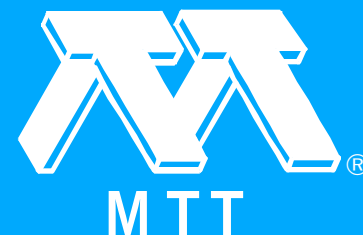
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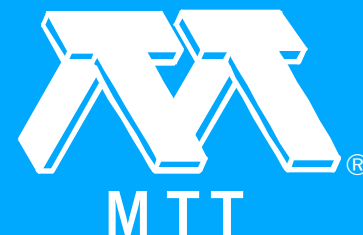
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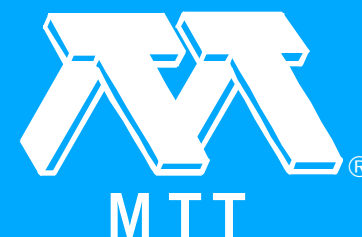
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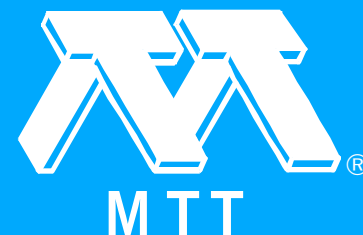
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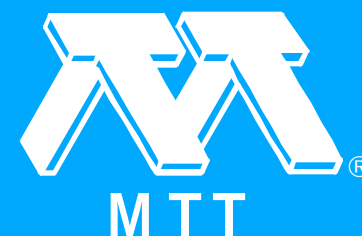
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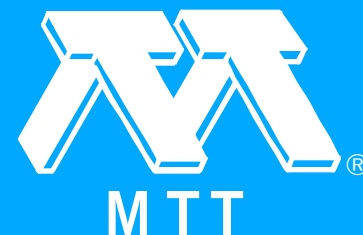
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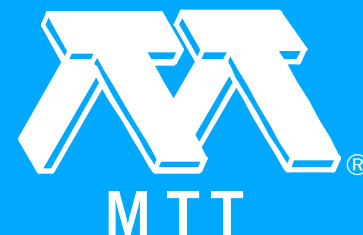
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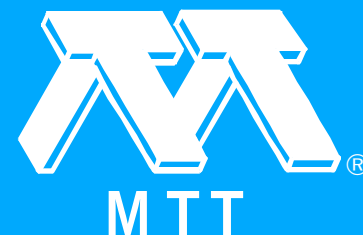
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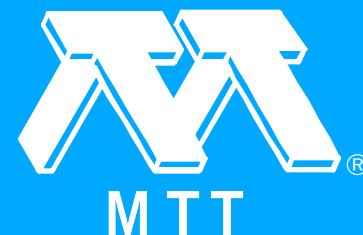
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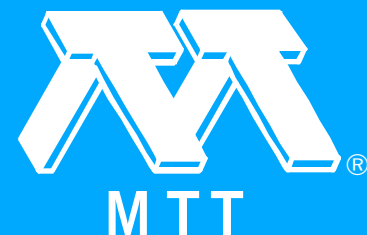
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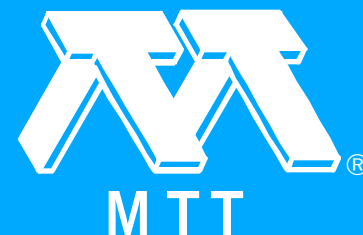
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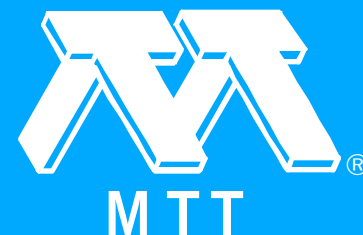
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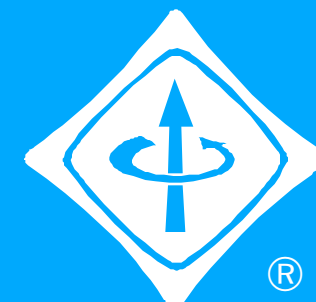
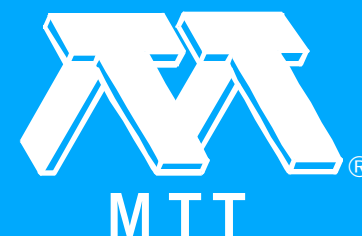
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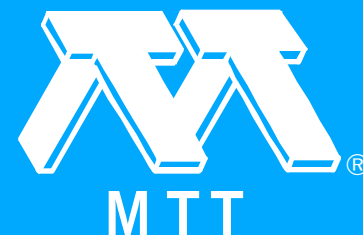
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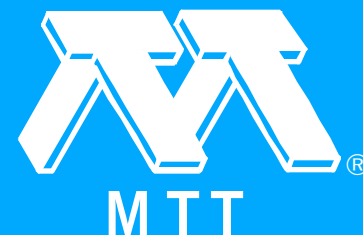
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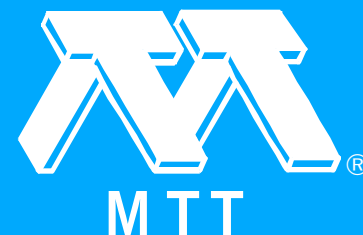
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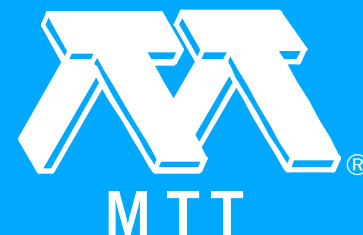
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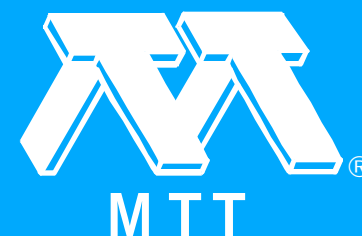
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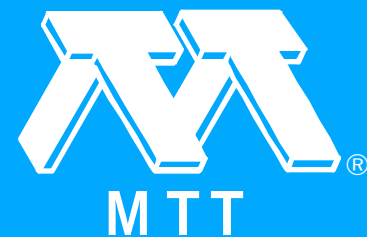
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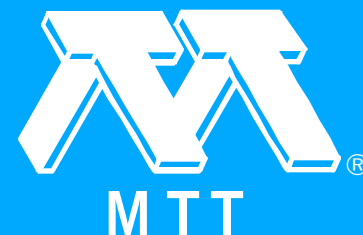
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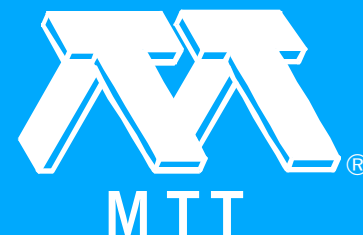


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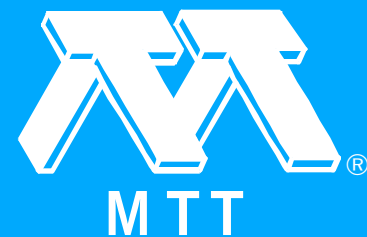
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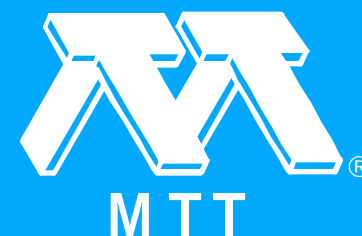
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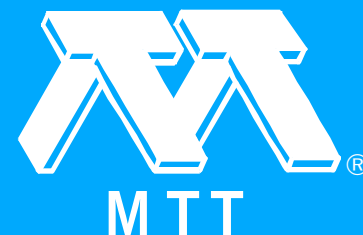
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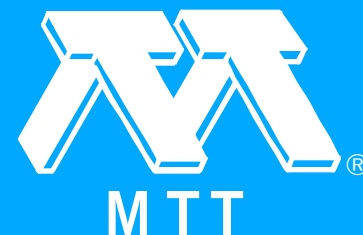
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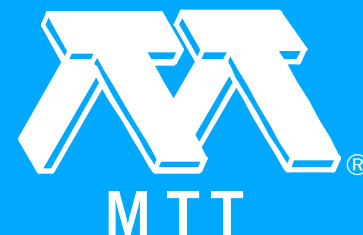
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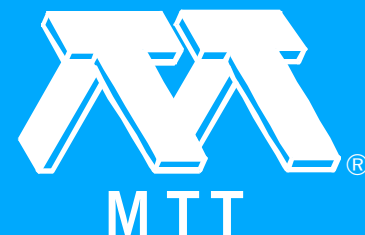
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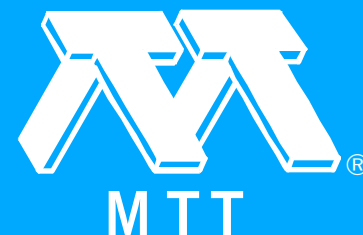
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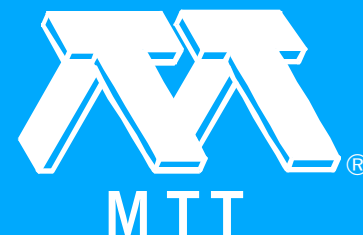
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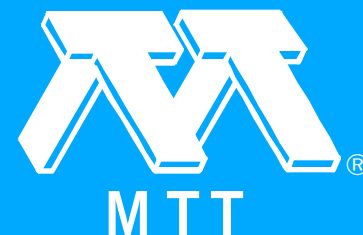
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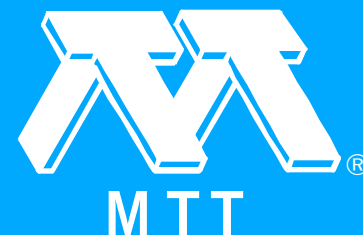
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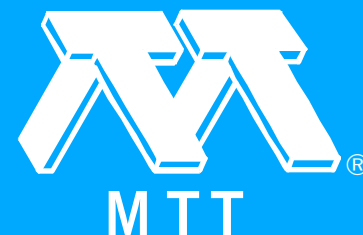
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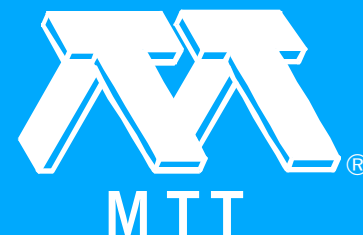


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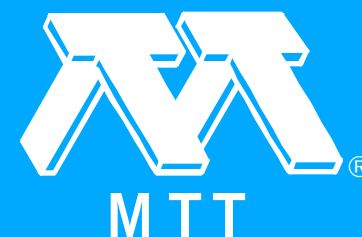
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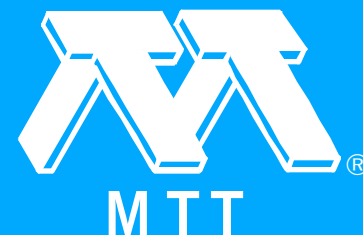
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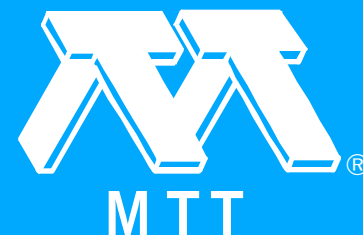
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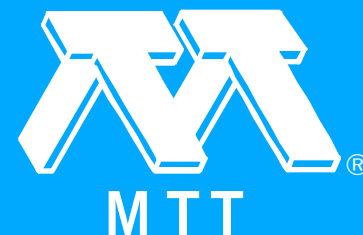
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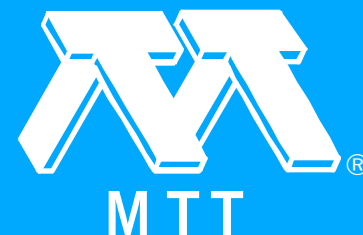
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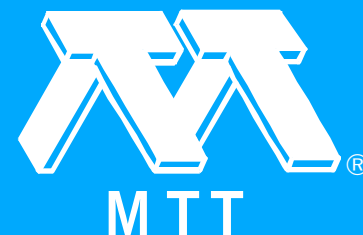
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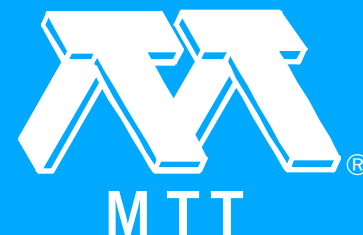


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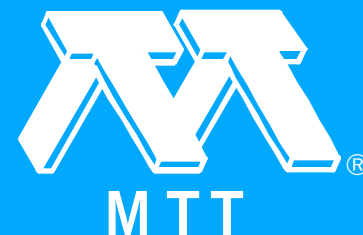
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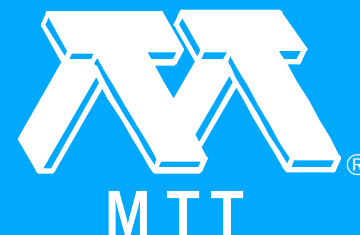
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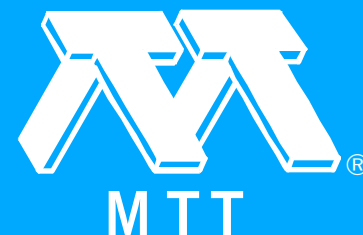
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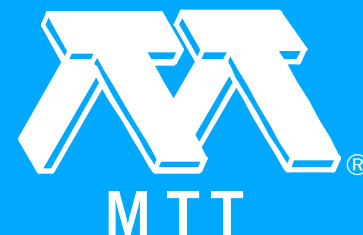
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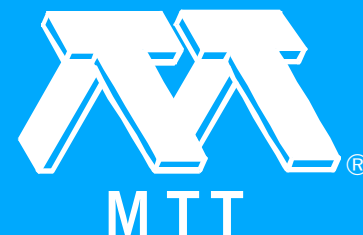
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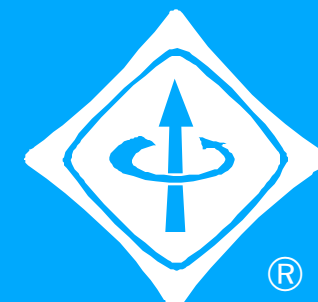
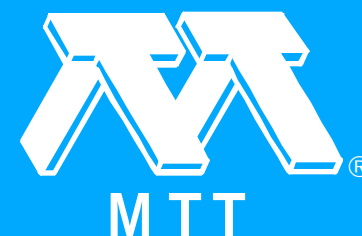
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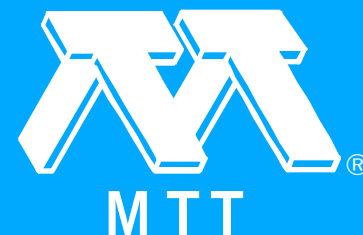
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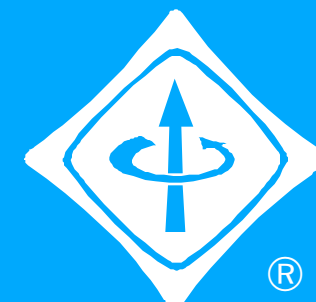
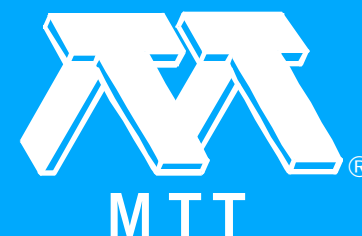
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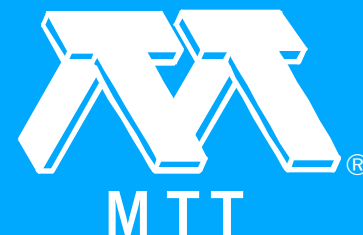
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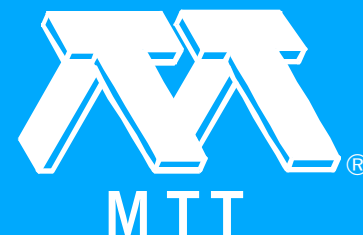
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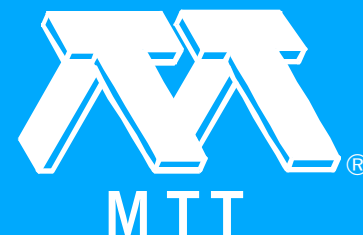
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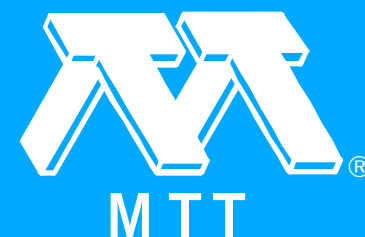
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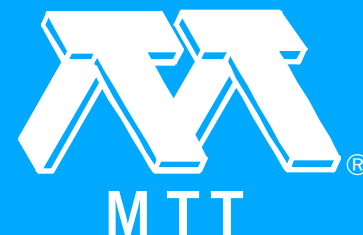


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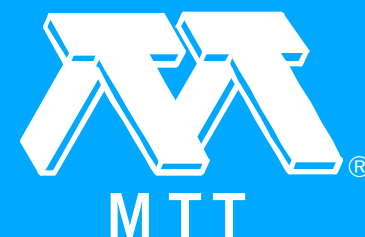
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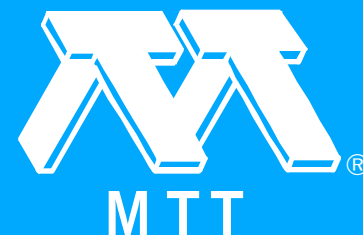
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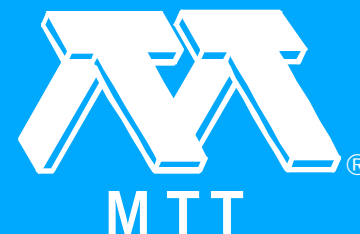
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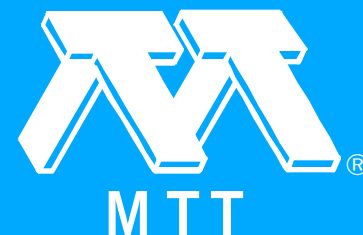
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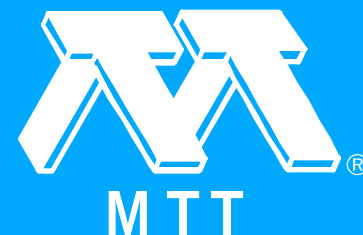
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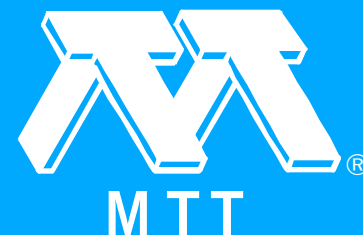
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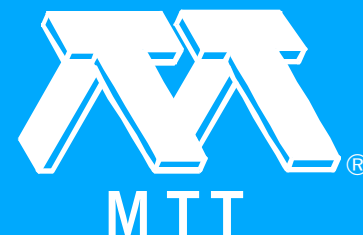
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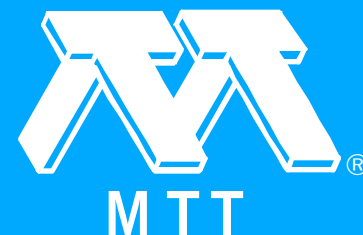
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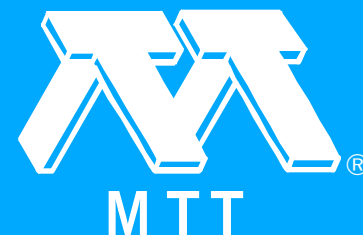
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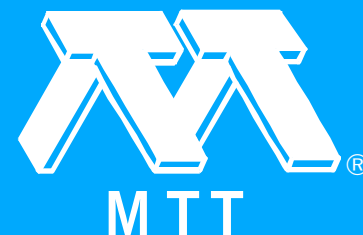


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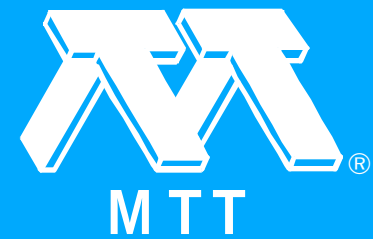
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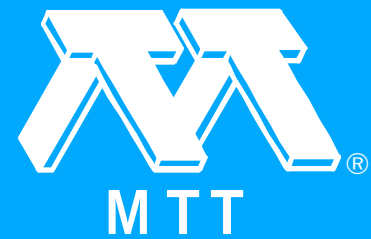
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Editorial (Jan. 1962 [T-MTT])

D.D. King. "Editorial (Jan. 1962 [T-MTT])." 1962 Transactions on Microwave Theory and Techniques 10.1 (Jan. 1962 [T-MTT]): 2-2.

In the face of rapid strides in microwave technology it is appropriate to review from time to time the part played by these Transactions. Through an understanding of what the Transactions On Microwave Theory And Techniques can and should do, we may make better use of what we now have, and improve it in the future as well. What, then, do we aim for in our six issues each year?



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X-Band Ladder-Line Traveling-Wave Maser

G.I. Haddad and J.E. Rowe. "X-Band Ladder-Line Traveling-Wave Maser." 1962 Transactions on Microwave Theory and Techniques 10.1 (Jan. 1962 [T-MTT]): 3-8.

An X-band ruby traveling-wave maser (TWM) has been constructed and tested in which the RF structure is a double-ridge ladder line and the signal is coupled into and out of the structure with coaxial lines. The pump power is propagated in a waveguide mode and the device is operated at and below liquid helium temperatures. A four-inch electromagnet was used. The TWM was operated at the push-pull point with a pump frequency of 24 Gc and a signal frequency of approximately 9.65 Gc; the magnetic field was 4.1 kilogauss. Electronic gains of 15 db have been obtained and bandwidths as high as 130 Mc were observed. Reduced structure losses and longer sections of ruby promise a $G/\sup{1/2}/B$ of 1100 Mc (30 db over 35 Mc).



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Field Expansions in Cavities Containing Gyrotropic Media

J. Van Bladel. "Field Expansions in Cavities Containing Gyrotropic Media." 1962 Transactions on Microwave Theory and Techniques 10.1 (Jan. 1962 [T-MTT]): 9-13.

The electric and magnetic eigenvectors for cavities containing media with tensor characteristics are examined, and explicit formulas for the electric and magnetic fields are obtained in terms of volume and boundary sources.



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An Impedance Transformation Method for Finding the Load Impedance of a Two-Port Network

R. Mittra and R.J. King. "An Impedance Transformation Method for Finding the Load Impedance of a Two-Port Network." 1962 Transactions on Microwave Theory and Techniques 10.1 (Jan. 1962 [T-MTT]): 13-19.

An unknown load impedance terminating a lossy two-port junction can be calculated if the input impedance and junction parameters are known. It is to be shown that there exists a linear relationship, dependent upon two calibration constants, between the input reflection coefficient and a modified reflection coefficient of the load. Applying the linear transformation to the junction input impedance permits evaluation of the unknown load impedance. Calibration is accomplished by terminating the transmission line in at least three different reactance and measuring the corresponding input reflection coefficients. These data plot into the usual circular configuration on a Smith chart from which the necessary calibration data is obtained. When several load reactances are used, the calibration accuracy can be considerably increased, since the averaging advantage of plotting a mean straight line is utilized. Furthermore, once the junction has been calibrated, its equivalent T-network impedances and scattering coefficients may be found.



Abstracts

Criteria for Designing High-Power Coupled Wave Duplexers and Isolators

L.R. Whicker, G.J. Neumann and F.E. Munyak. "Criteria for Designing High-Power Coupled Wave Duplexers and Isolators." 1962 Transactions on Microwave Theory and Techniques 10.1 (Jan. 1962 [T-MTT]): 20-25.

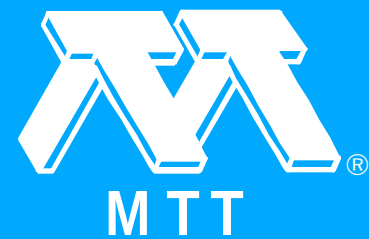
This paper presents criteria for designing nonreciprocal coupled-wave devices which may be used as isolators, circulators and duplexers. An experimental model of such a device was designed and tested over a 6 per cent frequency band centered at 35 kMc, and the obtained data are in good agreement with the theory. Such devices should have numerous applications as they offer the capability of operating under extremely high power levels, and are not restricted to dominant mode operation.



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Scattering Coefficients for Wall Impedance Changes in Waveguides

E.L. Johansen. "Scattering Coefficients for Wall Impedance Changes in Waveguides." 1962 Transactions on Microwave Theory and Techniques 10.1 (Jan. 1962 [T-MTT]): 26-29.

The Wiener-Hopf technique is used to obtain an exact solution to a two-dimensional scattering problem. In the problem solved, an incident TE/₁₀/ mode, traveling from $z = -\infty$ in the positive z direction, is confined by infinite bounding planes; these planes have infinite conductivity for $z < 0$ and an impedance $Z_{1/}$, for $z > 0$. The scattering from the junction at $z = 0$ gives rise to reflection and transmission coefficients that are exactly determined. An approximate solution for the reflection coefficients is also given when the TE/₁₀/ mode is incident from the opposite direction. Finally, a table is presented which lists some transmission and reflection coefficients for rectangular and circular waveguides with discontinuities in the wall impedances.

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Abstracts

An Apparent Anomaly in the Group and Energy Velocity in a Dielectrically Loaded Slow-Wave Structure

G.B. Walker and C.G. Englefield. "An Apparent Anomaly in the Group and Energy Velocity in a Dielectrically Loaded Slow-Wave Structure." 1962 Transactions on Microwave Theory and Techniques 10.1 (Jan. 1962 [T-MTT]): 30-33.

This paper is concerned with group and energy velocity in a cylindrical guide periodically loaded with dielectric disks. For a TM wave a confluence may be obtained between the first and second pass band of such a structure by arranging that the characteristic impedances of the air and dielectric regions are equal when the phase change per section is π . It was at first thought that, since the impedances are equal, there would be no reflections from the interfaces. Assuming only forward waves, however, the equivalence of group and energy velocity is violated. The detailed analysis presented here shows that, mathematically, infinitely many solutions for the field pattern at the matched π mode are possible but that only one of these has physical significance. For this one pattern the group and energy velocities are equal.



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Parallel Push-Pull Hybrid Circuit

M. Miyagi. "Parallel Push-Pull Hybrid Circuit." 1962 Transactions on Microwave Theory and Techniques 10.1 (Jan. 1962 [T-MTT]): 34-40.

This paper deals with a new hybrid circuit for signal branching or combining in parallel push-pull amplifiers. The purpose of the new hybrid circuit is to perform the branching or combining of two pairs of signals for parallel push-pull operation, each consisting of two oppositely phased, balanced signals. The advantage of combining two pairs of parallel push-pull signals by a single component of new hybrid circuit is clear; one would require a multiplicity of conventional rat-race circuits to do the same job, inasmuch as the basic rat-race circuit is limited to only one pair of push-pull signals. The new hybrid circuit is further elaborated to improve the performance for combining unbalanced push-pull signals by: (1) showing that the combination of unbalanced push-pull signals is equivalent to the super-position of cophase components on the balanced antiphase components; (2) analyzing the effect of the cophase components in the hybrid circuit; and (3) devising means of improving the adverse effects of the cophase components. Finally, an evaluation is made of a parallel push-pull amplifier using the new hybrid circuit in comparison with the conventional rat-race circuits required for the same parallel push-pull operation.





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Ridge Waveguide Field Description and Application to Directional Couplers

W.J. Getsinger. "Ridge Waveguide Field Description and Application to Directional Couplers." 1962 Transactions on Microwave Theory and Techniques 10.1 (Jan. 1962 [T-MTT]): 41-50.

An approximate determination of the dominant-mode fields in ridge waveguides at all frequencies has been made. Evaluations of the fields along the walls of a commercially standard single-ridge guide having a usable frequency range from 3.75 to 15.0 Gc, and a commercially standard double-ridge guide having a usable frequency range from 4.7 to 11.0 Gc were carried out, and graphs drawn so that the results could be applied to practical situations. The graphs were used to design some ridge-waveguide directional couplers. Both cross-guide and broad-wall couplers were made in single-ridge waveguides and in double-ridge waveguides, using cross sections approximating those of the above commercially available ridge guides. The validity of the field graphs was demonstrated by the close correspondence between measured and predicted coupling for the cross-guide couplers, and by achieving predicted equality of coupling at the band ends for the broad-wall couplers.

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Abstracts

A New Technique for the Measurement of Spinwave Linewidths from the Saturation of the Ferrimagnetic Resonance Line

P.E. Seiden. "A New Technique for the Measurement of Spinwave Linewidths from the Saturation of the Ferrimagnetic Resonance Line." 1962 Transactions on Microwave Theory and Techniques 10.1 (Jan. 1962 [T-MTT]): 51-54.

A new measurement technique is described that records the ferromagnetic saturation curve in a way that permits the Suhl critical field to be evaluated directly from the recording. This technique eliminates the tedious task of constructing point by point saturation curves for evaluating the critical field and shortens immensely the time required to determine spinwave linewidths from the saturation of the ferromagnetic resonance line.



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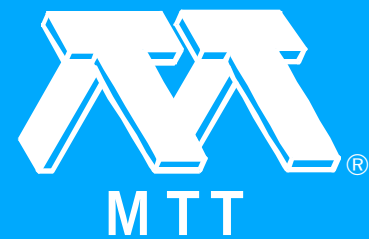
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Frequency Doubling Using Ferrite Slabs, Particularly Planar Ferrites

I. Bady. "Frequency Doubling Using Ferrite Slabs, Particularly Planar Ferrites." 1962 Transactions on Microwave Theory and Techniques 10.1 (Jan. 1962 [T-MTT]): 55-64.

An analysis is given of the results of frequency doubling experiments using relatively thick ferrite slabs. The primary frequency was 9100 Mc. It is shown that the dielectric properties of the ferrite cause the double-frequency wave to behave as a surface wave. This tends to concentrate the double-frequency fields in the vicinity of the ferrite, thus increasing its interaction with the oscillating magnetic-dipole moments that generate these fields and increasing the conversion efficiency. However, the surface-wave effect also causes a phase difference between the magnetic-dipole moments and the double-frequency fields, and this limits the efficiency obtainable through this effect. Experimental data give reasonable agreement with calculated results. Spinwave effects are considered, and it is shown that they can contribute to harmonic generation if the precession orbits of their magnetization vectors are highly elliptical. The best conversion efficiency obtained in these experiments was -11.1 db at a peak input power level of 6300 w. Planar ferrites have inherent advantages over isotropic ferrites because the planar anisotropy greatly increases the ellipticity of the precession of the magnetization vectors of both the uniform mode and the spinwaves. The relatively large dielectric constant of planar ferrites is also helpful to frequency doubling.





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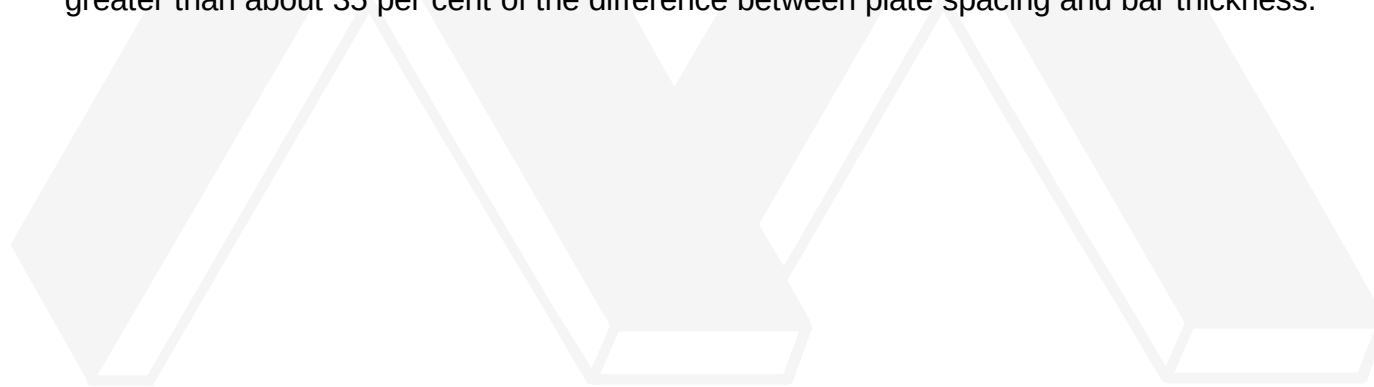
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Coupled Rectangular Bars Between Parallel Plates

W.J. Getsinger. "Coupled Rectangular Bars Between Parallel Plates." 1962 Transactions on Microwave Theory and Techniques 10.1 (Jan. 1962 [T-MTT]): 65-72.

Curves are presented giving the even-mode fringing capacitance, the odd-mode fringing capacitance, and the difference between odd- and even-mode fringing capacitances for wide ranges of thickness and spacing of rectangular bars centered between parallel plates. Simple formulas are given relating these capacitances to even- and odd-mode characteristic impedances of coupled rectangular bars. Possible applications to strip-line and other circuits are described. The appendix gives the derivation of the fringing, capacitances by conformal mapping techniques. The results are exact for bars extending in width infinitely far from the coupling region, and have only small error (less than 1.24 per cent) for bars whose width is greater than about 35 per cent of the difference between plate spacing and bar thickness.



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A Sampling Measurement of Multimode Waveguide Power

E.D. Sharp and E.M.T. Jones. "A Sampling Measurement of Multimode Waveguide Power." 1962 Transactions on Microwave Theory and Techniques 10.1 (Jan. 1962 [T-MTT]): 73-82.

This paper describes a simple method of measuring the total power that is propagating at various frequencies in a multimode, rectangular waveguide. It is particularly useful for determining the power that is generated at harmonic frequencies by high-power transmitters. In this method, the amplitude of the waveguide fields at a number of frequencies is sampled at evenly spaced points around the waveguide periphery. It is shown theoretically that by averaging the squares of the sampled field amplitudes, the total multimode power at the various frequencies can be determined to within ± 2 or ± 5 db, depending upon which combinations of waveguide fields are measured. The theoretical accuracy is verified by measurements at both low and high powers.

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Abstracts

Some Effects of Dielectric Loading on Ferrite Phase Shifters in Rectangular Waveguide (Correspondence)

A.K. Jordan. "Some Effects of Dielectric Loading on Ferrite Phase Shifters in Rectangular Waveguide (Correspondence)." 1962 Transactions on Microwave Theory and Techniques 10.1 (Jan. 1962 [T-MTT]): 83-84.

The use of dielectric loading with the ferrites in nonreciprocal transmission lines has become quite prevalent. The theoretical analysis of unloaded ferrite phase shifters in rectangular waveguide has been extended to the dielectrically loaded case by Soohoo. The boundary-value problem of ferrite phase shifters in dielectrically loaded coaxial lines, which possesses a transcendental equation similar to the waveguide case, has been thoroughly discussed by several authors.



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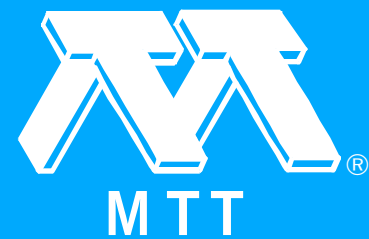
The Gyromagnetic Coupling Limiter at C-Band (Correspondence)

*J. Clark and J. Brown. "The Gyromagnetic Coupling Limiter at C-Band (Correspondence)."
1962 Transactions on Microwave Theory and Techniques 10.1 (Jan. 1962 [T-MTT]): 84-85.*

The original paper of DeGrasse and subsequent publications dealing with the use the crossed-strip gyromagnetic coupler as a limiter have been concerned with the operation of this device below 3300 Mc. At these frequencies the limiter exhibits a sharp threshold at a very low power level, in the neighborhood of -20 dbm. Fig. 1 illustrates typical flat leakage characteristics at a frequency of 2600 Mc. A single crystal YIG sphere of 2 mils was used in this limiter.

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Practical Microwave Power Limiters (Correspondence)

J. Brown and J. Clark. "Practical Microwave Power Limiters (Correspondence)." 1962 Transactions on Microwave Theory and Techniques 10.1 (Jan. 1962 [T-MTT]): 85-86.

The near future holds considerable promise for the utilization of solid-state limiters as receiver protection elements. This correspondence describes the performance of ferrimagnetic limiters in the actual role of diode protection. The peak powers involved in the tests were up to 25 kw.

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Abstracts

Temporal Instabilities in Traveling-Wave Parametric Amplifiers (Correspondence)

E.S. Cassedy. "Temporal Instabilities in Traveling-Wave Parametric Amplifiers (Correspondence)." 1962 Transactions on Microwave Theory and Techniques 10.1 (Jan. 1962 [T-MTT]): 86-87.

The basic traveling-wave parametric amplifier (TWPA), as here defined, consists of an all-pass uniform transmission-line structure in which the distributed circuit elements are modulated in time and space by a progressive pumping wave. TWPA's, in general, have aroused great interest due to the possibilities of wide-band amplification, as predicted by coupled mode theory. It is the purpose of this communication to show that temporal instabilities exists on the basic TWPA (or its dual) when the frequency relations are of the negative-resistance type (the inverting modulator of Manley and Rowe). It is found, from the exact solution for time harmonic waves existing on this line, that under these conditions waves growing in time are present, rather than waves growing in distance along the line.



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Abstracts

Novel Method to Orient Ferrimagnetic Single-Crystal Spheres (Correspondence)

M. Auer. "Novel Method to Orient Ferrimagnetic Single-Crystal Spheres (Correspondence)." 1962 Transactions on Microwave Theory and Techniques 10.1 (Jan. 1962 [T-MTT]): 88-88.

The method used to orient ferromagnetic single-crystal spheres has been the traditional X-ray technique. It is the purpose of this article to propose an orientation method which is simple and inexpensive, and which may be carried out by the microwave engineer or technician in his own laboratory.



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Tunnel Diode Burnout from the Video Transient of Gaseous (Correspondence)

C. Blake and W.J. Ince. "Tunnel Diode Burnout from the Video Transient of Gaseous (Correspondence)." 1962 Transactions on Microwave Theory and Techniques 10.1 (Jan. 1962 [T-MTT]): 88-88.

The helix-coupled, coaxial, gaseous noise source poses a burnout hazard to tunnel diodes unless certain precautions are taken. The attached oscillograms illustrate the transient in question. Typical short-circuit peak currents are 300 ma. The transient is a consequence of the sudden forced transition of the helix core from a nonconducting, unionized gaseous media to that of a conducting plasma. The transient coupled to the helix is easily suppressed with a high-pass or band-pass filter, or even by adequate padding. If only a pad is used, a word of warning is in order. The pad must be of the type that attenuates video, as well as radio, frequency.

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Radiation from a Rectangular Waveguide Filled with Ferrite (Remarks and Author's Reply)

H. Unz and G. Tyras. "Radiation from a Rectangular Waveguide Filled with Ferrite (Remarks and Author's Reply)." 1962 Transactions on Microwave Theory and Techniques 10.1 (Jan. 1962 [T-MTT]): 88-89.

These remarks concern the solution of the boundary value problem for the case of longitudinally magnetized ferrites between two perfectly conducting parallel planes. The above-mentioned paper by Tyras and Held treated only a very special particular case of propagation in the anisotropic media. A more general approach to the problem and a general solution will be given in this note. Throughout this note the author has kept most of the notation as in the original paper.

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Second-Harmonic Effects in Tuned Reflectometers (Correspondence)

M.M. Brady. "Second-Harmonic Effects in Tuned Reflectometers (Correspondence)." 1962 Transactions on Microwave Theory and Techniques 10.1 (Jan. 1962 [T-MTT]): 90-91.

The theory of operation of the tuned microwave reflectometer has been well documented in the literature and its operating characteristics have been described in great detail. According to reflectometer theory, as a short slides in the output waveguide of a tuned reflectometer a pattern of detector response vs short displacement similar to that shown in Fig. 1 will be observed. The over-all slope of the pattern is due to attenuation in the output waveguide, while the regular variations are due to the less than ideal tuning of the reflectometer. In the practical operation of a reflectometer the pattern shown in Fig. 2 can be observed. Such a pattern obviously will result in errors in the determination of the magnitude and positions of maxima and minima. It is the purpose of this note to explain this pattern and the errors it can produce and to suggest a simple remedy.

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Abstracts

A High-Capacitance Parametric Diode for Use at Low Frequencies (Correspondence)

R.E. Aitchison. "A High-Capacitance Parametric Diode for Use at Low Frequencies (Correspondence)." 1962 Transactions on Microwave Theory and Techniques 10.1 (Jan. 1962 [T-MTT]): 91-91.

For operation of parametric amplifiers at low frequencies and at low-impedance levels a parametric diode of very large capacitance is necessary.



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A Nonreflective Hybrid Stop-Band Filter (Correspondence)

R.D. Wanselow. "A Nonreflective Hybrid Stop-Band Filter (Correspondence)." 1962 Transactions on Microwave Theory and Techniques 10.1 (Jan. 1962 [T-MTT]): 91-91.

A novel waveguide stop-band filter employing a four terminal hybrid circuit and two lossy cavity resonators has been developed. With this circuit, adjustable frequency sensitive loss can be accomplished with very little reflection similar to directional filter type operation. The circuit utilizes the diplexing characteristics of two adjacent ports of a standard 3-db short slot forward-wave directional coupler. Two identical cavities, each filled with lossy dielectric material, produce the necessary loss. Fig. 1 shows a schematic diagram of the device.

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Abstracts

A New Electronic Phase Shifter (Correspondence)

M.D. Rubin. "A New Electronic Phase Shifter (Correspondence)." 1962 Transactions on Microwave Theory and Techniques 10.1 (Jan. 1962 [T-MTT]): 92-92.

With the imminent feasibility of very large electronically-scanned phased-array antennas, has come the necessity for suitable circuitry for accurately shifting phase of very many elements. A scheme, which is now receiving some attention, was described by the author in February, 1960, in a Mitre memo, which has achieved some circulation in Air Force circles.



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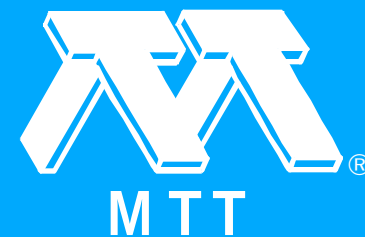
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Contributors (Jan. 1962 [T-MTT])

I. Bady, C.G. Englefield, W.J. Getsinger, G.I. Haddad, E.L. Johansen, E.M.T. Jones, R.J. King, R. Mittra, M. Miyagi, F.E. Munyak, G.J. Neumann, J.E. Rowe, P.E. Seiden, E.D. Sharp, J.G. Van Bladel, G.B. Walker and L.R. Whicker. "Contributors (Jan. 1962 [T-MTT])." 1962 Transactions on Microwave Theory and Techniques 10.1 (Jan. 1962 [T-MTT]): 93-95.



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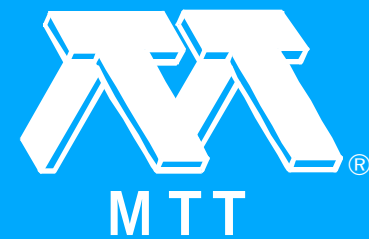
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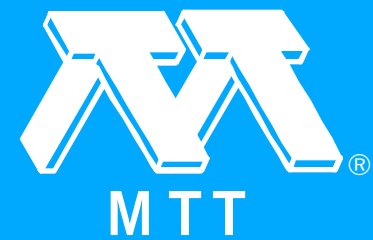
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"Table of Contents (Mar. 1962 [T-MTT])." 1962 Transactions on Microwave Theory and Techniques 10.2 (Mar. 1962 [T-MTT]): 97-97.



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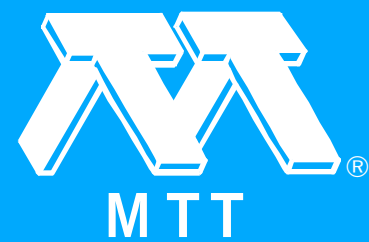
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A Microwave Ferrite Single-Sideband Modulator

A. Clavin. "A Microwave Ferrite Single-Sideband Modulator." 1962 *Transactions on Microwave Theory and Techniques* 10.2 (Mar. 1962 [T-MTT]): 98-102.

A microwave single-sideband modulator has been designed utilizing two reflection types of Faraday rotation ferrite-balanced modulators. Power is fed to the two balanced modulators by means of a 3-db quadrature hybrid such that each modulator has equal incident power with a 90-degree phase difference. The output power of the balanced modulators is combined by means of a magic tee sum and difference circuit. It is shown that if the modulation signals applied to the balanced modulators are in phase quadrature, the upper sideband will appear at the output sum arm and the lower sideband will appear in the output difference arm. An analysis of the device relates the spurious and undesired sidebands to the conversion loss, and a method is proposed for minimizing carrier output. The drive power is reduced due to the use of reflection-type balanced modulators, and experimental data is presented for the modulation frequency impedance and drive power requirements. The temperature and frequency sensitivity of the undesired sidebands have also been measured. A number of applications of the device are discussed.

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A Nondegenerate Traveling-Wave Parametric Amplifier

K.P. Grabowski. "A Nondegenerate Traveling-Wave Parametric Amplifier." 1962 Transactions on Microwave Theory and Techniques 10.2 (Mar. 1962 [T-MTT]): 103-107.

The traveling-wave parametric amplifiers reported to date are not sufficiently competitive to ensure their use in advanced radar systems. The major hindrance is the relatively high-radar noise figure which is due to the fact that the signal and idler frequencies are about equal; i.e., the amplifier is degenerate. Initial experiments directed toward obtaining a nondegenerate microwave traveling-wave parametric amplifier are reported in this paper. A promising circuit has been developed and an S-band nondegenerate amplifier has been built and tested. In the first part of the paper the circuit is described and the experimental results are given. The second part of the paper describes procedures which have proved useful in the development of the circuit and which should also prove useful in future investigations.



Line Width and Bandwidth of Millimeter-Wave Resonance Isolators

P. Vilmur and K. Ishii. "Line Width and Bandwidth of Millimeter-Wave Resonance Isolators." 1962 Transactions on Microwave Theory and Techniques 10.2 (Mar. 1962 [T-MTT]): 108-113.

A theoretical derivation is made of bandwidth as a function of resonant frequency of a single crystal ferrite resonance isolator at millimeter wavelengths. The derivation takes into account the ferrite isolator as a bounded system. Using the derived relation of bandwidth and resonant frequency, and Kittel's relation between resonant frequency and applied field, equations are derived which relate line width to resonant frequency, line width to the applied magnetic field, and line width to frequency bandwidth. These resulting equations are compared with experimental data obtained with a single crystal barium ferrite isolator from 58 to 59 kMc. The theoretical relations agreed closely with the experimental data within the accuracy of the measuring equipment at these frequencies. In general, the results showed that for small frequency ranges (1 kMc) bandwidth and line width increase almost linearly with frequency, bandwidth and line width are linearly related, and line width is a fairly complicated but increasing function of applied field.



Abstracts

Some Characteristics of Microwave Balanced Modulators

R.C. Mackey. "Some Characteristics of Microwave Balanced Modulators." 1962 Transactions on Microwave Theory and Techniques 10.2 (Mar. 1962 [T-MTT]): 114-117.

Microwave modulator characteristics pertinent to two state balanced modulation are discussed. An equivalence between balanced modulation and phase modulation is shown for rectangular modulation waveforms and experimental results are described. The characteristics of a tuned hybrid tee, untuned hybrid tee and novel circulator type of balanced modulator are compared. X-band measurements show that a carrier rejection of 70 db and modulator loss of 3 db can be achieved with carrier levels up to several hundred milliwatts. The carrier rejection of an untuned modulator is dependent on crystal match and data showing dependence of the match on orientation and temperature are presented.



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Symmetric Strip Transmission Line Tee Junction

A.G. Franco and A.A. Oliner. "Symmetric Strip Transmission Line Tee Junction." 1962 Transactions on Microwave Theory and Techniques 10.2 (Mar. 1962 [T-MTT]): 118-124.

Several different network forms have been employed previously to characterize the symmetrical strip-line tee junction and the parameters of these networks have been obtained by various means. In this paper the available theoretical and experimental results are systematically correlated. A choice, based on design convenience, is made of the most appropriate network form, and recommendations are given for the values of each of the parameters in this representation. In some ranges, the available data were inadequate, and additional experimental results were taken in order to clarify the recommendations.

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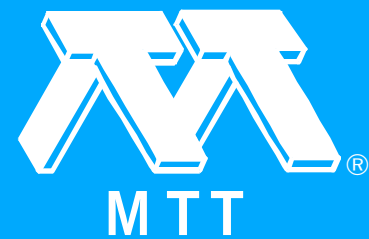


Abstracts

The Use of Exponential Transmission Lines in Microwave Components

C.P. Womack. "The Use of Exponential Transmission Lines in Microwave Components." 1962 Transactions on Microwave Theory and Techniques 10.2 (Mar. 1962 [T-MTT]): 124-132.

This paper describes some techniques for utilizing exponential transmission lines in microwave components in order to reduce element lengths, and hence size and weight, and to significantly increase the operating frequency range. Formulas are developed which relate line length to the frequency and rate of taper for transmission line resonators, and a nomogram is included for easy determination of spurious frequencies. Additional formulas are given for the distributed representation of lumped elements using exponential sections of both coaxial and strip transmission line, and their use described in application to microwave filters and related components. In addition, the paper describes how unusually large rejection bandwidths can easily be obtained by proper selection of the individual element lengths and rates of taper.



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Abstracts

Eigenvalues for a Centrally Loaded Circular Cylindrical Cavity

D.M. Bolle. "Eigenvalues for a Centrally Loaded Circular Cylindrical Cavity." 1962 Transactions on Microwave Theory and Techniques 10.2 (Mar. 1962 [T-MTT]): 133-138.

The general availability of large high-speed computers has made the use of series expansions in complicated field theory problems feasible even when these series do not converge rapidly. This paper outlines the method and illustrates its application to the solution of a problem in cylindrical coordinates. At the same time, the errors inherent in this method of solution are indicated and estimates are made of their magnitudes. A comparison of the method with Slater's perturbation theory is made.



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Abstracts

A Graphical Method for Transforming Impedances and Reflectances Through a Lossy Twoport

O.F. Hinckelmann. "A Graphical Method for Transforming Impedances and Reflectances Through a Lossy Twoport." 1962 Transactions on Microwave Theory and Techniques 10.2 (Mar. 1962 [T-MTT]): 139-141.

In this paper a simple projective geometric construction is applied to the problem of finding the input impedance of a linear lossy twoport junction for a given output port termination. The method, an extension of Bracewell's transducer diagram, is presented in both the impedance and reflectance planes.



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Abstracts

VHF Slow-Wave Slotted Line (Correspondence)

L.L. Oh and C.D. Lunden. "VHF Slow-Wave Slotted Line (Correspondence)." 1962 Transactions on Microwave Theory and Techniques 10.2 (Mar. 1962 [T-MTT]): 142-142.

A slotted line is generally used for voltage-standing-wave-ratio and impedance measurements in the microwave region. Because a slotted line operable down to 25 Mc would be from 10 to 15 feet long, it is impractical for general laboratory use, and is difficult and expensive to construct with the necessary mechanical tolerances.



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Miniature Strip-Line to Waveguide Slot Adapter--Co-Linear (Correspondence)

O. Shahan. "Miniature Strip-Line to Waveguide Slot Adapter--Co-Linear (Correspondence)." 1962 Transactions on Microwave Theory and Techniques 10.2 (Mar. 1962 [T-MTT]): 142-143.

An inline adapter from miniature air dielectric strip transmission line with ground plane spacing of 0.130 in to half height X-band waveguide has been developed by the Microwave Design Group at Hycon Manufacturing Company, Monrovia, Calif. The upper wall of the waveguide was used as the lower ground plane for the stripline. Unity coupling was accomplished through a transverse slot in the common wall. The slot was 0.066-in wide by 0.750-in long surrounded by a metal cavity 0.250 in by 1.000 in built into the ground planes. (See Fig. 1.) The slot junction was matched by use of tunable shorts both in the stripline and the waveguide. The output of the 50-ohm stripline was terminated by a built-in strip-line load whose VSWR was 1.04.

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Abstracts

Discontinuities in the Center Conductor of Symmetric Strip Transmission Line (Addendum)

H.M. Altschuler and A.A. Oliner. "Discontinuities in the Center Conductor of Symmetric Strip Transmission Line (Addendum)." 1962 Transactions on Microwave Theory and Techniques 10.2 (Mar. 1962 [T-MTT]): 143-143.

It has been pointed out to the authors that the formulas contained in their paper refer only to air-filled and not to dielectric-filled strip transmission lines. This is indeed the case and constitutes an omission which is now rectified by sketching the simple extension to the dielectric-filled case.



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Abstracts

A Simple Method for Measuring the Phase Shift and Attenuation through Active Microwave Networks (Correspondence)

J.R. Alday. "A Simple Method for Measuring the Phase Shift and Attenuation through Active Microwave Networks (Correspondence)." 1962 Transactions on Microwave Theory and Techniques 10.2 (Mar. 1962 [T-MTT]): 143-143.

Most methods used to measure the phase shift and attenuation through a microwave network require that the network be matched to the waveguide or the VSWR must be measured. In passive networks, these are simple and straightforward operations. However, in some active networks, principally networks which are time/temperature dependent, these operations become very tedious and time consuming. The method illustrated here can measure the phase shift and attenuation simultaneously, directly, independently, eliminates the inconvenience of measuring the VSWR, or matching the network to the waveguide and consists of generally available microwave equipment.



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Design of Interstage Coupling Apertures for Narrow-Band Tunable Coaxial Band-Pass Filters (Correspondence)

R.M. Kurzrok. "Design of Interstage Coupling Apertures for Narrow-Band Tunable Coaxial Band-Pass Filters (Correspondence)." 1962 Transactions on Microwave Theory and Techniques 10.2 (Mar. 1962 [T-MTT]): 143-144.

The design technique to be described in this note is applicable to tunable coaxial band-pass filters having narrow bandwidths (i.e., less than 10 per cent). In the frequency range of 1500 Mc to about 10,000 Mc, coaxial band-pass filters usually employ coupled $\lambda/4$ resonant cavities.

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Abstracts

Pass-Band VSWR of Maximally Flat Band-Pass Filters (Correspondence)

R.M. Kurzrok. "Pass-Band VSWR of Maximally Flat Band-Pass Filters (Correspondence)." 1962 Transactions on Microwave Theory and Techniques 10.2 (Mar. 1962 [T-MTT]): 145-145.

Microwave band-pass filters using high-Q cavity resonators can often be designed for almost negligible midband dissipation losses (i.e., $< \frac{1}{2}$ db). If these filters are designed for a maximally flat amplitude response, the insertion loss within the pass band is approximately equal to the reflection loss within the pass band.



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Abstracts

An Approximate Method of Finding the Order of a Combination Bessel-Function Equation (Correspondence)

A. Y. Hu. "An Approximate Method of Finding the Order of a Combination Bessel-Function Equation (Correspondence)." 1962 *Transactions on Microwave Theory and Techniques* 10.2 (Mar. 1962 [T-MTT]): 145-146.

Assume a transverse electric wave, TE mode, propagated in a waveguide with a circular boundary.



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Abstracts

A Source of Error in the Use of Slope Detection for Perturbation Measurements (Correspondence)

K.B. Mallory. "A Source of Error in the Use of Slope Detection for Perturbation Measurements (Correspondence)." 1962 Transactions on Microwave Theory and Techniques 10.2 (Mar. 1962 [T-MTT]): 146-147.

In a typical laboratory measurement of the field-intensity distribution in a resonant cavity, the resonant frequency of the cavity is determined as a function of the position of a small metal or dielectric bead. The field distribution itself is then deduced directly from the frequency change.



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Abstracts

A New Microwave Mixer Suitable for Use with Very High Intermediate Frequencies (Correspondence)

P.C. Butson and M.H. Glover. "A New Microwave Mixer Suitable for Use with Very High Intermediate Frequencies (Correspondence)." 1962 Transactions on Microwave Theory and Techniques 10.2 (Mar. 1962 [T-MTT]): 147-148.

In the conventional microwave mixer it is generally necessary to provide a low-pass filter or some similar network in the inter-mediatefrequency output circuit. This filter usually takes the form of a capacitance or choke, which is arranged to present, as nearly as possible, a short circuit to the signal and local oscillator frequencies. For a microwave mixer with an IF of less than 100 Mc chokes have been found to be satisfactory provided that a correct choice of the short-circuit position has been made.



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A High-Power S-Band Filter (Correspondence)

H. Guthart and E.M.T. Jones. "A High-Power S-Band Filter (Correspondence)." 1962 Transactions on Microwave Theory and Techniques 10.2 (Mar. 1962 [T-MTT]): 148-149.

This note describes the measured performance of a high-power S-band "waffle-iron" filter. Techniques for designing varying-impedance corrugated waveguide filters in rectangular waveguide have been available for some time. If propagation is restricted to the dominant TE/sub 10/ mode, these filters have wide well-matched pass bands and wide high-attenuation stop bands. Unfortunately, the filters may have spurious transmissions in the stop band when power is incident upon them in other modes, such as TE/sub 20/ or TE/sub 30/, if the guide wavelength of these modes at the stop-band frequencies is equal to the guide wavelength of the TE/sub 10/ mode at the pass-band frequencies of the filter.

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Abstracts

Contributors (Mar. 1962 [T-MTT])

D.M. Bolle, A. Clavin, A.G. Franco, K.P. Grabowski, O.F. Hinckelmann, K. Ishii, R.C. Mackey, P.L. Vilmur and C.P. Womack. "Contributors (Mar. 1962 [T-MTT])." 1962 Transactions on Microwave Theory and Techniques 10.2 (Mar. 1962 [T-MTT]): 149-150.



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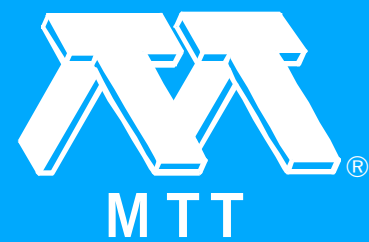
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Magnetically Tunable Nonreciprocal Band-Pass Filters Using Ferrimagnetic Resonators

C.N. Patel. "Magnetically Tunable Nonreciprocal Band-Pass Filters Using Ferrimagnetic Resonators." 1962 Transactions on Microwave Theory and Techniques 10.3 (May 1962 [T-MTT]): 152-161.

Possibilities of a small-bandwidth, small-insertion loss, magnetically tunable band-pass filters with nonreciprocal characteristics have been studied. the unloaded $Q(Q_{\text{sub } u})$ for a ferrimagnetic sample has been derived, considering the fundamental definition of Q for a resonator. Theoretical analysis is given for coupling due to ferrimagnetic resonance, between two RF transmission circuits when the RF magnetic fields due to the two circuits are circularly polarized or, in general, elliptically polarized. The analysis gives the open-circuit impedance parameters for the equivalent circuit representing the ferrimagnetic coupling mechanism, from which the external-loading Q 's ($Q_{\text{sub } e1}$ and $Q_{\text{sub } e2}$) are obtained. This analysis, applied to the case of the waveguides, shows that the behavior of the $Q_{\text{sub } e}$ vs frequency characteristic depends upon the ellipticity of the RF magnetic field, and hence, upon the location of the off-axis position of the ferrimagnetic resonator. Also, the nonreciprocity depends upon the ellipticity of the RF magnetic field--the nonreciprocal behavior being optimum when the RF magnetic field is circularly polarized. Thus, again, for the case of waveguide circuits, the off-axis position determines the reverse-coupling-vs-frequency characteristic. The measurements on the experimental filters, tunable from 8.2 to 12.4 kMc, verify the results obtained from the theory. The forward and the reverse directions of the operation of these filters can be interchanged by reversing the dc magnetic field. Power limiting with these filters is briefly described.





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Propagation on Modulated Corrugated Rods

C.C. Wang and E.T. Kornhauser. "Propagation on Modulated Corrugated Rods." 1962 Transactions on Microwave Theory and Techniques 10.3 (May 1962 [T-MTT]): 161-165.

The velocity of surface-wave propagation on two types of axially modulated corrugated rods has been measured experimentally. Type A has a constant outer diameter and sinusoidally varying slot depth, while in type B the slot depth varies in virtue of a modulated outer diameter. In both cases the measured phase velocity is about ten per cent less than that for a uniformly corrugated rod with the average slot depth and outer diameter, but agrees within two per cent over the frequency range used with the value calculated from an analysis based on the Mathieu equation.

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Abstracts

Small Resonant Scatterers and Their Use for Field Measurements

R.F. Harrington. "Small Resonant Scatterers and Their Use for Field Measurements." 1962 Transactions on Microwave Theory and Techniques 10.3 (May 1962 [T-MTT]): 165-174.

A general formulation for the back-scattered field from loaded objects is given. It is shown that small resonant objects produce a much greater back-scattered field than small nonresonant ones. The theory is applied to short dipoles and small loops. The use of small resonant scatterers to measure electric and magnetic fields by scattering techniques is discussed. Resonant scatterers are found to have several advantages over nonresonant scatterers when used for field measurements.



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Wide-Band Matching of Lossless Waveguide Two-Ports

D. Kajfez. "Wide-Band Matching of Lossless Waveguide Two-Ports." 1962 Transactions on Microwave Theory and Techniques 10.3 (May 1962 [T-MTT]): 174-178.

A new procedure of matching is presented, based in the equations which transform the output reflection coefficient of a lossless two-port network into the input reflection coefficient. The parameters of the equations are the residual reflection coefficients which can be easily measured. The optimum reflection coefficients which have the minimum frequency variation are computed for the specific case when the frequency variation of the residual reflection coefficients can be approximated by a circular arc in the Smith diagram. An illustrative example is given to explain the determination of the position and the size of the inductive obstacles that match a waveguide two-port structure within a wide frequency band.

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An X-Band Ferroelectric Phase Shifter

M. DiDomenico, Jr. and R.H. Pantell. "An X-Band Ferroelectric Phase Shifter." 1962 Transactions on Microwave Theory and Techniques 10.3 (May 1962 [T-MTT]): 179-185.

An X-band electrically-tunable ferroelectric phase shifter has been constructed. The phase shifter is reciprocal and consists of a thin ferroelectric slab completely filling the transverse plane of a rectangular waveguide with suitable dielectric matching sections placed symmetrically about the slab forming a band-pass filter. Phase shift is controlled by applying a dc electric field to the ferroelectric. The measured characteristics of this device indicate that incremental phase shifts of 40° to 50° are attainable over a bandwidth of 400 Mc centered about 9.3 kMc with insertion losses ranging from 2 to 6 db. Since the phase shifter does not require a magnetic field for operation, the device can be biased with inexpensive, light-weight equipment requiring negligible dc control power, and the response time can be expected to be fast.



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



A Balanced-Type Parametric Amplifier

S. Hayasi and T. Kurokawa. "A Balanced-Type Parametric Amplifier." 1962 Transactions on Microwave Theory and Techniques 10.3 (May 1962 [T-MTT]): 185-190.

A balanced-type diode amplifier is reported, in which the cutoff mode of the pumping waveguide resonating with the diode capacitances, is used as a signal circuit and a series connected diode loop is used as an idler. Theoretical noise-figure and gain-bandwidth product are derived after calculating the equivalent susceptance of two diodes which are parallel-connected for the signal input and series-connected for the idler. This reveals that 1) the noise figure of the balanced-type amplifier can be expressed in the same form as that of the single diode amplifier, and 2) the gain-bandwidth product is identical to that of the single diode amplifier. In the experiment at 1900 Mc, a bandwidth of more than 200 Mc is obtained at the gain of more than 10 db. A single-channel noise-figure of 2.5 db is measured at the pump power of 100 Mw.

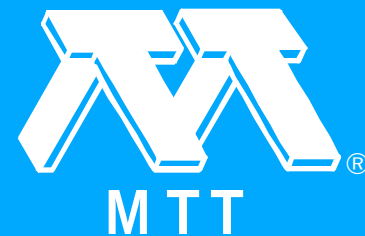


Abstracts

A Survey of the Theory of Wire Grids

T. Larsen. "A Survey of the Theory of Wire Grids." 1962 Transactions on Microwave Theory and Techniques 10.3 (May 1962 [T-MTT]): 191-201.

The paper gives a survey of the literature concerning the electromagnetic properties of wire grids. As an introduction to the literature survey, a short description of the properties and applications of wire grids is given. Finally some particular grid configurations are mentioned.



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Propagation of TE Modes in Nonuniform Waveguides

H. Zucker and G.I. Cohn. "Propagation of TE Modes in Nonuniform Waveguides." 1962 Transactions on Microwave Theory and Techniques 10.3 (May 1962 [T-MTT]): 202-208.

The conditions for TE mode propagation in rectangular waveguides with nonuniform dielectric media are established. An equation is derived for determining the capacity functions which have equivalent curved waveguides with uniform dielectric media. The types of variable dielectric waveguides which have equivalent curved wall waveguides and a separable wave equation are determined.

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An Investigation of a Feedback Control System for Stabilization of Microwave Radiometers

T.V. Seling. "An Investigation of a Feedback Control System for Stabilization of Microwave Radiometers." 1962 Transactions on Microwave Theory and Techniques 10.3 (May 1962 [T-MTT]): 209-213.

A method of stabilizing receivers for radio telescopes is discussed and shown to be capable of substantially reducing sensitivity to gain fluctuations. The system employs a variable noise source as a controlled feedback element. Such a system does not require long warm up times since the output is dependent only upon the stability of the variable noise source and reaches stabilization very rapidly. Investigations were made of a number of variable noise sources for use in the system, including: gas discharge tubes with variable attenuators, crystal diodes, and gas discharge tubes with variable duty cycles. Several crystal diodes were measured and the noise output was found to be linear with current for temperatures up to approximately 5000°K. A variable noise source using a gas discharge tube with variable duty cycles to adjust the average temperature of the comparison termination of the radiometer is also discussed. Results are given for an experimental X-band system using a crystal diode as a variable noise source. For this system, a reduction of gain by 5 db had no measurable effect on the accuracy of measurement.

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Abstracts

Surface Current Measurements with an Electric Probe

R. Plonsey. "Surface Current Measurements with an Electric Probe." 1962 Transactions on Microwave Theory and Techniques 10.3 (May 1962 [T-MTT]): 214-217.

The use of an electric probe for measurement of induced surface currents on obstacles in a parallel plate region is described. An analysis of the sources of error, and in particular the interaction of the probe with the obstacle, is examined theoretically and experimentally. It is concluded that the technique is capable of yielding measurements of good accuracy.



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Direct Coupled Coaxial and Waveguide Band-Pass Filters (Correspondence)

R.M. Kurzrok. "Direct Coupled Coaxial and Waveguide Band-Pass Filters (Correspondence)." 1962 Transactions on Microwave Theory and Techniques 10.3 (May 1962 [T-MTT]): 218-219.

In this note, experimental results will be presented for practical coaxial and waveguide band-pass filters. Filters of both types were originally developed in the 1700 Mc to 2300 Mc frequency range for application in a wide-band microwave radio relay communications system. The specifications for these filters called for very low input VSWR's over an appreciable part of the filter pass bands. This is necessary to minimize the degradation in system performance due to intermodulation noise resulting from feeder distortion of microwave transmission lines and/or group delay distortion within the microwave filters. Both the coaxial and waveguide band-pass filters employed five direct coupled resonators. Filters were designed for Butterworth (maximally flat amplitude) response shapes and nominal filter 3 db bandwidths of 60 Mc.

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Abstracts

A Microwave Power Limiter (Correspondence)

M.J. Rodriguez and D. Weissman. "A Microwave Power Limiter (Correspondence)." 1962 Transactions on Microwave Theory and Techniques 10.3 (May 1962 [T-MTT]): 219-220.

Through the use of the familiar hybrid directional coupler and two PIN junction diodes as load impedances, the power delivered to the port not directly coupled to the input may be limited to any desired level, without rigid tolerances on the diode impedances.



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A Four-Component Polarization Resolver (Correspondence)

P.J. Allen. "A Four-Component Polarization Resolver (Correspondence)." 1962 Transactions on Microwave Theory and Techniques 10.3 (May 1962 [T-MTT]): 220-220.

Numerous ways are known for resolving a polarized microwave signal into pairs of orthogonally polarized components. Although pairs of orthogonal components contain redundant information, in many experimental applications it is desirable to have both linearly polarized and circularly polarized components available for comparison purposes. These four polarization components are derived simultaneously in the simple resolver-mixer assembly of Fig. 1.





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The Channel Waveguide (Correspondence)

R.J. Vilmur and K. Ishii. "The Channel Waveguide (Correspondence)." 1962 Transactions on Microwave Theory and Techniques 10.3 (May 1962 [T-MTT]): 220-221.

A waveguide propagating the TE/sub 10/ mode can carry more power than the normal rectangular waveguide if it has a symmetrically placed channel in the E-plane as shown in Fig. 1. The greater height of the channel in the center of the waveguide will allow a higher voltage to be applied before dielectric breakdown occurs. The TE/sub 10/ cutoff wavelength $\lambda_{c/}$ was investigated using the methods of Iashkin and Cohn to find out if the cutoff wavelength of the channel waveguide was equivalent to that of the rectangular waveguide $\lambda_{cr/}$.

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Frequency Diplexing with Waveguide Bifurcations (Correspondence)

G.P. Kefalas. "Frequency Diplexing with Waveguide Bifurcations (Correspondence)." 1962 Transactions on Microwave Theory and Techniques 10.3 (May 1962 [T-MTT]): 221-222.

A relatively simple form of microwave frequency diplexer consists of a waveguide E- or H-plane Y-junction terminated with bandpass filters in each of the two output ports. The E- or H-plane bifurcation, or zero-degree Y-junction, allows a compact diplexer design as shown in Fig. 1.

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Abstracts

Contributors (May 1962 [T-MTT])

G.I. Cohn, M. DiDomenico, Jr., R.F. Harrington, S. Hayasi, D. Kajfez, E.T. Kornhauser, T. Kurokawa, T. Larsen, R.H. Pantell, C.N. Patel, R. Plonsey, T.V. Seling, C.C. Wang and H. Zucker. "Contributors (May 1962 [T-MTT])." 1962 Transactions on Microwave Theory and Techniques 10.3 (May 1962 [T-MTT]): 223-225.



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Injection Locking of Klystron Oscillators

R.C. Mackey. "Injection Locking of Klystron Oscillators." 1962 Transactions on Microwave Theory and Techniques 10.4 (Jul. 1962 [T-MTT]): 228-235.

If certain criteria are met, a microwave oscillator may be synchronized by the injection of a controlling signal into the oscillator cavity. Synchronization is dependent upon oscillator circuit parameters, the ratio of injected power to oscillator power, and frequency difference between the free-running oscillator and the injection signal. Locking has been observed with injection signals 70 db below the oscillator output and 30-db ratios have been demonstrated to be easily realizable. Injection locking may be considered a form of amplification that permits taking advantage of the fact that microwave oscillators are smaller, lighter, less expensive and more efficient than amplifier devices. The low-frequency theory of Adler is shown to describe accurately the locking phenomena in reflex klystron oscillators and the transient response is extended to determine limitations on the amplification of modulated signals. Experimental verification of the theory is shown for 180° phase modulation of the locking signal at rates up to 100 kc for a VA-201 klystron. Design relations and curves are presented and applications and improvements are discussed.

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Abstracts

The Application of Hypercomplex Matrix Analysis to Variable Parameter Networks

S. Krongelb, J.J. McNichol and N. Kroll. "The Application of Hypercomplex Matrix Analysis to Variable Parameter Networks." 1962 Transactions on Microwave Theory and Techniques 10.4 (Jul. 1962 [T-MTT]): 236-251.

The hypercomplex matrix methods developed to treat variable parameter elements are reviewed. The application of these techniques to the linear analysis of networks of variable parameter elements is demonstrated by considering a specific problem. A network containing two resonated variable capacitors separated by one-eighth wavelength of transmission line is first considered by the phase dependent admittance method. A partial treatment of the subharmonic case is given by this method to provide a physically plausible understanding of the network behavior. The complete problem is treated by the hypercomplex matrix methods. The discussion of the results illustrates how the network properties are determined from the mathematical formalism. Calculated characteristics of the two-capacitor network are given for several values of circuit parameters.



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Broad-Band Directional Couplers

E.A. Marcatili and D.H. Ring. "Broad-Band Directional Couplers." 1962 Transactions on Microwave Theory and Techniques 10.4 (Jul. 1962 [T-MTT]): 251-257.

It is shown how to connect two identical hybrids to obtain a directional coupler of arbitrary power division that operates over a broader band than that of the components. The broad-banding technique is possible with a certain kind of hybrid that includes Riblet couplers, multihole hybrids, coaxial hybrids and semioptical hybrids, but excludes T hybrids and ring hybrids. Riblet couplers have a geometry particularly adaptable to the broad-banding technique. Where the balance of one of these couplers is better than 1 db, the balance of the broad-band hybrid can be made better than 0.16 db. The broad-banding technique is particularly effective in the case of the 100 per cent transfer directional coupler type of circuit used for band separation filters and radar duplexers. In the semioptical waveguide band-splitting filters the bandwidth can be increased from about one to about four octaves (35-75 kMc to 35-580 kMc).

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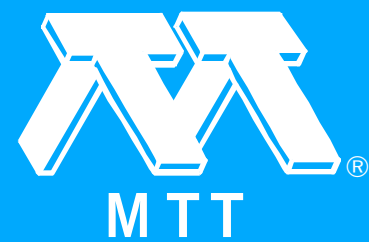
Noise Output and Noise Figure of Biased Millimeter-Wave Detector Diodes

K. Ishii and A.L. Brault. "Noise Output and Noise Figure of Biased Millimeter-Wave Detector Diodes." 1962 Transactions on Microwave Theory and Techniques 10.4 (Jul. 1962 [T-MTT]): 258-262.

The behavior of a dc biased millimeter-wave detector diode was investigated by theoretical analysis and experimental measurement. The results indicate that because of the nonlinearity of the diode, shot noise appearing across the diode increases with dc biasing. For the same reason conversion gain of the detector increases with bias. The increase in gain is faster than the increase in noise for a certain range of bias current. Thus the noise figure of the diode detector and its minimum detectable signal are decreased.

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Microwave Variable Attenuators and Modulators Using PIN Diodes

J.K. Hunton and A.G. Ryals. "Microwave Variable Attenuators and Modulators Using PIN Diodes." 1962 Transactions on Microwave Theory and Techniques 10.4 (Jul. 1962 [T-MTT]): 262-273.

The PIN diode is a double diffused junction with an intrinsic layer separating the P and N regions. At frequencies above 100 Mc, the diode ceases to be a rectifier because of carrier storage and transit time effects. Its shunt capacitance is quite small because of the separation of the P and N regions by the I layer. Conductivity of the I region can be varied by a dc bias current and the device becomes an electrically variable resistor which can be used for microwave attenuators and modulators up to frequencies as high as 20 Gc. The PIN junctions are mounted on posts which are inserted in a 50-ohm strip transmission line as shunt elements, and a number of these elements, spaced a quarter wavelength apart at midband, are used to form an attenuator. At the appropriate bias current, yielding 50-ohm junction resistances, the diode elements are reactively compensated by choice of post dimensions so that they are effectively pure resistances, yielding an image attenuation of 4.2 db per element. Many elements can be used to attain any desired total attenuation and higher impedance end elements can be used to improve the SWR. Bandwidths of 4 to 1 with low SWR in both ON and OFF conditions are achievable. Maximum attenuation of 60 db, insertion loss of 1 db, and SWR of 1.5 are typical for a 12-diode attenuator and powers of the order of watts can be handled with negligible harmonic generation. When used as a pulse modulator, rise times of the order of 10 nsec are achievable.



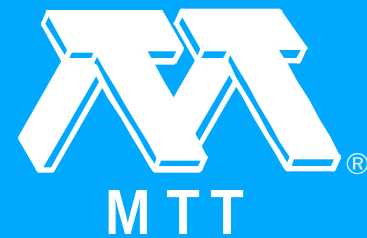
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Analysis of Waveguide Modes by Standing-Wave Pattern Measurements

H.B. Dave. "Analysis of Waveguide Modes by Standing-Wave Pattern Measurements." 1962 Transactions on Microwave Theory and Techniques 10.4 (Jul. 1962 [T-MTT]): 274-278.

A method of analyzing a multimode transmission system is described, which is based upon the measurement of mean-square electric field along a line parallel to the waveguide axis.

Although the analysis given is for a rectangular waveguide, the method has the advantage that it can readily be adapted to all types of transmission structures.



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Excitation of Surface Waves on a Unidirectionally Conducting Screen

S.R. Seshadri. "Excitation of Surface Waves on a Unidirectionally Conducting Screen." 1962 Transactions on Microwave Theory and Techniques 10.4 (Jul. 1962 [T-MTT]): 279-286.

The excitation of plane surface waves by a line source on a unidirectionally conducting 1) infinite and 2) semi-infinite screen is considered. The conditions for the existence of the surface wave and the optimum location of the line source for obtaining the highest efficiency of excitation is determined.



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On a Class of Multiple-Line Directional Couplers

C.R. Boyd, Jr.. "On a Class of Multiple-Line Directional Couplers." 1962 Transactions on Microwave Theory and Techniques 10.4 (Jul. 1962 [T-MTT]): 287-294.

Multiple-line directional couplers that utilize only two linearly independent modes of propagation are possible, provided certain restrictions on the maximum coupling are not exceeded. This paper discusses a class of multiple-line directional couplers which may be considered as a generalization of the familiar double-stub four-port directional coupler. The basic design relations for the symmetrical case are developed, and frequency behavior is investigated. Experimental results for an L-band six-port hybrid junction are presented and compared with theoretical curves. Limitations on maximum coupling and fabrication problems will probably confine the number of lines in practical circuits to a small value. Bandwidths of couplers of this class tend to become narrower for the same total coupling off the main line as the number of lines is increased; however, standard techniques for broadbanding are applicable. Experimental results on the six-port hybrid junction agreed well with theory, and the circuit proved to be relatively compact.

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Abstracts

Analysis of a Two-Section Coupler (Correspondence)

L.O. Sweet. "Analysis of a Two-Section Coupler (Correspondence)." 1962 Transactions on Microwave Theory and Techniques 10.4 (Jul. 1962 [T-MTT]): 295-295.

The use of single-section quarter wavelength TEM mode directional couplers having excellent wide-band performance is well known. A method for decreasing the coupling variation with frequency by cascading three quarter wavelength couplers has also been described. The purpose of this note is to analyze, for loose coupling, the behavior of a two quarter wave section coupler and compare the results with a coupler consisting of three sections.



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Measuring the omega-beta Diagram of Periodic Structures (Correspondence)

O.P. McDuff. "Measuring the omega-beta Diagram of Periodic Structures (Correspondence)." 1962 Transactions on Microwave Theory and Techniques 10.4 (Jul. 1962 [T-MTT]): 295-296.

One of the most important properties of a periodic structure is the shape of the omega - beta diagram. A common technique for measuring the omega - beta diagram is to form a resonant section by placing shorting planes at positions of symmetry within the periodic structure and to observe the resonant frequencies of the resulting resonator. Discussed in this correspondence is a technique wherein the far end of the periodic structure is shorted and the positions of nulls of voltage on an input line are observed as frequency is varied. From these nulls it is possible to determine the frequencies where the electrical length of the loaded structure is a multiple of pi radians. Basically, it is a procedure for graphically determining points on the omega - beta diagram.

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Synthetic Transmission-Line Impedance Transformers (Correspondence)

H.F. Mathis. "Synthetic Transmission-Line Impedance Transformers (Correspondence)." 1962 Transactions on Microwave Theory and Techniques 10.4 (Jul. 1962 [T-MTT]): 296-298.

Somlo has presented a convenient procedure for obtaining the characteristic impedance and length of a single section of lossless transmission line to match two impedances. One impedance and the conjugate of the other are plotted on a circular transmission-line chart, i.e., Smith or Carter chart. A circle is drawn through the two points with its center on the $X = 0$ axis. If the circle does not lie entirely within the $R = 0$ circle, the two impedances cannot be matched with a single section of lossless transmission line with real characteristic impedance. However, if one does not require that the transmission line have a real characteristic impedance, it can be synthesized by a symmetrical T or pi network consisting of either lossless inductances or capacitances.





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A Unique Solid-State Diplexer (Correspondence)

J. Brown and J. Clark. "A Unique Solid-State Diplexer (Correspondence)." 1962 Transactions on Microwave Theory and Techniques 10.4 (Jul. 1962 [T-MTT]): 298-298.

A diplexer is a familiar device which readily combines two separate radio-frequency signals to permit simultaneous transmission through a single transmission line or separates a composite signal into its constituent parts to permit each part to be transmitted or proceed individually. This correspondence describes a unique method of deriving diplexing action in a simple Y-junction circulator, and suggests a method of diplexing in other devices which depend upon the phase shift properties of ferromagnetic material for their operation.

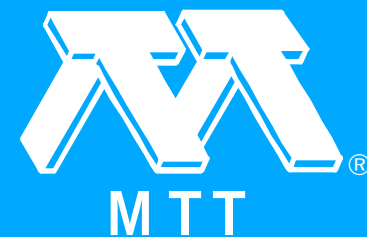
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Contributors (Jul. 1962 [T-MTT])

C.R. Boyd, Jr., A.L. Brault, Jr., H.B. Dave, J.K. Hunton, K. Ishii, N.M. Kroll, S. Krongelb, R.C. Mackey, E.A.J. Marcatili, J.J. McNichol, D.H. Ring, A. Ryals and S.R. Seshadri. "Contributors (Jul. 1962 [T-MTT])." 1962 Transactions on Microwave Theory and Techniques 10.4 (Jul. 1962 [T-MTT]): 299-300.



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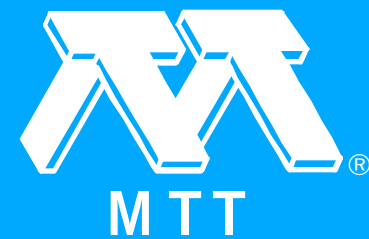
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Broad-Band TEM Diode Limiting

R.V. Garver and J.A. Rosado. "Broad-Band TEM Diode Limiting." 1962 Transactions on Microwave Theory and Techniques 10.5 (Sep. 1962 [T-MTT]): 302-310.

The bandwidths of two types of limiters operating below diode resonance and one type of limiter operating at diode resonance are calculated. A 2.5-Gc base-band limiter was made providing a low power insertion loss of less than 1 db, a limiting threshold of 10 mw, and a high power isolation of greater than 20 db. A 0.9-to 1.3-Gc matched limiter was made having a VSWR of less than 1.2 for all power levels. The burnout power of these two limiters was calculated to be about 10 watts incident CW power or 1500 watt-microsecond incident pulse energy. Using the diode resonance the calculations indicate that it is possible to make a 5-Gc limiter with 15 per cent bandwidth, less than 1-db low power insertion loss, a limiting level of 10 mw, and greater than 20-db isolation at high power. The bandwidths derived for diode limiting are equally applicable to switching.

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Improvements in Light Modulators of the Traveling-Wave Type

I.P. Kaminow, R. Kompfner and W.H. Louisell. "Improvements in Light Modulators of the Traveling-Wave Type." 1962 Transactions on Microwave Theory and Techniques 10.5 (Sep. 1962 [T-MTT]): 311-313.

Wide-band modulation of light by means of the electro-optic effect requires a traveling-wave type of interaction, with the modulation field traveling with the same phase velocity as the light in some suitably proportioned structure. If electro-optic material is lossy at the modulation frequencies, the modulating field is strongly attenuated with a resultant low-modulation efficiency. A scheme is analyzed here in which power is continuously fed into the light-carrying guide to make up for the attenuation as the wave progresses down the guide. By suitably tapering the coupling and the uncoupled propagation constant, the electric field can be maintained constant in the light-carrying guide and the "coupled" propagation constant in this guide can be maintained in synchronism with the light wave, thereby increasing the modulation efficiency.

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Electromagnetic Waves in Waveguides with Wall Impedance

K. Kurokawa. "Electromagnetic Waves in Waveguides with Wall Impedance." 1962 Transactions on Microwave Theory and Techniques 10.5 (Sep. 1962 [T-MTT]): 314-320.

A variational expression for the propagation constant of the waves in waveguides with inhomogeneous media and with wall impedance is presented. Using this expression, the shift of the propagation constant due to the wall impedance is calculated. It is also clarified how the removal of degeneracy takes place. Then the same problem is discussed using another approach, a perturbation method. The result is identical with that of the variational principle, as is to be expected. In the final section, taking degenerate TEM modes as an example, it is shown that appropriate choices of field configuration are necessary when the formula for an attenuation constant derived from the conservation of energy is applied to degenerate modes.

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Abstracts

A Three-Cavity Circularly Polarized Waveguide Directional Filter Yielding a Maximally Flat Response

R.L. Williams. "A Three-Cavity Circularly Polarized Waveguide Directional Filter Yielding a Maximally Flat Response." 1962 Transactions on Microwave Theory and Techniques 10.5 (Sep. 1962 [T-MTT]): 321-328.

A directional filter is a completely matched four-port device which exhibits directional properties and a filter-like frequency characteristic. This paper extends work previously done on a single-cavity narrow-band circularly polarized waveguide directional filter to the case of three cavities connected in cascade with an overall bandwidth greater than 1 per cent. Analysis of the filter leads to a relationship between the two inner coupling factors and the two outermost coupling factors for a maximally flat response. The results obtained from an experimental filter using the design approach discussed herein compare favorably with the theoretical filter response. Directivity and band-elimination filter characteristics are discussed.



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Abstracts

Power Transmission through General Uniform Waveguides

W.K. Kahn. "Power Transmission through General Uniform Waveguides." 1962 Transactions on Microwave Theory and Techniques 10.5 (Sep. 1962 [T-MTT]): 328-331.

The problem of transmitting electromagnetic power through a dissipative waveguide in an optimal fashion is examined. At any frequency the problem is reduced to a weighted eigenvalue problem in which the maximum efficiency appears as the eigenvalue and the required excitation is specified by the corresponding eigenvector. Numerical results are presented.



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Abstracts

Further Considerations on Fabry-Perot Type Resonators

W. Culshaw. "Further Considerations on Fabry-Perot Type Resonators." 1962 Transactions on Microwave Theory and Techniques 10.5 (Sep. 1962 [T-MTT]): 331-339.

An integral equation valid for fabry-perot type resonators with reflectors of arbitrary curvature and spacing is derived, and equations for the planar, confocal, and spherical geometries are considered further. A numerical iteration method is used to solve the equations, and the properties of the various solutions for the different kernels are discussed. Results show that the confocal type has the lowest diffraction loss, and that the losses in the planar- and spherical-type geometries are identical, as are the normal mode field distributions over the reflectors, apart from a change in sign of the phase angle. Variational methods are applied to give results for the eigenvalues of the planar geometry with great facility, particularly for cases where the eigenvalues are closely spaced. Some potential uses and the respective merits of the resonators are briefly mentioned.



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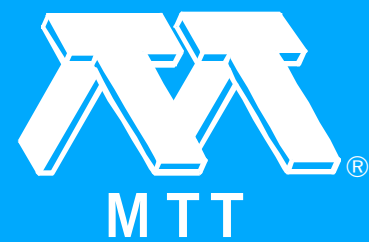
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Stepped-Impedance Transformers and Filter Prototypes

L. Young. "Stepped-Impedance Transformers and Filter Prototypes." 1962 Transactions on Microwave Theory and Techniques 10.5 (Sep. 1962 [T-MTT]): 339-359.

Quarter-wave transformers are widely used to obtain an impedance match within a specified tolerance between two lines of different characteristic impedances over a specified frequency band. This paper gives design formulas and extensive tables of designs, most of which were especially derived so that an integrated account could be presented for the first time.

Numerous examples are given. Only homogeneous, synchronous transformers and filters are included in this paper, but a short bibliography on related topics is appended. The theory is also applied to band-pass filters, by showing how to convert quarter-wave transformers into half-wave filter prototypes. The theoretical and numerical results presented are applicable to the design of impedance transformers, direct-coupled cavity filters, short-line low-pass filters, optical antireflection coatings and interference filters, acoustical transformers, branch-guide directional couplers, TEM-mode coupled-transmission-line directional couplers, and other circuits. These applications have been or will be dealt with in separate papers; this paper gives the basic theory and some of the numerical data required for these applications.

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In-Line Waveguide Calorimeter for High-Power Measurement

M.M. Brady. "In-Line Waveguide Calorimeter for High-Power Measurement." 1962 Transactions on Microwave Theory and Techniques 10.5 (Sep. 1962 [T-MTT]): 359-366.

The static in-line calorimeter measures the temperature rise in the walls of a waveguide caused by the attenuation of microwave power flowing through the waveguide. It is simple and inexpensive and can be constructed so that it will fit on waveguide already existing in a microwave system. The device should be reliable because it uses no active circuitry. In addition, few mechanical problems are encountered in its use because the existing waveguide need not be altered. The theory of the device is developed, and two experimental S-band calorimeters using stainless steel waveguide and resistance-wire bridge temperature indicators are described. The measured sensitivity and time constant for both units fall within the experimental error of confirming the theoretically predicted figures.

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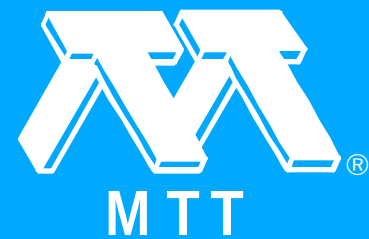


Scattering of Surface Waves by Discontinuities on a Unidirectionally Conducting Screen

S.R. Seshadri. "Scattering of Surface Waves by Discontinuities on a Unidirectionally Conducting Screen." 1962 Transactions on Microwave Theory and Techniques 10.5 (Sep. 1962 [T-MTT]): 367-375.

It is shown that a plane screen consisting of closely-spaced parallel wires which are separated from one another and which are such that the radius of the wires and the spacing between them are small in comparison to wavelength, can support a surface wave, the spread of whose field components depends only on the angle which the direction of propagation makes with the direction of the wires. The problem of radiation from a discontinuity in such a semi-infinite waveguide is studied for the following three types of discontinuities: 1) when the waveguide terminates in empty space, 2) when it terminates at another such semi-infinite waveguide having different propagation characteristics, and 3) when it terminates at a perfectly conducting half-plane. In each case, the power reflection coefficient, where applicable the power transmission coefficient, the loss of power due to radiation, and its angular distribution are evaluated. The motivation for this investigation is briefly indicated.





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Surface Waves on Radially Inhomogeneous Cylinders

A. Vigants and S.P. Schlesinger. "Surface Waves on Radially Inhomogeneous Cylinders." 1962 Transactions on Microwave Theory and Techniques 10.5 (Sep. 1962 [T-MTT]): 375-382.

A characteristic equation and a cutoff equation are derived for higher order surface-wave modes on lossless isotropic cylinders with arbitrary radial permittivity variation. The derivation, based on the use of the fundamental matrix of a set of differential equations, reduces analytical work and results in expressions well suited for digital computer evaluation of surface-wave eigenvalues and mode spectra. The theory is applied in an investigation of HE/sub 21/ and EH/sub 21/ mode propagation for a particular set of models for the radially varying permittivity. Typical results showing eigenvalue variation, dispersion characteristics and radial field variation, including experimental verification of dispersion characteristics, are shown. The method of analysis can be extended to anisotropic cylinders with permittivity a function of both radius and frequency.

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A Plasma Controlled Directional Coupler

J. Willis. "A Plasma Controlled Directional Coupler." 1962 Transactions on Microwave Theory and Techniques 10.5 (Sep. 1962 [T-MTT]): 383-389.

A new type of waveguide directional coupler is described which has a discharge tube as the coupling element in the common narrow wall between the guides. The use of the discharge tube allows continuous control of the amount of coupling between the guides. The theory of the coupler is given with curves for designing such a coupler. The paper describes the results obtained from a 3-db coupler. Measurements were made at a frequency of 450 Mc, of VSWR, noise output, and switching speed. These show a VSWR of the order of 1.3 over the control range, and an excess noise temperature with a peak of 20,000°K at one value of control current. The coupler is capable of switching up to speeds of 1000 cps.

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Couplings in Direct-Coupled Waveguide Band-Pass Filters (Correspondence)

R.M. Kurzrok. "Couplings in Direct-Coupled Waveguide Band-Pass Filters (Correspondence)." 1962 Transactions on Microwave Theory and Techniques 10.5 (Sep. 1962 [T-MTT]): 389-390.

Couplings in direct-coupled waveguide band-pass filters can be described in two different ways. Cohn describes couplings in terms of normalized susceptances of the coupling circuit elements (e. g., posts or irises). Dishal describes interstage couplings in terms of a coefficient of coupling between adjacent resonators. Although Cohn has briefly mentioned coefficients of coupling in his paper, the interchangeability of the two methods of describing the couplings has not been clearly established.

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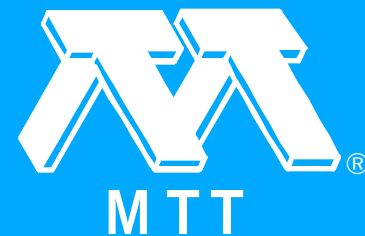


Abstracts

Contraphaseshifter (Correspondence)

E.J. Wilkinson and F. LaRussa. "Contraphaseshifter (Correspondence)." 1962 Transactions on Microwave Theory and Techniques 10.5 (Sep. 1962 [T-MTT]): 390-391.

A novel combination of ring hybrid and variable power divider is shown to result in a three-terminal device having a single matched input and two outputs whose relative phase can be continuously varied independent of their amplitude.



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A Beam Plasma Surface Wave Interaction (Correspondence)

P.J. Crepeau and T. Keegan. "A Beam Plasma Surface Wave Interaction (Correspondence)." 1962 Transactions on Microwave Theory and Techniques 10.5 (Sep. 1962 [T-MTT]): 391-392.

This communication describes the interaction of an electron beam with a beam-generated hydrogen plasma. As a result of this interaction the dc energy of the electron beam is converted into microwave energy in the plasma.



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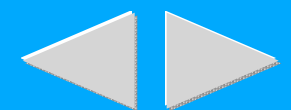
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A Double-Prism Attenuator for Millimeter Waves (Correspondence)

H.D. Raker and G.R. Valenzuela. "A Double-Prism Attenuator for Millimeter Waves (Correspondence)." 1962 Transactions on Microwave Theory and Techniques 10.5 (Sep. 1962 [T-MTT]): 392-393.

A double-prism attenuator, similar to the one built by Garnham for use at 35 Gc, was built in the laboratory for use at 100 Gc and above. This attenuator utilizes the well-known fact that a wave which is incident on the interface between two dielectrics at an angle greater than the critical angle is totally reflected.

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Abstracts

Application of Sampling Theorem to the Synthesis of Transmission Line Tapers and Antenna Radiation Patterns (Correspondence)

R.E. Collin. "Application of Sampling Theorem to the Synthesis of Transmission Line Tapers and Antenna Radiation Patterns (Correspondence)." 1962 Transactions on Microwave Theory and Techniques 10.5 (Sep. 1962 [T-MTT]): 393-394.

In this note it is demonstrated how the sampling theorem may be used to reduce the problems of transmission line taper synthesis and antenna aperture field thesis to that of optimizing a polynomial.



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A Proposed Lossless Electronic Phase Shifter (Correspondence)

W.J. Robertson and J.R. Copeland. "A Proposed Lossless Electronic Phase Shifter (Correspondence)." 1962 Transactions on Microwave Theory and Techniques 10.5 (Sep. 1962 [T-MTT]): 394-394.

Modern antenna array designs frequently require the use of high-speed, electronically controlled phase shifters. The use of low-noise receivers now becoming available also dictates the requirement that such phase shifters have zero, or very small, losses. The use of parametric devices as active elements in such phase shifters is particularly attractive because of their high degree of reliability, high frequency capability, and excellent noise performance. This memorandum proposes such an active electronic phase shifter, which accomplishes the additional function of providing amplification or attenuation independently of its phase shift.

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Abstracts

Oversize Waveguide Directional Coupler (Correspondence)

H.J. Hindin and J.J. Taub. "Oversize Waveguide Directional Coupler (Correspondence)." 1962 Transactions on Microwave Theory and Techniques 10.5 (Sep. 1962 [T-MTT]): 394-395.

Oversize rectangular waveguide using TE/sub 10/ mode propagation has been suggested as a means of reducing the attenuation and fabrication difficulties of transmission lines and components for frequencies above 40 Gc. Experiments on straight sections of such transmission lines show that it is superior to pure optical transmission for short distances.



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Resonances in a Cylindrical Plasma Column (Correspondence)

J. Willis and I. Petroff. "Resonances in a Cylindrical Plasma Column (Correspondence)." 1962 Transactions on Microwave Theory and Techniques 10.5 (Sep. 1962 [T-MTT]): 395-396.

A plasma column irradiated by an electromagnetic wave which has its electric vector and direction of propagation perpendicular to the axis of the tube exhibits Tonks-Dattner resonances in its absorption pattern when the electron density in the column is varied. The pattern consists of a main resonance and a number of less pronounced subsidiary resonances at currents corresponding to electron densities lower than that of the main peak. The subsidiary resonances grow progressively smaller as the electron density decreases.

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Proposed Experiment for Eliciting Multiple Resonances from the Ionosphere (Correspondence)

W.D. Hershberger. "Proposed Experiment for Eliciting Multiple Resonances from the Ionosphere (Correspondence)." 1962 Transactions on Microwave Theory and Techniques 10.5 (Sep. 1962 [T-MTT]): 396-397.

In the theory of Herlofson only one resonance is predicted for a cylindrical plasma column irradiated by an electromagnetic wave having both its direction of propagation and electric field E perpendicular to the axis of the column, a mode which he designates as sagittal. Herlofson treats the problem by solving the wave equation in cylindrical coordinates and then imposing boundary conditions to find the frequency or frequencies for maximum scattering from the column. In his treatment, the modes which involve Bessel functions of order higher than unity have the same resonant frequency as that for the dipolar mode for which the order of the Bessel function is unity. No resonances at all are predicted for the parallel mode of excitation in which E is parallel to the axis of the column. These predictions are contrary to the experimental observations of Dattner and others for the sagittal mode and also contrary to the observations reported by Willis and Petroff in which a spectrum of resonances is found for the parallel mode. Experiments by Boley have shown that the sagittal scattering for the higher order resonances is that appropriate for a dipole, that is, his experiments show that the field about the column for the higher-order modes is not quadropolar or sextupolar.

Click on title for a complete paper.



Stability Criteria for Tunnel-Diode Amplifiers (Correspondence)

B. Henoch and Y. Kvaerna. "Stability Criteria for Tunnel-Diode Amplifiers (Correspondence)." 1962 Transactions on Microwave Theory and Techniques 10.5 (Sep. 1962 [T-MTT]): 397-398.

A tunnel-diode amplifier is stable when the amplifier network is reduced to ml arbitrary single loop and the equation given by the sum of the impedances around this loop equal to zero [$\Sigma Z(P)=0$ where $p=\gamma + j\omega$] has no solution in the right-half plane ($\gamma > 0$). This is equivalent to the requirement that the system determinant shall have no zeros in the right-half plane. Several authors have used this criterion. To determine analytically whether $\Sigma Z(p)$ has any positive zeros is very laborious if at all possible for many practical amplifier configurations.



Abstracts

On "An Impedance Transformation Method for Finding the Load Impedance of a Two-Port Network" (Correspondence)

D.J.R. Stock, L.J. Kaplan, R. Mittra and R.J. King. "On "An Impedance Transformation Method for Finding the Load Impedance of a Two-Port Network" (Correspondence)." 1962 Transactions on Microwave Theory and Techniques 10.5 (Sep. 1962 [T-MTT]): 398-399.

The above article begins with ten extensive footnotes, but the authors omit the one reference that discusses their problem: Deschamps' "Hyperbolic Protractor." The undersigned writers concede that the method of Mittra and King is different, but it is more complicated and less useful than that of Deschamps.



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Abstracts

On "A Solid-State Microwave Source from Reactance-Diode Harmonic Generators" (Correspondence)

G.B. Stracca, K.L. Kotzebue and T.M. Hyltin. "On "A Solid-State Microwave Source from Reactance-Diode Harmonic Generators" (Correspondence)." 1962 Transactions on Microwave Theory and Techniques 10.5 (Sep. 1962 [T-MTT]): 399-401.

In a recent paper, Hyltin and Kotzebue have given some interesting formulas about the maximum efficiency of reactance-diode harmonic generators. It may be interesting to submit to the attention of the authors some considerations about their theoretical analysis.



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Double-Layer Matching Structures (Correspondence)

M.A. Kott. "Double-Layer Matching Structures (Correspondence)." 1962 Transactions on Microwave Theory and Techniques 10.5 (Sep. 1962 [T-MTT]): 401-401.

In the millimeter wavelength region, as in other regions, the design of matching layers for dielectric surfaces is limited by the lack of suitable dielectric materials. Artificial dielectric layers, formed by periodic perturbations of the boundary surface, are not practical because of the small physical dimensions required. The following approach uses two layers of materials whose relative dielectric constants are given. The thicknesses of the layers are chosen to eliminate reflections at the desired center frequency. A broad-band match is obtained because the layers can be made less than an eighth wavelength in thickness.

Abstracts

Microwave Noise-Figure Measurement for Small Noise Output (Correspondence)

K. Ishii. "Microwave Noise-Figure Measurement for Small Noise Output (Correspondence)." 1962 Transactions on Microwave Theory and Techniques 10.5 (Sep. 1962 [T-MTT]): 401-402.

The purpose of this communication is to propose a new method of noise-figure measurement for a microwave amplifier of small noise output. The new method is helpful when the accuracy of a conventional method is not satisfactory.



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On Voltage and Current Continuity in the Youla-Weissfloch Circuit (Correspondence)

L.J. Kaplan, D.J.R. Stock and D.C. Youla. "On Voltage and Current Continuity in the Youla-Weissfloch Circuit (Correspondence)." 1962 Transactions on Microwave Theory and Techniques 10.5 (Sep. 1962 [T-MTT]): 402-403.

Any lossless $2n$ -port can be represented as a cascade of three $2n$ -ports: an all-pass network, a set of n uncoupled ideal transformers, and another all-pass network. The $2n$ -port may be either a physical $2n$ -port [i.e., a device with an even number of ports considered as a device mapping the scattering (impedance) matrix of a device connected to one half of the ports into the input scattering (impedance) matrix], or it may be a multimode transmission line. In the latter case the network may be a set of uniform lines with a discontinuity, and there may be a condition that the mode voltages or currents are continuous across the discontinuity.



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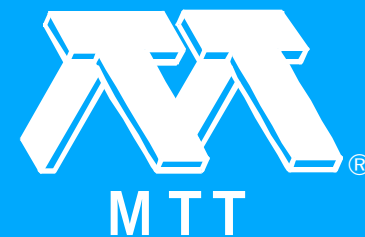
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Contributors (Sep. 1962 [T-MTT])

M.M. Brady, W. Culshaw, R.V. Garver, W.K. Kahn, I.P. Kaminow, R. Kompfner, K. Kurokawa, W.H. Louisell, J.A. Rosado, S.P. Schlesinger, S.R. Seshadri, A. Vigants, R.L. Williams, J. Willis and L. Young. "Contributors (Sep. 1962 [T-MTT])." 1962 Transactions on Microwave Theory and Techniques 10.5 (Sep. 1962 [T-MTT]): 404-405.



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Abstracts

Biography - George L. Matthaei

"Biography - George L. Matthaei." 1962 Transactions on Microwave Theory and Techniques 10.6 (Nov. 1962 [T-MTT]): 408-409.

George L. Matthaei (S'49–A'52–M'57) was born in Tacoma, Wash., on August 28, 1923. After leaving college for three years of military service, he returned to his studies and received the B.S. degree in electrical engineering from the University of Washington, Seattle, in 1948, and the Ph.D. degree in electrical engineering from Stanford University, Stanford, Calif., in 1952.



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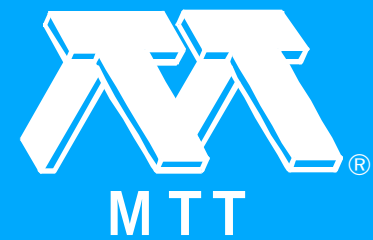
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1962 PGMTT National Symposium (Nov. 1962 [T-MTT])

"1962 PGMTT National Symposium (Nov. 1962 [T-MTT])." 1962 Transactions on Microwave Theory and Techniques 10.6 (Nov. 1962 [T-MTT]): 410-412.



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Abstracts

Standards and the Microwave Profession

J.M. Richardson. "Standards and the Microwave Profession." 1962 Transactions on Microwave Theory and Techniques 10.6 (Nov. 1962 [T-MTT]): 413-415.

The Keynote of the 1962 PGMTT Symposium was the reciprocal dependence between the National Bureau of Standards and the microwave profession. The fact that the Symposium was held at the NBS Boulder Laboratories symbolized our mutual interest. I would like to analyze this relationship and suggest the mutual benefits to be gained by fostering it.



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Microwave Band-Stop Filters with Narrow Stop Bands

L. Young, G.L. Matthaei and E.M.T. Jones. "Microwave Band-Stop Filters with Narrow Stop Bands." 1962 Transactions on Microwave Theory and Techniques 10.6 (Nov. 1962 [T-MTT]): 416-427.

Band-stop filters can be used to eliminate a band of frequencies, or to separate such a band from other frequencies; if properly designed, the insertion loss at frequencies outside the stop-band can be minimized. The filters considered here have stop-band bandwidths up to a few per cent, and equiripple or maximally flat characteristics in the passband. Design formulas are presented. The effect of dissipation loss is included. A strip-line filter and a waveguide filter were constructed. Experimental results conform closely to the performance predicted by theory.

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Abstracts

A Novel High-Power Harmonic Suppressor (Nov. 1962 [T-MTT])

E. Wantuch and R. Maines. "A Novel High-Power Harmonic Suppressor (Nov. 1962 [T-MTT])." 1962 Transactions on Microwave Theory and Techniques 10.6 (Nov. 1962 [T-MTT]): 428-431.

The use of high-power harmonic suppressors, or low-pass filters, is becoming an accepted technique in the microwave state-of-the-art. The filter to be described is a novel version of the "leaky wall" type. A C-band fundamental frequency harmonic suppressor has been designed with attenuation characteristics verified through the fourth harmonic (K band). This filter exhibited attenuation of greater than 40 db for several harmonic modes, fundamental frequency insertion loss of less than 0.15 db, an input VSWR of less than 1.15 in the pass band and an input VSWR of less than 2:1 in the stop band. The over-all length of this device is 18 in with a cross section of approximately 7 in x 7 in. Data on a similar X-band low-pass filter are also presented.



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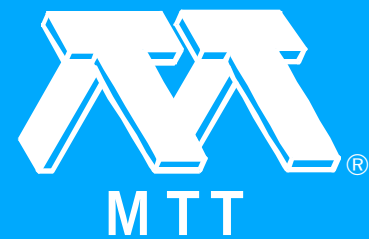
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A Plasma-Column Band-Pass Microwave Filter

I. Kaufman and W.H. Steier. "A Plasma-Column Band-Pass Microwave Filter." 1962 Transactions on Microwave Theory and Techniques 10.6 (Nov. 1962 [T-MTT]): 431-439.

A tunable band-pass filter using the dipole resonance of a plasma column has been investigated. The center frequency of the pass band can be electronically tuned over a large portion of a waveguide band. For the prototype investigated at S band, the insertion loss at the center frequency was less than 2 db, with isolation for frequencies outside the pass band on the order of 12 db. A typical 3-db bandwidth of this prototype was 150 Mc. It is expected that this figure can be improved by choice of better discharges than the positive column of the mercury discharge used here. An analysis of the external Q's for the input and output coupling is presented. From these calculations, it is possible to determine approximately the various coupling parameters that produce a given degree of overcoupling.

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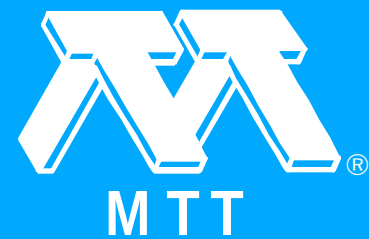
Fine Grain Spectrum Analysis of Pulsed Microwave Amplifiers (Nov. 1962 [T-MTT])

R.F. Koontz. "Fine Grain Spectrum Analysis of Pulsed Microwave Amplifiers (Nov. 1962 [T-MTT])." 1962 Transactions on Microwave Theory and Techniques 10.6 (Nov. 1962 [T-MTT]): 440-453.

With the advent of microwave transmitter systems requiring high spectral purity, it has become important to control the interline noise and modulation products in the fine grain spectrum of CW or pulsed microwave amplifiers. Some of the causes of interline noise and modulation in high-power microwave amplifiers such as klystrons, TWT's and coaxial triodes are reviewed in this paper. A spectrum analyzer capable of resolving interline noise and modulation products in CW or pulsed microwave spectrums is described. This analyzer has a dynamic range of better than 50 db and a resolution of less than 2 cps. Some typical measurements made on transmitters operating in the UHF and L-band regions are presented.

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Ferrite Switches in Coaxial or Strip Transmission Line (Nov. 1962 [T-MTT])

C.E. Fay. "Ferrite Switches in Coaxial or Strip Transmission Line (Nov. 1962 [T-MTT])." 1962 Transactions on Microwave Theory and Techniques 10.6 (Nov. 1962 [T-MTT]): 455-458.

An examination of the properties of longitudinally-magnetized ferrite in coaxial transmission lines reveals regions of low and high attenuation which could be used for the ON and OFF conditions, respectively, of a switch. A strip line switch designed for fast switching and L band is described. Its performance includes approximately 0.1-db insertion loss and 45-db isolation over a 13 per cent band.

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Abstracts

Synchronous Branch Guide Directional Couplers for Low and High Power Applications

L. Young. "Synchronous Branch Guide Directional Couplers for Low and High Power Applications." 1962 Transactions on Microwave Theory and Techniques 10.6 (Nov. 1962 [T-MTT]): 459-475.

Branch-guide directional couplers can be built in most types of transmission line. A design procedure is here developed which gives predictable and superior performance over a specified frequency band. A new chart was constructed from which the coupler impedances or admittances can be calculated quickly and with sufficient accuracy for nearly all practical applications. A five-branch, 6-db coupler and a thirteen-branch, 0-db coupler were constructed in waveguide. The measured points and computed curves were in excellent agreement. Over the frequency band of 1300 ± 130 Mc, the 0-db coupler had a VSWR of less than 1.07, its insertion loss was better than 0.05 db, and the couplings into the two remaining arms were weaker than 20 db. This coupler can pass at least 5 Mw of peak power in air at atmospheric pressure.



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Abstracts

A 6-kw Peak Power Varactor Duplexer (Nov. 1962 [T-MTT])

J.C. Hoover. "A 6-kw Peak Power Varactor Duplexer (Nov. 1962 [T-MTT])." 1962 Transactions on Microwave Theory and Techniques 10.6 (Nov. 1962 [T-MTT]): 476-479.

A strip transmission line varactor duplexer was developed for 6-kw operation at 1600 Mc for a missile application. The insertion losses were 0.6 db from antenna to receiver, and 0.3 db from transmitter to antenna. Transmitter to receiver isolation was greater than 40 db. The paper discusses the parameters leading to the choice of varactor and circuit configuration as to provide the power handling ability. Also discussed are the characteristics of interest to system designers that are peculiar to the varactor duplexer.



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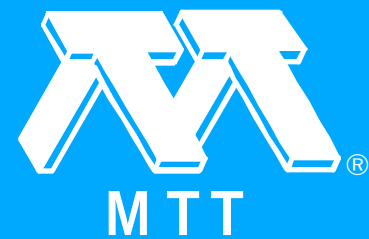
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Interdigital Band-Pass Filters

G.L. Matthaei. "Interdigital Band-Pass Filters." 1962 Transactions on Microwave Theory and Techniques 10.6 (Nov. 1962 [T-MTT]): 479-491.

The design of band-pass filters using interdigital arrays of resonator line elements between parallel ground planes is discussed. Two approximate design procedures are described, both of which permit design directly from lumped element, low-pass, prototype filters. Both design procedures will work for either narrow or wide-band filters, but one procedure gives more practical dimensions for filters having wide bandwidths (such as an octave), while the other gives more practical dimensions for filters having narrow or moderate bandwidth. The resulting filters are very compact, have relatively noncritical manufacturing tolerances, and strong stop bands with the second pass band centered at three times the center frequency of the first pass band. The dimensions and measured performance curves are presented for a 10 per cent bandwidth design and an octave bandwidth design.

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Phase-Shift Characteristics of Dielectric Loaded Waveguide

G.F. Bland and A.G. Franco. "Phase-Shift Characteristics of Dielectric Loaded Waveguide." 1962 Transactions on Microwave Theory and Techniques 10.6 (Nov. 1962 [T-MTT]): 492-496.

An investigation of waveguide phase-shifting techniques was conducted for the purpose of establishing the design criteria for a device capable of meeting the following specifications: a phase-shift variable over a minimum range of 360° and a maximum phase error of $\pm 5^\circ$ at any phase setting over at least a 10 per cent frequency bandwidth. The dielectric loaded waveguide is the basis of a device which meets the design requirements. In this paper the analytical expressions applicable to the dielectric loaded waveguide cross section are derived using the transverse resonance procedure. A rigorous description of the propagation characteristics of this structure for various parameter values is obtained through the use of a high-speed computing machine. The excellent correlation between computed values and the data obtained from an experimental model is presented.

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Abstracts

A New Technique for Multimode Power Measurement (Nov. 1962 [T-MTT])

J.J. Taub. "A New Technique for Multimode Power Measurement (Nov. 1962 [T-MTT])." 1962 Transactions on Microwave Theory and Techniques 10.6 (Nov. 1962 [T-MTT]): 496-505.

A new and simple technique for measuring total power flow to within ± 1 db in an overmoded waveguide has been developed. A set of fixed probes (typically, 40 probes) samples the electric fields normal to the surface of an enlarged waveguide section. The enlarged waveguide and a dispersive line stretcher permit quick determinations of power delivered to a matched load when the power is propagating in a large number of modes. Extension to the case of a mismatched load is also discussed. This technique is useful for measuring spurious emissions of microwave transmitters and power flow in millimeter and submillimeter waveguides.



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Subtle Differences in System Noise Measurements and Calibration of Noise Standards (Nov. 1962 [T-MTT])

T. Mukaihata, B.L. Walsh, Jr., M.F. Bottjer and E.B. Roberts. "Subtle Differences in System Noise Measurements and Calibration of Noise Standards (Nov. 1962 [T-MTT])." 1962 Transactions on Microwave Theory and Techniques 10.6 (Nov. 1962 [T-MTT]): 506-516.

Stringent system requirements and the lack of accurate standards have been the source of many controversies in low-noise receiver measurements. Some of the critical measurement problems where subtle errors commonly arise, and their significance in automatic noise temperature monitoring systems have been investigated at L-, S-, and X-band frequencies. Problems of interest include the following: 1) difficulty in determining losses associated with low-noise systems and measuring equipment, 2) differences in noise figure measurements depending upon the use of gated or nongated receivers, 3) discrepancies in excess noise ratios of secondary standard argon gas tubes, 4) non-uniformity in the output noise power of such gas tubes due to critical coupling from the gas tube proper to the waveguide (or coaxial) output flange. As a partial solution to these problems noise standards at liquid nitrogen temperature in coax and waveguide were developed at the aforementioned bands.





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Frequency-Selective Limiting (Nov. 1962 [T-MTT])

K.L. Kotzebue. "Frequency-Selective Limiting (Nov. 1962 [T-MTT])." 1962 Transactions on Microwave Theory and Techniques 10.6 (Nov. 1962 [T-MTT]): 516-520.

In the usual microwave limiter, the presence of one more large signals above a certain threshold level produces a limiting action which can be explained as a change in insertion loss of the limiter so as to maintain a constant output power, regardless of the number of independent signals present. Experimental results of coincidence mode passive ferrite limiters in S band and C band are presented which show that they do not behave in this manner, but rather to a good approximation limit on a frequency-by-frequency or frequency-selective basis. A qualitative explanation of this phenomenon is presented, using the passive parametric limiter as a model.

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Abstracts

An Accurate Millimeter Wave Loss and Delay Measurement Set (Nov. 1962 [T-MTT])

M.B. Chasek. "An Accurate Millimeter Wave Loss and Delay Measurement Set (Nov. 1962 [T-MTT])." 1962 Transactions on Microwave Theory and Techniques 10.6 (Nov. 1962 [T-MTT]): 521-527.

A millimeter wave loss and delay measurement set has been built which combines large dynamic range with high accuracy. Up to 80-db loss and 100-nsec envelope delay can be measured in the 50-60-Gc range. The accuracy for 0-40-db loss measurements is ± 0.05 db while beyond that accuracy is progressively diminished to ± 0.9 db at 80 db. Delay accuracy for low-loss devices (0-20 db) is ± 0.2 nsec. The measurement method employs rapid comparison switching, heterodyne detection, precision IF loss and delay standards. The method, the test set and some new microwave components are described. Sources of measurement error are discussed and some typical measurements are included.



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Electromagnetic Diffraction by a Planar Array of Circular Disks (Nov. 1962 [T-MTT])

W.H. Eggimann and R.E. Collin. "Electromagnetic Diffraction by a Planar Array of Circular Disks (Nov. 1962 [T-MTT])." 1962 Transactions on Microwave Theory and Techniques 10.6 (Nov. 1962 [T-MTT]): 528-535.

The diffraction of a plane electromagnetic wave by a planar rectangular array of perfectly conducting circular disks is considered. The diffracted field is calculated from the induced electric and magnetic dipole moments and higher-order multipole moments. Static and dynamic interactions between the induced dipole moments are being considered, first by using a plane-wave approximation for the dipole fields (for cases where the separation of the disks is large compared with the wavelength) and then by calculating the actual fields at each disk. The formulas are applied to calculate the input susceptance of a disk-loaded rectangular waveguide. Satisfactory agreement with experimental results is obtained.

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Ferroelectric Phase Shifters for VHF and UHF (Nov. 1962 [T-MTT])

M. Cohn and A.F. Eikenberg. "Ferroelectric Phase Shifters for VHF and UHF (Nov. 1962 [T-MTT])." 1962 Transactions on Microwave Theory and Techniques 10.6 (Nov. 1962 [T-MTT]): 536-548.

The analysis, construction, and performance of compact surface wave ferroelectric phase shifters suitable for operation in the 100-to 1000-MC frequency range are described. Although this ferroelectric loaded parallel-plane structure is a very low impedance structure, a satisfactory terminal impedance matching technique has been devised. Kilovolt level voltages are needed; but since the current required to maintain or rapidly shift phase is low, the overall control power requirements are at least an order of magnitude less than those for comparable ferrite phase shifters. One of these room temperature operable phase shifters provided 348° of phase shift at 207 Mc. It had an insertion loss which varied from 3.7 to 2.2 db over a zero- to 4000-volt range of applied dc control voltage.

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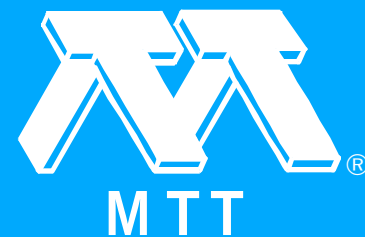


Abstracts

An Automatic Microwave Phase Comparator

J.A. Kaiser, H.B. Smith, Jr., W.H. Pepper and J.H. Little. "An Automatic Microwave Phase Comparator." 1962 Transactions on Microwave Theory and Techniques 10.6 (Nov. 1962 [T-MTT]): 548-550.

A method for passively measuring the phase angle between two signals of the same frequency is described. While simple in concept, the system has no ambiguities throughout 360° and is independent of relative signal amplitudes because phase angle is displayed orthogonally to amplitude. Consisting principally of two hybrids with detectors and an X-Y indicator, the system contains no moving parts or active phasing devices. In addition to making routine phase measurements, it can be readily applied to automatic direction finders, polarization analyzers, and impedance plotters.



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Abstracts

The Synthesis of N-Port Circulators (Nov. 1962 [T-MTT])

B.L. Humphreys and J.B. Davies. "The Synthesis of N-Port Circulators (Nov. 1962 [T-MTT])." 1962 Transactions on Microwave Theory and Techniques 10.6 (Nov. 1962 [T-MTT]): 551-554.

It is shown that there is a certain wide class of three-port network that can be transformed into a circulator by the addition of reactive elements. For such synthesis from a symmetrical three-port junction it is necessary and sufficient for it to be loss-free and for the moduli of the two transmission coefficients to be different. This approach may be used in the design of broadband circulators. For junctions approximating to an n-port circulator with $n > 3$, it is shown that when the n reflection coefficients are matched by reactive networks in each arm, n particular transmission coefficients also vanish.



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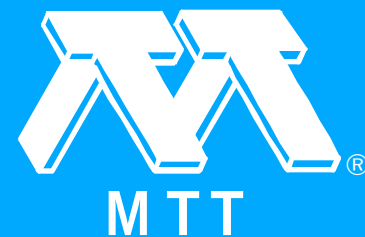


Abstracts

Propagation of Surface Waves on an Inhomogeneous Plane Layer

J.H. Richmond. "Propagation of Surface Waves on an Inhomogeneous Plane Layer." 1962 Transactions on Microwave Theory and Techniques 10.6 (Nov. 1962 [T-MTT]): 554-558.

The permittivity of a plane layer is assumed to vary continuously as a function of distance measured from the surface. Solutions for the field distributions of surface waves on the inhomogeneous layer are developed with the WKB technique. Transcendental equations for the phase velocity are derived for TE and TM modes. These equations are solved most conveniently with the aid of phase-velocity graphs which are included. The accuracy of the solution is verified by comparison with the rigorous solution for an exponential inhomogeneity.



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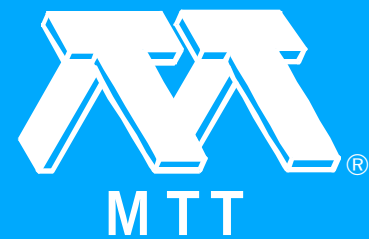
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UHF Backward-Wave Parametric Amplifier

S. Okwit, M.I. Grace and E.W. Sard. "UHF Backward-Wave Parametric Amplifier." 1962 Transactions on Microwave Theory and Techniques 10.6 (Nov. 1962 [T-MTT]): 558-563.

This paper describes a breadboard model of a UHF varactor diode backward-wave parametric amplifier that can be electronically tuned over an octave tuning range (250-500 Mc). It operates in a mode that has a relatively constant idler frequency; however, it uses two forward-wave transmission lines in contrast to the backward-wave transmission line requirement previously reported. A theoretical discussion on the design considerations of this mode is presented and applied to the UHF model. Measurements taken in the conventional mode of operation (output frequency equal to the input frequency) yielded voltage gain bandwidth products in excess of 100 Mc and over-all effective receiver noise temperatures of less than 140°K. Detailed measurements in the mode where the constant idler frequency is used as the output were not taken because directional filters and circulators, which are necessary in this mode, were not available.

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Abstracts

Microwave Propagation in Semiconductors with Carrier Density Varying in Time

B.R. Nag and P. Das. "Microwave Propagation in Semiconductors with Carrier Density Varying in Time." 1962 Transactions on Microwave Theory and Techniques 10.6 (Nov. 1962 [T-MTT]): 564-567.

Expressions are derived for the propagation function of a microwave signal inside a waveguide filled with a semiconductor with carrier density varying in time. The bearing of these expressions on the performance of semiconductor microwave modulators and on microwave methods for the measurement of lifetime in semiconductors is discussed.



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On the Resonant-Cavity Method for Measurement of Varactors

F. Keywell. "On the Resonant-Cavity Method for Measurement of Varactors." 1962 Transactions on Microwave Theory and Techniques 10.6 (Nov. 1962 [T-MTT]): 567-578.

An extension of Houlding's method for measurement of varactor quality has been developed by using a swept-bias voltage instead of a discrete step in bias. The method can be used to measure the cutoff frequency of high-Q varactors if the law of capacitance variation is known. In this case, it is not necessary to measure capacity or reactance since cutoff frequency is shown to be determined by reflected power on a microwave-reflectometer system. The Sweep-Voltage Method places emphasis on the measurement of reflected power and a test bench is described for application of the method. The series resistance of high-voltage epitaxial varactors is shown, by calculation and experimental data, to be a function of bias. This is due to space-charge layer widening which causes the epitaxial base layer to vary in length. For this reason it is advantageous to compare high-voltage epitaxial varactors by sweeping the bias over a broad range of the diode characteristics. Data is given for typical per cent of reflected microwave power R for 6.5-, 15-, and 100-v varactors where the varactor is matched to the line at 2.00-, 5.00- and 15.0-v bias and a sine wave at 100 kc with amplitude 4.00, 10.0 or 30.0 v is superimposed on the bias. The measurements are independent of the power incident on the varactor to a level of 700 μ w.



Abstracts

Excitation of Surface Waves on a Perfectly Conducting Screen Covered with Anisotropic Plasma

S.R. Seshadri. "Excitation of Surface Waves on a Perfectly Conducting Screen Covered with Anisotropic Plasma." 1962 Transactions on Microwave Theory and Techniques 10.6 (Nov. 1962 [T-MTT]): 573-578.

The field due to a line source of magnetic current situated in a lossless plasma region above a perfectly conducting screen is considered when a uniform static magnetic field is impressed throughout the plasma region parallel to the direction of the line source. It is shown that under certain conditions surface waves are excited on the screen. The dependence of the efficiency of excitation of surface waves on the distance d of the line source from the ground screen is examined. Also, the asymptotic series for the radiation field is derived, and its leading term is shown to vanish for a particular value of d . Under these conditions a strong surface-wave field is maintained near the guiding surface.



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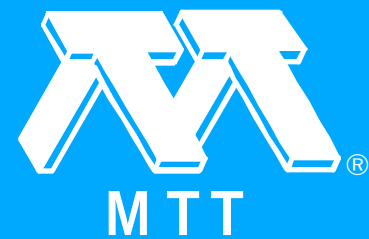
Ferrite Resonance Isolators Using Tapered DC Magnetic Fields

F.S. Chen. "Ferrite Resonance Isolators Using Tapered DC Magnetic Fields." 1962 Transactions on Microwave Theory and Techniques 10.6 (Nov. 1962 [T-MTT]): 579-584.

Tapered dc magnetic fields can be used to broad-band ferrite resonance isolators of the rectangular waveguide type. In this work a ferrite slab of narrow resonance line width was employed in order to keep the ratio of reverse-to-forward attenuation large while the bandwidth of the isolator was broadened by means of an appropriately tapered magnetic field. A ratio of reverse-to-forward attenuation of more than 60 has been obtained experimentally over a 38 per cent frequency range at X band, and further improvement of these figures seems possible.

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Plane Waves on a Periodic Structure of Circular Disks and Their Application to Surface-Wave Antennas

J. Shefer. "Plane Waves on a Periodic Structure of Circular Disks and Their Application to Surface-Wave Antennas." 1962 Transactions on Microwave Theory and Techniques 10.6 (Nov. 1962 [T-MTT]): 585-592.

The structure supporting the surface-wave consists of a row of concentric circular disks embedded in a lossless dielectric medium. Exact solutions for the "dipole mode" (corresponding to the HE/sub 11/ surface-wave mode on a dielectric rod) are set up and an approximation is derived for calculating the propagation constants. It is shown experimentally that a pure "dipole mode" can be excited by simple means, and that propagation constants may be controlled over a wide range by varying the geometrical parameters of the periodic structure. The possible uses as a surface-wave antenna are discussed, and approximate radiation patterns are calculated from the field distribution in the terminal plane.

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Abstracts

The Sinusoidal Variation of Dissipation Along Uniform Waveguides

G. Persky. "The Sinusoidal Variation of Dissipation Along Uniform Waveguides." 1962 Transactions on Microwave Theory and Techniques 10.6 (Nov. 1962 [T-MTT]): 592-595.

Standing waves in a waveguide with dielectric and/or metal wall losses generally give rise to expressions for power dissipation per unit length containing a term which is a sinusoidal function of the distance along the waveguide. In the present paper this phenomenon is explained and expressions for the dissipation are derived. The development is carried out for TE and TM modes in a uniform dielectric filled waveguide of arbitrary cross section, and then again from the standpoint of transmission line theory. The practical implications of the results are discussed.



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An Analysis of the m-Port Symmetrical H-Plane Waveguide Junction with Central Ferrite Post

J.B. Davies. "An Analysis of the m-Port Symmetrical H-Plane Waveguide Junction with Central Ferrite Post." 1962 Transactions on Microwave Theory and Techniques 10.6 (Nov. 1962 [T-MTT]): 596-604.

An analysis is presented for the m-port symmetrical H-plane waveguide junction with central ferrite post. It has application to the engineering problem of microwave circulators and to the more academic problem of the empty symmetrical junction. An exact solution is formulated from which is developed an approximation that is equivalent to considering only the propagating modes of the rectangular waveguides. The method is found to give results in agreement with the theory for the 2-port junction (i. e., waveguide) with ferrite post, and with experiment for ferrite-free 3- and 4-port junctions. Theoretical design curves are given for the 3-port circulator, although for lack of suitable ferrite data, these have not been checked accurately. A number of 3- and 4-port circulators have been made to designs arising from the analysis. Because the microwave performance is derived explicitly in terms of the junction geometry and ferrite properties, the design of a particular component must of necessity involve much computation.

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Microwave Modulator Requiring Minimum Modulation Power

E.M. Rutz and E. Kramer. "Microwave Modulator Requiring Minimum Modulation Power." 1962 Transactions on Microwave Theory and Techniques 10.6 (Nov. 1962 [T-MTT]): 605-610.

A microwave modulator was devised which requires a minimum of modulation power and which has very high modulation efficiency. The modulator functions as a switch, which opens and closes a transmission line proportional to a time function which represents information in digital form. The modulator is a varactor diode operating in the reverse bias region. To obtain the required modulation characteristics, the diode was switched between two resonant modes. It was operated alternatively in series and in shunt resonance by varying the diode's capacitance. To obtain the resonant modes, tuning elements were added in series and in shunt with the varactor diode. At the design frequency of 2.2 Gc the semiconductor modulator has an insertion loss of less than 1 db in the transmission mode and more than 24 db in the rejection mode. In the transmission mode $Q/\text{sub } L/$ is close to one; in the rejection mode $Q/\text{sub } L/$ ranges from 30 to 50. The consumption of modulation power is extremely low. For a modulation voltage of square waveform with the fundamental frequency of 1 Mc, the dissipated modulation power is below $10/\text{sup } -8/$ watts. The modulation efficiency is nearly one, since the response time of the varactor diode which is operated in the space charge region is below $10/\text{sup } -11/$ sec.



Abstracts

Higher-Order Evaluation of Electromagnetic Diffraction by Circular Disks (Correction)

W.H. Eggimann. "Higher-Order Evaluation of Electromagnetic Diffraction by Circular Disks (Correction)." 1962 Transactions on Microwave Theory and Techniques 10.6 (Nov. 1962 [T-MTT]): 610-610.

W. H. Eggimann, author of "Higher-Order Evaluation of Electromagnetic Diffraction by Circular Disks," which appeared on pages 408-418 of the September, 1961, issue, of these Transactions, has brought the following misprints to the attention of the Editor.



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Millimeter Resonance Isolator Using Chemically Deposited Ferrite Films (Correspondence)

W. Wade, Jr., T. Collins and R. Stern. "Millimeter Resonance Isolator Using Chemically Deposited Ferrite Films (Correspondence)." 1962 Transactions on Microwave Theory and Techniques 10.6 (Nov. 1962 [T-MTT]): 611-611.

An experimental resonance isolator showing the feasibility of newly developed chemically deposited ferrite films, was made in the 35-Gc region. Included in this letter are two graphs showing the isolation characteristics that were obtained and also a brief description of the film preparation techniques.



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A Device for Rapidly Aligning and Mounting Ferromagnetic Single Crystals Along any Desired Axis (Correspondence)

Y. Sato and P.S. Carter. "A Device for Rapidly Aligning and Mounting Ferromagnetic Single Crystals Along any Desired Axis (Correspondence)." 1962 Transactions on Microwave Theory and Techniques 10.6 (Nov. 1962 [T-MTT]): 611-612.

A new type of device has been developed that locates the axes of a ferromagnetic crystal quickly and easily, without the usual time-consuming X-ray procedures. This device makes it possible to quickly find any desired axis of a ferromagnetic crystal and provides a convenient method of mounting the crystal on a rod along this axis.



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Millimeter Wave Cavity Coupling by Quarter-Wave Transformer (Correspondence)

R.J. Strain and P.D. Coleman. "Millimeter Wave Cavity Coupling by Quarter-Wave Transformer (Correspondence)." 1962 Transactions on Microwave Theory and Techniques 10.6 (Nov. 1962 [T-MTT]): 612-614.

In order to use high mode-order microwave cavities (Fabry-Perot, confocal, or biconical spherical resonators) to achieve either high field intensities or high selectivity with low transmission losses, it is necessary to couple power into the resonators efficiently. This may be accomplished if the coupling system acts as a transformer matching the lossy elements of the cavity to a source of input power, and if the coupling system has an aperture large enough to make diffraction losses negligible.



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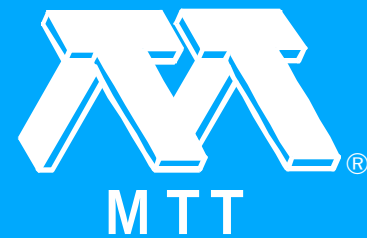
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G.F. Bland, M.F. Bottjer, M.B. Chasek, F.-S. Chen, M. Cohn, R.E. Collin, P. Das, J.B. Davies, W.H. Eggimann, A.F. Eikenberg, C.E. Fay, A.G. Franco, M.I. Grace, J.C. Hoover, B.L. Humphreys, E.M.T. Jones, J.A. Kaiser, Jr., I. Kaufman, F. Keywell, R.F. Koontz, K.L. Kotzebue, E. Kramer, N.M. Kroll, J.H. Little, R.Q. Maines, G.L. Matthaei, T. Mukaihata, B. Nag, S. Okwit, W.H. Pepper, G. Persky, J.H. Richmond, E.B. Roberts, E.M. Rutz, E.W. Sard, S.R. Seshadri, J. Shefer, H.B. Smith, Jr., W.H. Steier, J.J. Taub, B.L. Walsh, Jr., E. Wantuch and L. Young. "Contributors (Nov. 1962 [T-MTT])." 1962 Transactions on Microwave Theory and Techniques 10.6 (Nov. 1962 [T-MTT]): 614-619.



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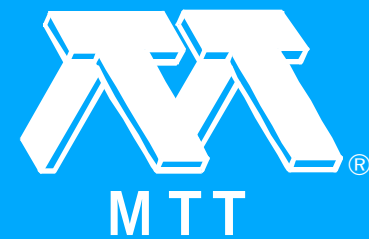
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*"Index, IRE Transactions on Microwave Theory and Techniques, Volume MTT-10, 1962."
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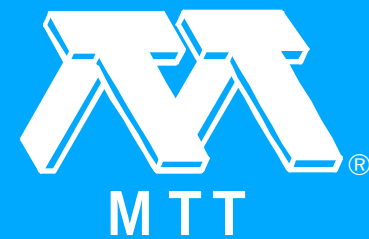
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Editorial (Jan. 1963 [T-MTT])

D.D. King. "Editorial (Jan. 1963 [T-MTT])." 1963 Transactions on Microwave Theory and Techniques 11.1 (Jan. 1963 [T-MTT]): 2-2.

During the past four years these transactions have grown. We now have more issues, more articles, more letters, and more pages per year. In this growth we have not forsaken quality for quantity--the percentage of manuscripts rejected after review has also increased. Whether the present trend will continue in the future is doubtful. Certainly we cannot expect an indefinite number of original contributions on waveguide filters, parametric amplifiers, and ferrite devices. The theory and techniques in these areas are maturing. Gradually, new subjects and also new authors must take over the pages of future issues. At this time, when editor and editorial board are changed, it is well to look beyond the quantity and quality of our present publication at the basic factors shaping the future of our transactions.



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Traveling-Wave Tube Nanosecond Pulse Generator in 24-Gc Region

K. Miyauchi. "Traveling-Wave Tube Nanosecond Pulse Generator in 24-Gc Region." 1963 Transactions on Microwave Theory and Techniques 11.1 (Jan. 1963 [T-MTT]): 3-17.

A 24-Gc traveling-wave tube of the type ECL-1180 /24W80 was used for generating nanosecond carrier pulses. The helix of the traveling-wave tube was modulated by a 40-Mc high voltage sine wave. Duration, power and carrier frequency shift of the output RF pulse were examined quantitatively with respect to the modulating voltage. It was found that the delay time of a traveling-wave tube has a large effect on the characteristics of the output pulse. The theory of transmission line modulators was developed to explain the pulse shaping mechanism in the traveling-wave tube. Observations of output pulses were made with three measuring devices, i.e., video-sampling oscilloscope with crystal detector, interferometer, and spectrum analyzer. The interferometer was found to be useful for measuring half-amplitude duration of carrier pulse. Output pulses with half-amplitude duration of as short as 1 nsec were observed.

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Loss Measurements of the Beam Waveguide

J.B. Beyer and E.H. Scheibe. "Loss Measurements of the Beam Waveguide." 1963 Transactions on Microwave Theory and Techniques 11.1 (Jan. 1963 [T-MTT]): 18-22.

The diffraction loss of a new low-loss waveguide for millimeter and shorter wavelength, called the beam waveguide, was measured. The loss measurements were made using a resonator technique. The beam waveguide resonator derived from the beam waveguide consists of confocal paraboloids and is itself a very useful millimeter and sub-millimeter wave circuit component having already found application in some optical masers. Measurements made to determine the reflection loss of the resonator end plates also resulted in information on the loss of 90° bends in the beam waveguide. The results of the loss measurements made on the beam waveguide, in the frequency range near 9 Gc, are in good agreement with theoretical values given by Goubau.

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



Abstracts

The Synthesis of Coupled Transmission Line All-Pass Networks in Cascades of 1 to n

W.J.D. Steenaart. "The Synthesis of Coupled Transmission Line All-Pass Networks in Cascades of 1 to n." 1963 Transactions on Microwave Theory and Techniques 11.1 (Jan. 1963 [T-MTT]): 23-29.

A homogeneous coupled line configuration realizing the characteristics of an all-pass network in the distributed network sense is useful for delay equalization in the UHF range. All-pass networks of first and second order are presented, while nth-order networks may be realized directly or built out of first- and second-order networks, analogous to the lumped-constant element network technique.



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Sharp Cutoff Microwave Filters

G. Oltman. "Sharp Cutoff Microwave Filters." 1963 Transactions on Microwave Theory and Techniques 11.1 (Jan. 1963 [T-MTT]): 30-35.

A class of sharp cutoff filters using combinations of lumped constant and distributed constant reactance have been analyzed and a test made of one type. The filters are developed in accordance with image parameter theory and are m-derived. Both high-pass and low-pass types are analyzed. The improvements over previous sharp-cutoff image parameter filters are predictable band limits and more predictable response. The derivations hold for all frequencies and are not approximations good only for short lengths of distributed constant reactance. Also, this class of filters have much sharper cutoffs than can be obtained with an equivalent number of sections designed using modern network theory. Some of these filters have fairly flat response close to the sharp-cutoff and are useful as end-matching sections. Curves and design equations are presented for three types---two high-pass and one low-pass filter. A seven-section high-pass filter was designed and tested. Its cutoff rate was 87db in a 3 per cent bandwidth located in the 300-Mc region. The pass-band width was greater than 30 per cent.

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Broad-Band Impedance Matching into Dielectric-Filled Waveguides

F.E. Goodwin and G.E. Moss. "Broad-Band Impedance Matching into Dielectric-Filled Waveguides." 1963 Transactions on Microwave Theory and Techniques 11.1 (Jan. 1963 [T-MTT]): 36-39.

The problem of impedance matching between two waveguides filled with different dielectrics is discussed, and the conditions for broad-band matching are determined. Experimental results are presented for standard waveguides matched to guides filled with dielectrics having permittivities ϵ as high as $100\epsilon_0$. Present applications include matching devices for X-band coupled-cavity transmission masers which employ ruby and alumina sections ($\epsilon \approx 10\epsilon_0$). Future applications include matching devices for masers utilizing rutile (ϵ as high as $250\epsilon_0$).



Excitation of Plasma Waves in an Unbounded Homogeneous Plasma by a Line Source

S.R. Seshadri. "Excitation of Plasma Waves in an Unbounded Homogeneous Plasma by a Line Source." 1963 Transactions on Microwave Theory and Techniques 11.1 (Jan. 1963 [T-MTT]): 39-50.

The radiation characteristics of a line source of magnetic current embedded in a homogeneous electron plasma of infinite extent are investigated for the case in which a uniform magnetic field is impressed externally throughout the medium in the direction of the source. The single-fluid theory of magnetohydrodynamics is employed. A very simple model is assumed for the plasma. Under this assumption, it is found that there are two modes of propagation of waves of small amplitude. By examining the behavior of these modes in the limiting cases of vanishing external magnetic field or infinite source frequency, they are identifiable as the modified forms of the usual plasma and optical modes which exist in an isotropic electron plasma. The dispersion relations for these two modes are discussed. The power radiated in each of the two modes is also evaluated. It is found that the power radiated in the optical mode is always lower than that due to the line source in free space, whereas the power radiated in the plasma mode is higher than that value for certain ranges of the source frequency.



Abstracts

Radial-Line Coaxial Filters in the Microwave Region

B.C. De Loach, Jr.. "Radial-Line Coaxial Filters in the Microwave Region." 1963 Transactions on Microwave Theory and Techniques 11.1 (Jan. 1963 [T-MTT]): 50-55.

Design techniques and a simple empirical formula for the design of band rejection radial-line coaxial filters are presented. The appropriateness of these filters for parametric work is discussed and a particular structure employing these filters to provide a high performance harmonic filter structure for rectangular waveguide is presented.



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Periodic Cylinder Arrays as Transmission Lines

J. Shefer. "Periodic Cylinder Arrays as Transmission Lines." 1963 Transactions on Microwave Theory and Techniques 11.1 (Jan. 1963 [T-MTT]): 55-61.

Periodic structures of conducting cylinders have been used as radiators (Yagi antennas), and, more recently, as slow-wave lines in traveling-wave tubes and masers. In this report it is shown that a nonresonant structure may have interesting capabilities as an open surface-wave transmission line. By means of a relatively simple matching network, efficient excitation of a surface wave on the periodic line is obtained. Response is flat over a 20 per cent frequency range at X band for several combinations of cylinder lengths and spacings. Total insertion losses are less than 3 db and largely independent of length of transmission line. Conducting cylinders are embedded in styrofoam. The effects of bends and twists in the line have also been investigated. It is shown experimentally that a guided wave on this periodic structure can follow a circular path having 1.5λ radius of curvature with very little loss. The plane of polarization can be rotated 90° by inserting a short twisted section. By terminating the transmission line with short circuits at both ends, a discrete series of transmission maxima is observed. Since these resonant peaks of transmission are of high Q factor, the dispersion characteristic of the line is obtained with very good accuracy. This type of open transmission line may offer advantages over heavy-weight and bulky conventional waveguides for some specialized applications.

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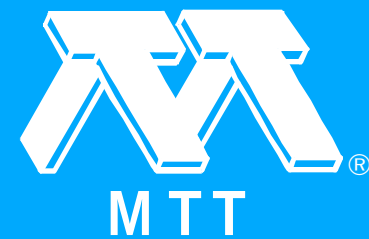


Abstracts

A New Method for Designing Wide-Band Parametric Amplifiers

B.T. Henoch. "A New Method for Designing Wide-Band Parametric Amplifiers." 1963 Transactions on Microwave Theory and Techniques 11.1 (Jan. 1963 [T-MTT]): 62-72.

A practical method of designing wide-band parametric amplifiers operated with a circulator is described. For amplifiers with an initially series-tuned varactor, it is possible to find simple relations between Butterworth and Chebyshev responses of lowpass filters and desired gain responses of maximally flat or equalripple type. These relations are shown to hold for most practical varactors. For amplifiers with an initially series-tuned varactor, simple expressions for the limiting gain bandwidth product are given. It is also shown how filters should be chosen to give stable amplifiers.



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Abstracts

Waveguide Perturbation Techniques in Microwave Semiconductor Diagnostics (Jan. 1963 [T-MTT])

K.S. Champlin and D.B. Armstrong. "Waveguide Perturbation Techniques in Microwave Semiconductor Diagnostics (Jan. 1963 [T-MTT])." 1963 Transactions on Microwave Theory and Techniques 11.1 (Jan. 1963 [T-MTT]): 73-77.

Scattering processes in semiconductors are often studied by observing scattering averages with measurements of various dc transport phenomena. With microwaves, the observation frequency can be of the order of the scattering frequency so that the corresponding microwave transport property may be complex. Thus, in studying detailed scattering mechanisms, a microwave transport experiment contains potentially more information than the analogous dc experiment. This paper discusses perturbation techniques which are useful in determining the microwave conductivity and low-field Hall effect of a bulk semiconductor contained in a waveguide from measurement of the properties of the transmitted wave.



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The Coupling Coefficients of an Unsymmetrical High-Q Lossy Waveguide Resonator

H.J. Riblet. "The Coupling Coefficients of an Unsymmetrical High-Q Lossy Waveguide Resonator." 1963 Transactions on Microwave Theory and Techniques 11.1 (Jan. 1963 [T-MTT]): 78-83.

This paper determines the minimum insertion loss and the minimum VSWR of a waveguide resonator constructed by spacing two, unequal, reactive, primarily-shunt, lossy, reflecting elements approximately one-half-wavelength apart on a lossy transmission line. The requirement that the resonant loss be small, 10 db or less, limits the size of the loss parameters and permits an approximate solution of the problem within an error of the order of $1/Q_{\text{sub } L}$. These formulas can be expressed in terms of two "coupling coefficients". Contrary to the familiar formulas derived from the low frequency analogue, however, these coupling coefficients depend, in general, on the parameters of both reflecting elements. Formulas for the loaded and unloaded Q of the resonator are derived. In general, it is not possible to determine the unloaded Q of the resonator from its loaded Q except by a limiting process. Within the order of the approximation involved, series losses cannot be distinguished from shunt losses. Accordingly they can be lumped together and one is led to the fact that a lossy admittance inverter consists of a lossless admittance inverter surrounded on both sides by series losses. This is used to justify the application of the idea of "predistortion" to the design of narrow-band, lossy, waveguide filters.

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Abstracts

A General Power Loss Method for Attenuation of Cavities and Waveguides (Jan. 1963 [T-MTT])

J.J. Gustincic. "A General Power Loss Method for Attenuation of Cavities and Waveguides (Jan. 1963 [T-MTT])." 1963 Transactions on Microwave Theory and Techniques 11.1 (Jan. 1963 [T-MTT]): 83-87.

The usual power loss method of evaluating the damping constant and Q of cavities and the attenuation constant of waveguides, as caused by finite wall conductivity, breaks down in the case of degenerate modes and fails to predict the coupling between degenerate modes. By means of variational formulations for the lossy case it is shown how the usual power loss method maybe generalized to treat the case when there are degenerate modes present. The generalized method turns out to be a particularly simple extension of the usual procedure.



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Abstracts

A Simple Method for Measuring the Phase Shift and Attenuation through Active Microwave Networks (Comments)

H.M. Altschuler. "A Simple Method for Measuring the Phase Shift and Attenuation through Active Microwave Networks (Comments)." 1963 Transactions on Microwave Theory and Techniques 11.1 (Jan. 1963 [T-MTT]): 87-87.

In his recent letter on the measurement of phase shift and attenuation of active two ports Alday has submitted material which the author believes should not remain unchallenged. His notion of the addition of power in his system is an erroneous one, so that what he claims to be a measure of attenuation is in fact a measure of a quantity which is not an attenuation at all. It is, as will be seen, a quantity which qualitatively follows the "ups and downs" of a peculiar attenuation.



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Abstracts

Measurement of Impedance at Frequencies above 300 Mc (Correspondence)

P.I. Somlo. "Measurement of Impedance at Frequencies above 300 Mc (Correspondence)." 1963 Transactions on Microwave Theory and Techniques 11.1 (Jan. 1963 [T-MTT]): 87-88.

I wonder if any of your readers can help me to find out whether the method described below has ever been proposed in the literature to measure the output impedance of signal sources in the frequency range above 300 Mc. Although it is realized that this method is in close relationship with Chipman's method, to the author's best knowledge it has not been proposed for the measurement of active two-terminal impedances, i.e., signal generator output impedances in particular.



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A Practical UHF Multidiscriminator Unit (Correspondence)

P. Chiu. "A Practical UHF Multidiscriminator Unit (Correspondence)." 1963 Transactions on Microwave Theory and Techniques 11.1 (Jan. 1963 [T-MTT]): 88-89.

The purpose of this communication is to report the design and development of a compact UHF multidiscriminator unit. This device offers possible new applications in the microwave systems. Fig. 1 shows the circuit of a single discriminator.



Abstracts

Q Measurement of Strongly Coupled Cavities (Correspondence)

R. Alvarez and J.P. Lindley. "Q Measurement of Strongly Coupled Cavities (Correspondence)." 1963 Transactions on Microwave Theory and Techniques 11.1 (Jan. 1963 [T-MTT]): 89-90.

The long-line method herein described provides a rapid, simple, and fairly accurate measurement of resonant frequency and loaded bandwidth of a one-port cavity which is tightly coupled to its transmission line.



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Abstracts

A Microwave Quadruplexer (Correspondence)

L.v.d. Kint and E. Schanda. "A Microwave Quadruplexer (Correspondence)." 1963 Transactions on Microwave Theory and Techniques 11.1 (Jan. 1963 [T-MTT]): 90-92.

In an earlier issue of these Transactions Brown and Clark brought an unpublished phenomenon into discussion with their correspondence, "A Unique Solid-State Diplexer: When a ferromagnetic oxide with small linewidth (yttrium-iron garnet substituted with aluminium in their experiments) is applied to a Y-junction circulator at a frequency lying just below the ferromagnetic resonance then circulation takes place in the opposite sense to that for a frequency just above the resonance.



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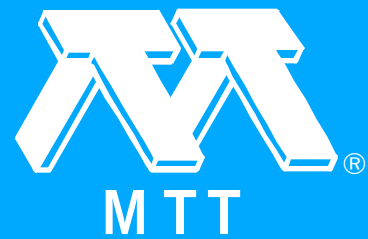


Abstracts

A Resonant Slope Amplifier Using a Microwave Pump Frequency (Correspondence)

R.J. Mayer. "A Resonant Slope Amplifier Using a Microwave Pump Frequency (Correspondence)." 1963 Transactions on Microwave Theory and Techniques 11.1 (Jan. 1963 [T-MTT]): 92-92.

Resonant slope (or resonant dielectric) amplifiers are of interest because of their high-input impedance and low-frequency capability.



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Abstracts

A Three-Port Network with Constant Phase Difference Properties (Correspondence)

B.L. Geddry. "A Three-Port Network with Constant Phase Difference Properties (Correspondence)." 1963 Transactions on Microwave Theory and Techniques 11.1 (Jan. 1963 [T-MTT]): 92-93.

The 90° hybrid and the 180° TEM magic tee can, at least theoretically, be made to work over bandwidths of 10 to 1, and more. The device described is not limited to 90° or 180°. It provides a phase shift between its outputs that is not only constant with frequency, but also capable of being set at any value. In addition, the ratio of the powers delivered to the outputs may be set as desired.



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Abstracts

A Simple Formula for Calculating Approximate Values of the First Zeros of a Combination Bessel Function Equation (Correspondence)

M.A.R. Gunston. "A Simple Formula for Calculating Approximate Values of the First Zeros of a Combination Bessel Function Equation (Correspondence)." 1963 Transactions on Microwave Theory and Techniques 11.1 (Jan. 1963 [T-MTT]): 93-94.

The solution of many problems in microwave theory, particularly those relating to waveguides having curved boundary surfaces, is dependent upon a determination of the zeros of the Bessel function equation.



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Maximum Efficiency of a Two Arm Waveguide Junction (Correspondence)

R.W. Beatty. "Maximum Efficiency of a Two Arm Waveguide Junction (Correspondence)." 1963 Transactions on Microwave Theory and Techniques 11.1 (Jan. 1963 [T-MTT]): 94-94.

It is well-known that the efficiency of two-arm waveguide junction (2-port) depends upon the reflection coefficient Γ_L of the load with which one of the arms terminated. The efficiency is known to vary between the limits 0 and n/m (maximum efficiency) as Γ_L assumes all possible values within the unit circle.

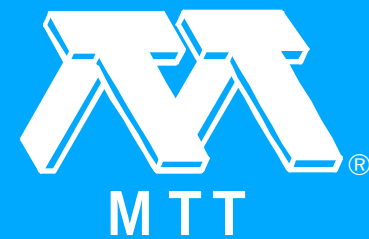
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Contributors (Jan. 1963 [T-MTT])

D.B. Armstrong, J.B. Beyer, K.S. Champlin, B.C. De Loach, Jr., F.E. Goodwin, J. Gustincic, B.T. Henoch, K. Miyauchi, G.E. Moss, G. Oltman, H.J. Riblet, E.H. Scheibe, S.R. Seshadri, J. Shefer and W.J.D. Steenaart. "Contributors (Jan. 1963 [T-MTT])." 1963 Transactions on Microwave Theory and Techniques 11.1 (Jan. 1963 [T-MTT]): 95-96.



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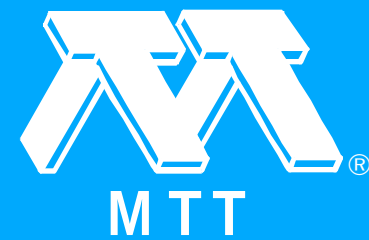
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Abstracts

PTGMTT Membership Roster as of November, 1962

"PTGMTT Membership Roster as of November, 1962." 1963 Transactions on Microwave Theory and Techniques 11.1 (Jan. 1963 [T-MTT]): 97-107.



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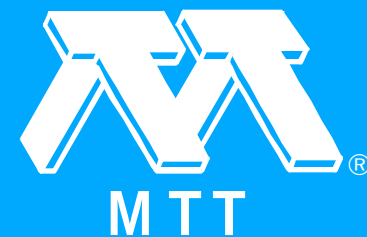
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Abstracts

Index, IRE Transactions on Microwave Theory and Techniques (Cumulative) 1953-1956

*"Index, IRE Transactions on Microwave Theory and Techniques (Cumulative) 1953-1956."
1963 Transactions on Microwave Theory and Techniques 11.1 (Jan. 1963 [T-MTT]): i-viii.*



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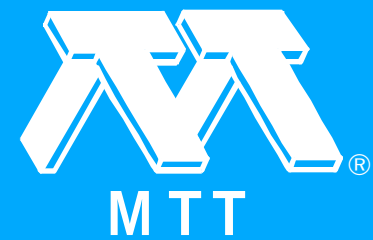
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"Front Cover (Mar. 1963 [T-MTT])." 1963 Transactions on Microwave Theory and Techniques 11.2 (Mar. 1963 [T-MTT]): f1-f2.



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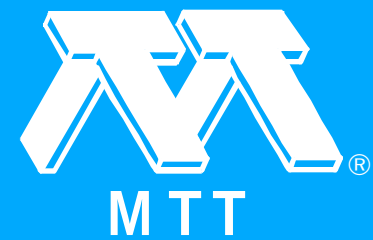
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"Table of Contents (Mar. 1963 [T-MTT])." 1963 Transactions on Microwave Theory and Techniques 11.2 (Mar. 1963 [T-MTT]): 109-109.



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Abstracts

Biography - Donald D. King

S.B. Cohn. "Biography - Donald D. King." 1963 Transactions on Microwave Theory and Techniques 11.2 (Mar. 1963 [T-MTT]): 110-110.

With our last issue, Donald D. King completed his service to our Professional Group as Transactions Editor for the past three years. However, Don is continuing to play an active role in the Group, as this year's Vice Chairman of the Administrative Committee.



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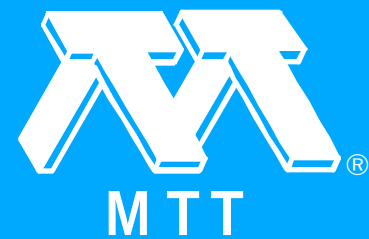
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A High-Power Wide-Band Waffle-Iron Filter

E.D. Sharp. "A High-Power Wide-Band Waffle-Iron Filter." 1963 Transactions on Microwave Theory and Techniques 11.2 (Mar. 1963 [T-MTT]): 111-116.

This paper describes the design and measured performance of an L-band model of a high-power wide-band low-pass waffle-iron filter. Three different waffle-iron filters with staggered stop bands are connected in series to give a combined stop band that extends from 2.2 Gc to 13.7 Gc. where the attenuation is 60 db or greater. The waffle-iron filter attenuates all propagating waveguide modes which can propagate at frequencies in the above stop band. In the pass band the waffle-iron filters are matched to full size L-band waveguide using quarter-wavelength stepped transformers. The pulsed power-handling capacity without breakdown is measured to be over 1.4 Mw peak power with air at atmospheric pressure filling the filter.

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Theory of Operation of a 3-Port Y-Junction Ferrite Circulator

E.N. Skomal. "Theory of Operation of a 3-Port Y-Junction Ferrite Circulator." 1963 Transactions on Microwave Theory and Techniques 11.2 (Mar. 1963 [T-MTT]): 117-122.

An analysis is made of the operation of a 3 port Y-junction ferrite circulator wherein it is assumed that the ferrite cylinder can support the propagation of a bound surface wave. The incident wave guided by the air-dielectric interface of the ferrite cylinder is taken to be linearly polarized parallel to the ferrite axis and after incidence on the cylinder is assumed to divide and propagate in opposite directions about the cylinder as two linearly polarized signals. By appropriate selection of ferrite cylinder diameter, permeability, magnetizing field and saturation magnetization, constructive and destructive interference of the RF components are shown to occur at the two output ports. The conditions for reinforcement and null at the outputs are discussed and compared with published experimental data. It is possible to predict the occurrence of ferrite circulator diplexing reported by Brown and Clark although good quantitative comparison is lacking. The theoretical dependence of ferrite diameter upon free space wavelength is computed and compares satisfactorily with recorded experimental data. The experimental observations that greater circulator bandwidths are achievable when below resonance magnetizing fields are employed are shown to have a theoretical basis. In addition, interrelationships among the designed variables: saturation magnetization, applied magnetic field, ferrite resonance linewidth and circulator insertion loss are noted in the theoretical results.



Abstracts

The Stabilization of Mixer Diode Performance Against L.O. Power Changes with Optimum DC Bias

J.W. Carr. "The Stabilization of Mixer Diode Performance Against L.O. Power Changes with Optimum DC Bias." 1963 Transactions on Microwave Theory and Techniques 11.2 (Mar. 1963 [T-MTT]): 123-129.

The advantages of using a particular dc forward bias in maintaining receiver sensitivity for fairly large reductions in local oscillator power are experimentally verified. Definite improvement of performance is obtained over broad band operation where L.O. power level may vary considerably. For each of the mixer diodes investigated there is a particular optimum bias for each diode type where both the input signal level and local oscillator RF impedances as well as the IF impedance are practically stationary with respect to very large changes in local oscillator power level. At optimum bias, signal frequency RF and IF impedances were found to vary by only about ten per cent for L.O. power reduced from 1 mw to 1 μ w. This results in considerably less reduction in tangential signal sensitivity over that obtained in the unbiased or overbiased condition.



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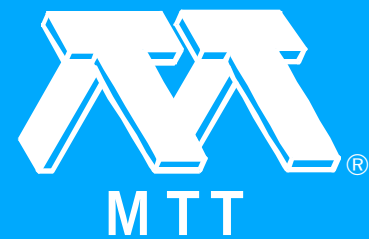
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Phase, Attenuation, and Impedance Characteristics of Coaxial Transmission Lines with Thin Tubular Conductors

E.J. Post. "Phase, Attenuation, and Impedance Characteristics of Coaxial Transmission Lines with Thin Tubular Conductors." 1963 Transactions on Microwave Theory and Techniques 11.2 (Mar. 1963 [T-MTT]): 129-136.

The phase, attenuation, and impedance characteristics of coaxial lines are discussed in some detail, stressing the improvements which can be obtained by removing conductor material that is not effective in the main part of the frequency interval for which the line is used. The ensuing attenuation is higher for the low frequencies but lower for the high frequencies, in comparison with the solid conductor line. The corresponding phase (that is, total phase minus the constant delay) is substantially more linear than for solid conductor lines in the frequency interval of interest. The real part of the characteristic impedance is more independent of frequency than for the solid conductor case. The reactive part of the characteristic impedance increases faster for low frequencies, but can be very nearly represented by a pure capacity, thus enabling a more ideal and simple line termination with lumped elements.

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Continuously Variable Directional Couplers in Rectangular Waveguide

M.E. Brodwin and V. Ramaswamy. "Continuously Variable Directional Couplers in Rectangular Waveguide." 1963 Transactions on Microwave Theory and Techniques 11.2 (Mar. 1963 [T-MTT]): 137-142.

Variable directional couplers can be constructed by placing a movable dielectric slab in the region of the coupling aperture. The coupling and directivity are a function of the position of the slab. For a two hole coupler, the change in coupling depends principally upon the variation of the field intensity at the coupling apertures. The directivity is solely a function of the difference in phase constants of the two waveguides. For a long, slot narrow wall coupler, the coupling is a function of both intensity and phase variation. Some applications of this device to microwave measurements are described.

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Abstracts

Millimeter Wavelength Resonant Structures (Mar. 1963 [T-MTT])

R.W. Zimmerer, M.V. Anderson, G.L. Strine and Y. Beers. "Millimeter Wavelength Resonant Structures (Mar. 1963 [T-MTT])." 1963 Transactions on Microwave Theory and Techniques 11.2 (Mar. 1963 [T-MTT]): 142-149.

This paper discusses the construction of millimeter wave Fabry-Perot resonators, using both planar and spherical reflectors. It also discusses the equivalent circuits of planar reflectors and the method of obtaining efficient power transfer into the resonators.



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Injection Locked Phase Modulator (Correspondence)

R.C. Mackey. "Injection Locked Phase Modulator (Correspondence)." 1963 Transactions on Microwave Theory and Techniques 11.2 (Mar. 1963 [T-MTT]): 150-150.

This communication describes a novel type of phase modulator based on the injection locking principle. The particular device described utilizes a klystron but the technique is not restricted to the microwave region of the frequency spectrum. The technique may be applied to any oscillator that has a voltage tuning characteristic. The frequency of most oscillators is somewhat dependent on the voltages applied to various parts of the oscillator circuit and heretofore many techniques have been devised to overcome this effect. The injection locked phase modulator makes use of the voltage tuning effect which may be inherent or induced by inclusion of a voltage variable capacitor, or other device.

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Abstracts

A Reflex Klystron Amplifier for Microwave Spectroscopy (Correspondence)

F.W. Chapman. "A Reflex Klystron Amplifier for Microwave Spectroscopy (Correspondence)." 1963 Transactions on Microwave Theory and Techniques 11.2 (Mar. 1963 [T-MTT]): 150-152.

There are situations in microwave resonance studies when the microwave power level must be kept very low in order not to seriously disturb the systems being studied. Electron spin resonance of many systems at low temperature where saturation effects occur and cyclotron resonance of carriers at low temperatures when it is important not to heat the carrier systems appreciably, are two examples of such situations. Operation at these low power levels creates a demand for an increase in sensitivity of the detection system for the microwave spectrometer. Usually this is accomplished by employing a superheterodyne detection system in place of the more usual video detector. The complexity of such an arrangement led us to consider the possibility of using a reflex klystron to amplify the microwave bridge output signal prior to the video detector.



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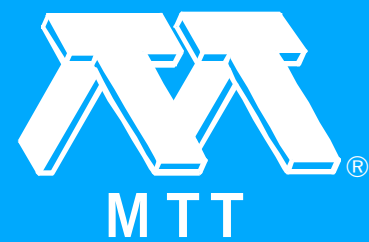
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In-Line Waveguide Calorimeter for High-Power Measurements"-- Accounting for Transverse Waveguide Wall Currents (Correction)

M.M. Brady. "In-Line Waveguide Calorimeter for High-Power Measurements"-- Accounting for Transverse Waveguide Wall Currents (Correction)." 1963 Transactions on Microwave Theory and Techniques 11.2 (Mar. 1963 [T-MTT]): 152-153.

In a recent paper an analysis of calorimeter error due to standing waves in the measured section of waveguide appeared in (11)-(13) and Fig. 3. This analysis was based on the most pessimistic case of a standing-wave of waveguide dissipated power proportional to the square of the transverse H field. Engen has pointed out that the resulting error expression thus obtained is applicable to a TEM wave problem; the actual waveguide calorimeter error will be smaller due to the effects of transverse waveguide wall currents. In the following an expression for the ratio of longitudinal to transverse dissipated power for the TE/sub 01/ mode is developed and a resulting correction to the original error expression (14) is given.

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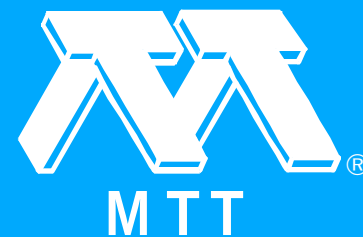


Abstracts

Comment on Fabry-Perot Type Resonators (Addendum)

C.L. Tang. "Comment on Fabry-Perot Type Resonators (Addendum)." 1963 Transactions on Microwave Theory and Techniques 11.2 (Mar. 1963 [T-MTT]): 153-153.

In a recent paper on Fabry-Perot type resonators, Culshaw makes reference to a note of mine to the effect that one of the rather lengthy formulas (5) in my paper is incorrect. I should like to point out the errors as they appeared in our internal research report.



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A Ferrite-Tuned Coaxial Cavity (Correspondence)

J.K. Butler and H. Unz. "A Ferrite-Tuned Coaxial Cavity (Correspondence)." 1963 Transactions on Microwave Theory and Techniques 11.2 (Mar. 1963 [T-MTT]): 153-153.

This communication presents a calculation of the electromagnetic wave propagation constant beta in a coaxial cavity partially loaded with ferrite and dielectric materials. The cavity was designed to operate around 600 Mc. The advantage of using a coaxial cavity compared to a rectangular cavity at 600 Mc is the fact that a coaxial cavity is much smaller than a rectangular cavity. Electronically tuned cavities have been built utilizing ferrite materials in the X-band frequency range. However, until recently no ferrite materials have been produced that could be used feasibly in the UHF frequency range. Tuning cavities with ferrites has certain advantages that some other electronically tuned cavities do not have with regard to power relations. For example, cavities have been built that are electronically tuned with the use of varactor diodes. These types of cavities cannot tolerate medium power levels, whereas, ferrite materials can withstand higher powers.



Abstracts

Some Remarks Concerning "Conditions for Maximum Power Transfer" (Correspondence)

L. Castagnetto, J.C. Matheau and C. Schulman. "Some Remarks Concerning "Conditions for Maximum Power Transfer" (Correspondence)." 1963 Transactions on Microwave Theory and Techniques 11.2 (Mar. 1963 [T-MTT]): 153-154.

In these Transactions Shulman studied the conditions for maximum power transfer.



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Discontinuities Appear in the Repeller Current of a Reflex Klystron Detector (Correspondence)

K. Ishii. "Discontinuities Appear in the Repeller Current of a Reflex Klystron Detector (Correspondence)." 1963 Transactions on Microwave Theory and Techniques 11.2 (Mar. 1963 [T-MTT]): 154-155.

It is known that reflex klystrons are usable as microwave detectors. When the repeller current was plotted against acceleration grid (which is anode) voltage, Kocvienko, Deviatkov, and Lebed found discontinuities. Whitford did not find these discontinuities for the 726A reflex klystron. Kocvienko, et al., explained that the discontinuities were attributed to the appearance and disappearance of the virtual cathode when the klystron began or stopped oscillation. Whitford explained that the beam current density of the 726A reflex klystron was sufficiently high to maintain the virtual cathode at all times.

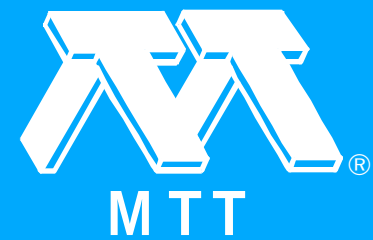
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Abstracts

Contributors (Mar. 1963 [T-MTT])

M.V. Anderson, Y. Beers, M.E. Brodwin, J.W. Carr, E.J. Post, V. Ramaswamy, E.D. Sharp, E.N. Skomal, G.L. Strine and R.W. Zimmerer. "Contributors (Mar. 1963 [T-MTT])." 1963 Transactions on Microwave Theory and Techniques 11.2 (Mar. 1963 [T-MTT]): 156-157.



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1963 Microwave Field and Network Techniques Program (Announcement) (Mar. 1963 [T-MTT])

"1963 Microwave Field and Network Techniques Program (Announcement) (Mar. 1963 [T-MTT])." 1963 Transactions on Microwave Theory and Techniques 11.2 (Mar. 1963 [T-MTT]): 157-157.



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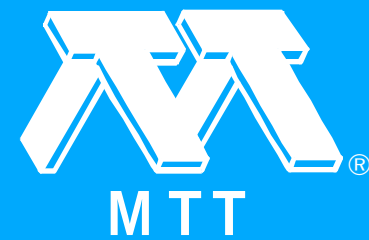
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Abstracts

1963 PTGMTT National Symposium (Mar. 1963 [T-MTT])

"1963 PTGMTT National Symposium (Mar. 1963 [T-MTT])." 1963 Transactions on Microwave Theory and Techniques 11.2 (Mar. 1963 [T-MTT]): 158-160.



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Direct-Coupled Cavity Filters for Wide and Narrow Bandwidths

L. Young. "Direct-Coupled Cavity Filters for Wide and Narrow Bandwidths." 1963 Transactions on Microwave Theory and Techniques 11.3 (May 1963 [T-MTT]): 162-178.

Direct-coupled resonator filters in transmission line are discussed. The resonators consist of sections of transmission line coupled either by series capacitances or shunt inductances. Over narrow frequency bands, such filters show characteristics similar to those of lumped-constant filters and their design is straightforward. The design of direct-coupled resonator filters over wide (as well as narrow) frequency bands is presented here using the quarter-wave transformer as a prototype circuit. Several numerical examples (with fractional bandwidths between 10 per cent and 85 per cent) are worked out to illustrate the method. It is shown that the response can be improved by optimizing the line impedances.

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Intrinsic Attenuation (May 1963 [T-MTT])

R.W. Beatty. "Intrinsic Attenuation (May 1963 [T-MTT])." 1963 Transactions on Microwave Theory and Techniques 11.3 (May 1963 [T-MTT]): 179-182.

The name "intrinsic attenuation" is suggested for the concept originally called "intrinsic insertion loss" and reasons for the proposed change are given. Formulas are given to permit calculation of this quantity, given the scattering coefficients of the network. The use of lossless tuners to obtain a bilaterally matched nonreflecting network is described, and the expected reduction in attenuation is discussed. A graph is presented for rapidly estimating this reduction in attenuation, given minimum information about the network. Experimental results for badly mismatched coaxial attenuators show that the losses in the tuners may in some cases prevent one from realizing any reduction in attenuation.

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Analytical Solution to a Waveguide Leaky-Wave Filter Structure

E.G. Cristal. "Analytical Solution to a Waveguide Leaky-Wave Filter Structure." 1963 Transactions on Microwave Theory and Techniques 11.3 (May 1963 [T-MTT]): 182-190.

Leaky-wave absorption filters have been found advantageous for the suppression of spurious energy of high-power transmitters. However, although there are experimental data of the properties of several specially constructed leaky-wave filters, there are apparently little data relating the effect upon the attenuation of the filters of varying one or more of the possible parameters of their design. In this paper a waveguide leaky-wave filter structure that retains the basic geometry of waveguide leaky-wave filters is analyzed theoretically over a finite frequency range. The complex propagation constant for the least-attenuated leaky-wave mode is obtained by reducing the fundamental integral equation to a transverse resonance equation and solving the reduced equation. The attenuation constant of the least-attenuated mode is obtained for values of $2a/\lambda$ (i.e., the ratio of waveguide width to one half the freespace wavelength) ranging from 0 to 2. Its dependence on various design parameters of leaky-wave filters, such as main waveguide height, spacing of the coupling slots, width of coupling slots and height of the absorbing waveguides is presented. Good correspondence between theoretically computed curves and experimental data was obtained.

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On the Integral Equations of Laser Theory

S.P. Morgan. "On the Integral Equations of Laser Theory." 1963 Transactions on Microwave Theory and Techniques 11.3 (May 1963 [T-MTT]): 191-193.

Mathematical comments are made on a class of integral equations with complex symmetric kernels which occur in laser theory. It is pointed out that integral equations of this class do not have some of the well-known properties of integral equations with Hermitian kernels. In particular, the usual extremal principle by which the eigenvalues of a Hermitian kernel may be estimated using the Rayleigh-Ritz procedure does not apply to integral equations with complex symmetric kernels. It is suggested that the use of variational techniques to calculate diffraction losses in laser interferometers leads to results of doubtful accuracy.

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The Dipolar Resonance of the Cylindrical Low-Pressure Arc Discharge

J.H. Battocletti. "The Dipolar Resonance of the Cylindrical Low-Pressure Arc Discharge." 1963 Transactions on Microwave Theory and Techniques 11.3 (May 1963 [T-MTT]): 193-203.

When an em wave of fixed frequency is incident on the cylindrical positive column of a low-pressure arc discharge, nearly complete absorption occurs at a definite value of discharge current I_0 as the discharge current is varied. I_0 yields a plasma electron density which corresponds to the well-known cylindrical, or dipolar, plasma resonance frequency f_0 . The ratio f_p / f_0 where f_p is the ordinary (plane) plasma frequency, has been determined by others using a quasi-static approach. In this paper a dynamic approach is used, and comparison is made with the quasi-static approach. Agreement is within 3 per cent for values of β_0/a less than 0.25. For β_0/a equal to 0.60, the discrepancy in the quasi-static method is 15 per cent. Theoretical calculations as well as experimental evidence indicate that the electron sheath, which exists on the outside surface of the positive column, plays a significant role in the location of the dipolar plasma resonance. Application of the results of this paper improve the agreement between theory and experiment for the Plasma Microwave Coupler described by Steier and Kaufman.

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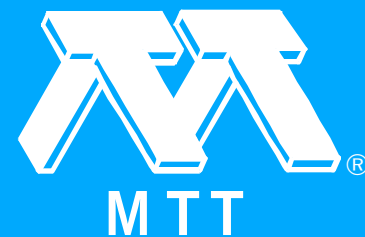


Abstracts

A New Technique for Multimode Power Measurement (Correction)

J.J. Taub. "A New Technique for Multimode Power Measurement (Correction)." 1963 Transactions on Microwave Theory and Techniques 11.3 (May 1963 [T-MTT]): 203-203.

Jesse J. Taub, author of "A New Technique for Multimode Power Measurement", which appeared on pages 496-505 of the November, 1962, issue of these Transactions, has called the following to the attention of the Editor. On page 496, the asterisk footnote should have included the following sentence. This work was supported by the Rome Air Development Center, Griffiss Air Force Base, N.Y., under Contract No AF30(602)-2511". On page 500, line 10 of Section IV-C, the word "even" should be "odd".



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Propagation in Arbitrarily Magnetized Ferrites Between Two Conducting Parallel Planes

H. Unz. "Propagation in Arbitrarily Magnetized Ferrites Between Two Conducting Parallel Planes." 1963 Transactions on Microwave Theory and Techniques 11.3 (May 1963 [T-MTT]): 204-210.

The electromagnetic waves propagating in arbitrarily magnetized homogeneous ferrites between two perfectly conducting parallel planes have been investigated by using the operational calculus method. The discrete propagation constants and the eigenvalues are to be determined from an algebraic equation of the fourth order and a determinantal equation derived from the boundary conditions. The hybrid modes thus found degenerate to the solutions already found for the particular cases of longitudinally and transversely (parallel and perpendicular to boundaries) magnetized ferrite cases.

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Abstracts

Parametric Amplification (Correspondence)

V. Uzunoglu. "Parametric Amplification (Correspondence)." 1963 Transactions on Microwave Theory and Techniques 11.3 (May 1963 [T-MTT]): 211-211.

According to Manley-Rowe power relations the difference of pump and signal frequencies yields the so-called negative resistance parametric amplifier. In this case, infinite gain is possible in contrast to the sum frequency amplifier or up-converter which has a finite gain determined by the pump and signal frequencies.



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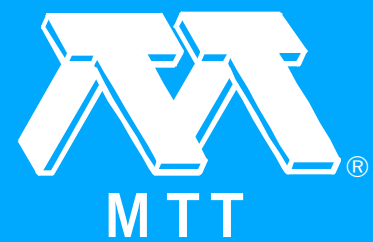
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A Microwave Technique for the Measurement of the Dielectric Properties of Soils (Correspondence)

W.L. Curtis and R.J. Coe. "A Microwave Technique for the Measurement of the Dielectric Properties of Soils (Correspondence)." 1963 Transactions on Microwave Theory and Techniques 11.3 (May 1963 [T-MTT]): 211-212.

During a recent investigation of antennas mounted flush with the earth, it was necessary to measure the dielectric properties of soil. Many different techniques for the measurement of dielectric constants and loss tangent have been developed. These techniques generally fall into two categories: those which utilize transmission through a sample and those which use the reflection from the sample. The particular technique employed is modified to suit the range of parameters being measured and the physical characteristics of the sample. In general, a measurement that provides an accurate determination of dielectric constant is relatively insensitive to variations in loss tangent and vice versa. The technique described here utilizes both types of measurements to find in a practical manner the dielectric constant and loss tangent of relatively moist loamy soil at microwave frequencies.

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Investigation of Millimeter Wave Reflex Klystron Amplifiers (Correspondence)

K. Ishii and D.E. Schumacher. "Investigation of Millimeter Wave Reflex Klystron Amplifiers (Correspondence)." 1963 Transactions on Microwave Theory and Techniques 11.3 (May 1963 [T-MTT]): 212-213.

It has been shown that reflex klystrons are usable for microwave and millimeter wave amplification. The purpose of this communication is to report that a VA-99 fixed-cavity reflex klystron performed well as a negative-resistance amplifier in the "difficult" millimeter wave region and that the amplifier was operated not by loading it so that it was incapable of oscillation as has been previously reported, but by adjusting voltages and impedances so that it was on the edge of a mode of oscillation. All measurements were made using the setup shown in Fig. 1. In the amplifier section, the reflex klystron was connected to the main waveguide line with an H-plane tee with an EH tuner, each at the input and output end of the colinear arm of the H-plane tee. The repeller and anode voltages, and the circuit impedance were adjusted so that the oscillation stopped at the signal frequency.

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Still Another Method For Transforming Impedances Through Lossless Networks (Correspondence)

H.F. Mathis. "Still Another Method For Transforming Impedances Through Lossless Networks (Correspondence)." 1963 Transactions on Microwave Theory and Techniques 11.3 (May 1963 [T-MTT]): 213-214.

The input impedance Z_{in} and the terminating impedance Z_L of a symmetrical lossless four-terminal network are related by an equation which contains only one additional parameter; namely, the input impedance Z_1 when the network is terminated in any known resistance R_0 . Let $\Gamma_{in} = (Z_{in} - R_0)/(Z_L + R_0)$, $\Gamma_L = (Z_L - R_0)/(Z_L + R_0)$, $\Gamma_1 = (Z_1 - R_0)/(Z_1 + R_0)$, and the superscript "*" denote the conjugate.

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Abstracts

Group Delay and Dissipation Loss in Transmission-Line Filters (Correspondence)

L. Young. "Group Delay and Dissipation Loss in Transmission-Line Filters (Correspondence)." 1963 Transactions on Microwave Theory and Techniques 11.3 (May 1963 [T-MTT]): 215-217.

Basic formulas for the group delay and for the dissipation loss are derived for transmission-line filters. The optimum number of resonators for minimum dissipation loss is found.



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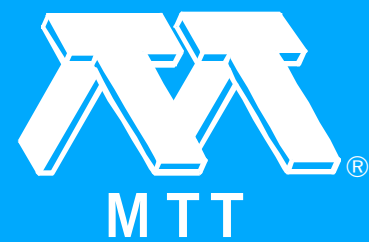
Reciprocal and Nonreciprocal Switches Utilizing Ferrite Junction Circulators (Correspondence)

A. Clavin. "Reciprocal and Nonreciprocal Switches Utilizing Ferrite Junction Circulators (Correspondence)." 1963 *Transactions on Microwave Theory and Techniques* 11.3 (May 1963 [T-MTT]): 217-218.

The symmetrical ferrite junction circulator has assumed a position of prominence in recent years due to its small physical size and excellent electrical characteristics. The device was described theoretically by Auld, and other investigators have contributed to the design of improved electrical characteristics. Due to their low loss, these circulators have found wide use with parametric and tunnel diode amplifiers. Other applications include duplexers, multiplexer and load isolators.

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Mixed Two-Port Parameters for Characterizing Varactor Mounts in Waveguides (Correspondence)

M.E. Viggh. "Mixed Two-Port Parameters for Characterizing Varactor Mounts in Waveguides (Correspondence)." 1963 Transactions on Microwave Theory and Techniques 11.3 (May 1963 [T-MTT]): 218-219.

In the design of harmonic generators using varactors in waveguide mounts, one of the most important problems is to determine the impedance seen from the terminals of the nonlinear junction capacitance, as well as the transfer properties of the networks between the terminals of this capacitance and the output and input waveguides. Since the junction region in most cases of interest is many times smaller than one wavelength in size, the logical variables for describing the electrical conditions at the junction terminals are voltage and current. On the other hand, at the input and output waveguide ports, scattering variables a and b would be preferable. This communication will define a parameter system for two ports, where voltage and current are used as variables on one side, and scattering variables on the other. A method for experimental determination of these parameters will also be outlined.

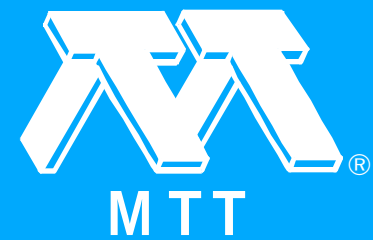
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Abstracts

Contributors (May 1963 [T-MTT])

J.H. Battocletti, R.W. Beatty, E.G. Cristal, S.P. Morgan, H. Unz and L. Young. "Contributors (May 1963 [T-MTT])." 1963 Transactions on Microwave Theory and Techniques 11.3 (May 1963 [T-MTT]): 220-220.



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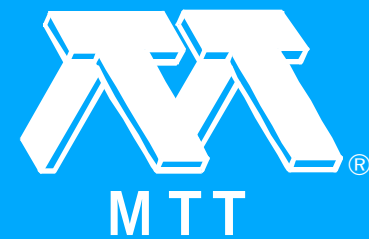
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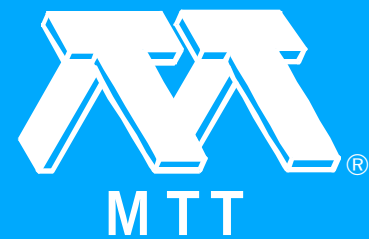
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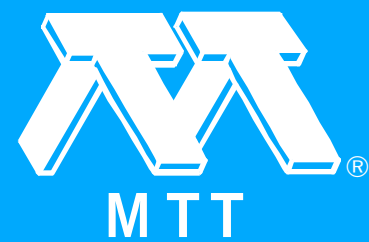
Dielectric Constant and Loss Tangent of Microwave Ferrites at Elevated Temperatures

I. Bady and T. Collins. "Dielectric Constant and Loss Tangent of Microwave Ferrites at Elevated Temperatures." 1963 Transactions on Microwave Theory and Techniques 11.4 (Jul. 1963 [T-MTT]): 222-226.

Experimental data are given on the effect of elevated temperature on the dielectric properties of ferrites intended for microwave applications. Measurements were made at X band. The real part of the dielectric constant generally increases slowly with temperature, the maximum temperature coefficient observed being 300 parts per million per degree C. The dielectric loss tangent also generally increases with temperature. Measurements were made in a rectangular waveguide cavity, using a modified perturbation technique. It is shown that the simple perturbation technique may cause an appreciable error in the measurement of the real part of the dielectric constant. The effect of the finite resistivity of the cavity walls and the effect of the cavity irises on the measurement of the dielectric loss tangent, are also considered.

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General Synthesis of Asymmetric Multi-Element Coupled-Transmission-Line Directional Couplers

R. Levy. "General Synthesis of Asymmetric Multi-Element Coupled-Transmission-Line Directional Couplers." 1963 Transactions on Microwave Theory and Techniques 11.4 (Jul. 1963 [T-MTT]): 226-237.

An exact synthesis procedure is derived for a class of asymmetric multielement coupled-transmission-line directional couplers with any number of elements. It is based on the equivalence between the theory of the directional coupler and that of a stepped quarter-wavelength filter. This can be treated using Richards' theorem for the synthesis of transmission-line distributed networks, as described previously by Riblet. The method is extended to give a general expression for the input reflection coefficient of the stepped filter, which corresponds to the voltage coupling of the directional coupler. Explicit formulas for the parameters of two, three, four and five couplers are derived and the extension to larger number of elements is straightforward. Two and three element couplers have been designed on this theoretical basis, and show excellent agreement with theory, for example a three element coupler of 20 db $\pm$ 0.5 db over a 6:1 bandwidth, and a two element coupler of 3.2 db $\pm$ 0.85 db over a 6.7:1 bandwidth. It is possible to design a 3-db $\pm$ 0.43 db-coupler for decade bandwidths using only four elements. The 3 db-couplers may be used as 90° hybrids by careful choice of reference planes in the output parts.

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Abstracts

Scattering of Unidirectional Surface Waves

S.R. Seshadri. "Scattering of Unidirectional Surface Waves." 1963 Transactions on Microwave Theory and Techniques 11.4 (Jul. 1963 [T-MTT]): 238-243.

A perfectly conducting plane screen embedded in a gyrotropic medium is shown to be able to support a unidirectional surface wave. Such a surface wave is assumed to be incident on the top of a semi-infinite screen. At the edge the incident power is converted partly into a reflected surface wave which travels on the bottom of the screen and partly into a space wave. The angular distribution of the radiated energy as well as the power-reflection and the power-transmission coefficients are evaluated. Total reflection is shown to occur for a certain band of frequencies.



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Attenuation Constant of Lunar Line and T-Septate Lunar Line

A.Y. Hu and A. Ishimaru. "Attenuation Constant of Lunar Line and T-Septate Lunar Line." 1963 Transactions on Microwave Theory and Techniques 11.4 (Jul. 1963 [T-MTT]): 243-250.

The attenuation constant α of the lunar line and that of the T-septate lunar line were derived from the average power loss $W_{\text{sub L}}$ and the average power transfer $W_{\text{sub T}}$ in each line, that is the ratio, $W_{\text{sub L}}/2W_{\text{sub T}}$. The average power loss and the average power transfer for the lunar line and for the T-septate lunar line were derived from their respective field functions. The theoretical attenuation constant of a typical lunar line is less than 0.7 db/ 100 ft for frequencies greater than 2000 Mc. The theoretical attenuation constant of a typical T-septate line is less than 0.9 db/ 100 f t for frequencies greater than 1000 Mc. Experimental measurements of the attenuation constant of a T-septate lunar line agree with the theoretical value. In the 200 to 2000 Mc frequency band, the lunar line and the T-septate lunar line offer a compact and light package without an appreciable sacrifice in peak power handling capacity or attenuation.

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Extension of The Laser-Pumped Ruby Maser to Millimeter Wavelengths

D.P. Devor. "Extension of The Laser-Pumped Ruby Maser to Millimeter Wavelengths." 1963 Transactions on Microwave Theory and Techniques 11.4 (Jul. 1963 [T-MTT]): 251-254.

A brief description is given on the operation of a microwave ruby maser in which the pump signal is the optical emission of a ruby laser. For operation in the millimeter spectrum the application of a magnetic field of inordinately high intensity can produce Zeeman splitting of the Cr^{3+} levels at millimeter wave energy in the ground state in ruby. To obtain population inversion by optical pumping on the levels requires that the ratio of maser frequency to temperature be $\nu/T < 14.4 \text{ Gc/sec } ^\circ\text{K}$. As the maser temperature is increased the spin lattice relaxation time T_1 decreases in addition to possibly decreasing with increasing magnetic field. Since the power required from the laser is estimated as that required to produce saturation of the optical pump transition in a time less than T_1 , then decreasing T_1 also requires increased laser emission. A broadening of the laser emission has been observed at increased power so that the limit on useful laser power can be given in terms of the absorption line width of the maser optical pumping transition. Treating these various effects conservatively indicates that the laser-pumped ruby maser can be operated over the entire millimeter spectrum, however. The design of an apparatus with a hard superconductor electromagnet producing the field intensity required to accomplish this objective is given.





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The Re-Entrant Cross Section and Wide-Band 3-db Hybrid Couplers

S.B. Cohn. "The Re-Entrant Cross Section and Wide-Band 3-db Hybrid Couplers." 1963 Transactions on Microwave Theory and Techniques 11.4 (Jul. 1963 [T-MTT]): 254-258.

A new type of parallel-coupled TEM-mode cross section is described and named the re-entrant cross section. An analysis of the even- and odd-mode characteristic impedances of the re-entrant cross section shows it to have advantages in the case of tight coupling when compared to previously used parallel-strip cross sections. Close tolerances are easily held, and considerable misalignment is permissible. Two single-section 3-db couplers were tested with coupling curves very close to theoretical, and with good directivity. Then a three-section coupler having a re-entrant center section was designed for the 400- to 2000-Mc band, yielding a coupling variation less than 0.4 db and a minimum directivity of 29 db. Next a three-section coupler was designed for the 1- to 5-Gc band. A series of modifications resulted in a final model having a coupling variation within 0.5 db, and a minimum directivity of about 22 db.

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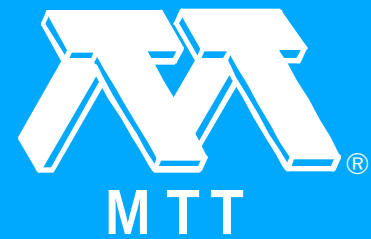


Abstracts

On the General Relation Between α and Q (Correspondence)

*H.P. Hsu. "On the General Relation Between α and Q (Correspondence)." 1963
Transactions on Microwave Theory and Techniques 11.4 (Jul. 1963 [T-MTT]): 258-258.*

The relation between the quality factor Q and the attenuation constant α of a transmission line has been known as follows.



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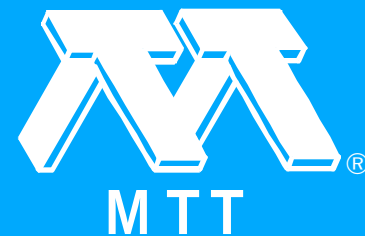


Abstracts

A Varactor Frequency-Modulated AFC Reference Cavity (Correspondence)

A. Farokhrooz and J.B. Linker, Jr.. "A Varactor Frequency-Modulated AFC Reference Cavity (Correspondence)." 1963 Transactions on Microwave Theory and Techniques 11.4 (Jul. 1963 [T-MTT]): 258-260.

A varactor frequency-modulated microwave cavity is described where the application of a periodic square wave voltage to a varactor serves to electronically detune the cavity. There results a discriminator characteristic which makes the device applicable as an AFC reference. Experimental results are given and discussed.



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Nonlinear Biasing Resistors for Microwave Tunnel-Diode Oscillators (Correspondence)

J.T. Wallmark and A.H. Dansky. "Nonlinear Biasing Resistors for Microwave Tunnel-Diode Oscillators (Correspondence)." 1963 Transactions on Microwave Theory and Techniques 11.4 (Jul. 1963 [T-MTT]): 260-262.

By using a nonlinear rather than a linear stabilizing resistor in tunnel-diode oscillator and amplifier circuits, the dc power dissipation in the resistor may be reduced by a factor of 3 for typical germanium tunnel diodes, and by a factor of 6 for typical gallium arsenide tunnel diodes. At the same time ac loading by the resistor is reduced. Such nonlinear stabilizing resistors may consist of reverse- or forward-biased heavily doped pn junctions.

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Mode Cutoff Frequencies in Screened Dielectric Rod Waveguide (Correspondence)

A.S. Thompson. "Mode Cutoff Frequencies in Screened Dielectric Rod Waveguide (Correspondence)." 1963 Transactions on Microwave Theory and Techniques 11.4 (Jul. 1963 [T-MTT]): 262-263.

The geometry of the screened dielectric rod waveguide is shown in Fig. 1. The theory for this waveguide has been solved by Beam and Wachowskil for the case of $\mu_{\text{sub } 1} = \mu_{\text{sub } 2} = 1$.

Click on title for a complete paper.





On the Measurement of Detector Impedance (Correspondence)

P.A. Szente, R.H. Miller and K.B. Mallory. "On the Measurement of Detector Impedance (Correspondence)." 1963 Transactions on Microwave Theory and Techniques 11.4 (Jul. 1963 [T-MTT]): 263-263.

A detector or receiver may be used in conjunction with a directional coupler and a calibrated variable short to measure its own impedance. The observed VSWR as the short is adjusted is the VSWR of the detector if the coupling is light. Various minor corrections are described.



Abstracts

The Synthesis of N-Port Circulators (Jul. 1963 [T-MTT])

B.L. Humphreys and J.B. Davies. "The Synthesis of N-Port Circulators (Jul. 1963 [T-MTT])." 1963 Transactions on Microwave Theory and Techniques 11.4 (Jul. 1963 [T-MTT]): 263-263.

Professor P. Penfield has kindly brought to our notice his paper on lossless three-ports, which independently covers some of the work described by us. He has pointed out that for circulator synthesis from a three-port junction only one of the three conditions of equation (16) or (17) need be specified. This can be seen from the first two equations of (9) of our paper. Otherwise our classifications of three-port networks are the same.



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Broad-Band Microwave Discriminator (Correspondence)

R.J. Mohr. "Broad-Band Microwave Discriminator (Correspondence)." 1963 Transactions on Microwave Theory and Techniques 11.4 (Jul. 1963 [T-MTT]): 263-264.

A sketch of a novel broad-band microwave discriminator is shown in Fig. 1. The device utilizes a pair of symmetric 3-db hybrids joined by unequal lengths of transmission line. The difference between line lengths is represented as a frequency dependent phase difference ϕ .





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Frequency Response of Strip-line Traveling-Wave Directional Filters (Correspondence)

R.D. Standley. "Frequency Response of Strip-line Traveling-Wave Directional Filters (Correspondence)." 1963 Transactions on Microwave Theory and Techniques 11.4 (Jul. 1963 [T-MTT]): 264-265.

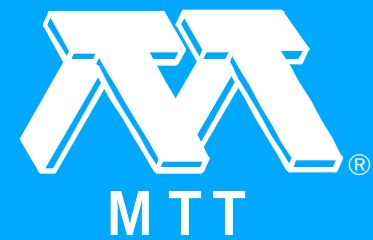
Coale analyzed the single resonator stripline traveling-wave filter shown in Fig. 1 by a perturbation method. Design criteria were formulated relating loaded Q to pertinent circuit parameters. Experimentally it is observed that properly aligned filters exhibit a frequency response which is approximately Butterworth. The purpose of this communication is to show that the approximate frequency response of narrow bandwidth filters in the absence of dissipation and resonator discontinuities is theoretically Butterworth. Comments on the design problem are included as well as a discussion of the effects of resonator discontinuities.



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Contributors (Jul. 1963 [T-MTT])

*I. Bady, S.B. Cohn, T. Collins, D.P. Devor, A.Y. Hu, A. Ishimaru, R. Levy and S.R. Seshadri.
"Contributors (Jul. 1963 [T-MTT])." 1963 Transactions on Microwave Theory and Techniques
11.4 (Jul. 1963 [T-MTT]): 265-266.*



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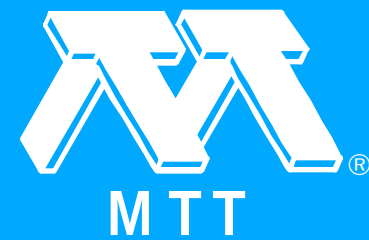
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The Millimeter and Submillimeter Conference (Introduction)

"The Millimeter and Submillimeter Conference (Introduction)." 1963 Transactions on Microwave Theory and Techniques 11.5 (Sep. 1963 [T-MTT]): 269-269.



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State of the Art: Background and Recent Developments--Millimeter and Submillimeter Waves

P.D. Coleman. "State of the Art: Background and Recent Developments--Millimeter and Submillimeter Waves." 1963 Transactions on Microwave Theory and Techniques 11.5 (Sep. 1963 [T-MTT]): 271-288.

The aim of this survey is to discuss the basic problems encountered in the general areas of generation, transmission, and detection of millimeter waves. Representative examples of work in these three areas since 1959 are reviewed with respect to the methods and techniques employed to circumvent present limitations and extend the frontier into the submillimeter range. Subject classifications include classical and quantum electronics, harmonic generation optical frequency pumping and mixing, waveguide and optical transmission systems, resonators, and detectors. At the end of each section, a few critical evaluation remarks are made on the work in progress and the prospects of success in the near future. A fairly comprehensive list of some 157 references dating from 1959 is listed by year and subject title. While substantial progress has been made, especially in technology, in the last few years, the submillimeter wave problem appears as formidable as ever and no breakthrough idea has yet been recognized.

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A Racetrack Microtron for Millimeter and Submillimeter Wave Generation

H. Froelich and E. Brannen. "A Racetrack Microtron for Millimeter and Submillimeter Wave Generation." 1963 Transactions on Microwave Theory and Techniques 11.5 (Sep. 1963 [T-MTT]): 288-291.

The accelerator described here is an eight-orbit four-sector racetrack microtron possessing strong focusing action. The magnet gap is only 7mm, and the accelerating cavity is placed in one of the field-free regions. The energy gain per traversal of the cavity can be varied from 0.4 to 1.5 Mev and synchronism obtained by adjustment of the magnetic field strength and the length of the main straight section. A theoretical analysis of the synchrotrons oscillations in energy and phase shows that tight bunching can be achieved at almost any point in any desired orbit by changing the frequency of the synchrotrons oscillations. This can be accomplished by varying the RF power and therefore the accelerating voltage. One particularly attractive operating region gives tight bunching in the third orbit, allowing the construction of a compact machine if desired. For the RF accelerating source used (frequency 2800 Mc) one obtains 20 per cent of the third orbit current in a bunch length of 0.1 mm using dc gun injection (no prebunching). A current of 20 ma was obtained in the third orbit (2.2 Mev) which should be sufficient for the production of milliwatt power in the submillimeter region.

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The Groove Guide, a Low-Loss Waveguide for Millimeter Waves

F.J. Tischer. "The Groove Guide, a Low-Loss Waveguide for Millimeter Waves." 1963 Transactions on Microwave Theory and Techniques 11.5 (Sep. 1963 [T-MTT]): 291-296.

A new waveguide for the low-loss transmission of millimeter waves is presented. The guide consists of two parallel conducting walls with grooves in the central region of the guide cross section. The grooves run along the guide in the direction of the wave propagation. It is shown that the waveguide, if excited in the TE-wave mode, has properties similar to those of the H guide, which contains a dielectric slab between the conducting walls in the center. The new guide is characterized by an exponential transverse decrease of the field distributions in direction from the center and by low attenuation. Theoretical considerations dealing with the field distribution and the data of the guide are presented.

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Factors Affecting Earth-Satellite Millimeter Wavelength Communications

A.W. Straiton and C.W. Tolbert. "Factors Affecting Earth-Satellite Millimeter Wavelength Communications." 1963 Transactions on Microwave Theory and Techniques 11.5 (Sep. 1963 [T-MTT]): 296-301.

The use of millimeter wavelengths for earth-satellite transmissions is suggested by the large bandwidths and high gain with small antennas possible at these wavelengths. The factors discussed are 1) propagation path loss, 2) refraction, and 3) antenna temperature. The attenuation through the entire atmosphere over the millimeter spectrum is given as a function of elevation angle of the antenna beam. The attenuation and scattering loss due to water and ice particles varies over a wide range of values depending on the number of particles and their sizes. Refraction by the atmosphere is less than one milliradian for elevation angles for which the absorption is low enough to make the transmission practical. Fluctuations due to refraction may, however, be quite severe. Contribution to antenna temperatures from the atmosphere, the earth, the sun and moon are given for earth-based antennas and antennas in space.

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Cerenkov Radiation in Anisotropic Ferrites

F.J. Rosenbaum and P.D. Coleman. "Cerenkov Radiation in Anisotropic Ferrites." 1963 Transactions on Microwave Theory and Techniques 11.5 (Sep. 1963 [T-MTT]): 302-311.

A numerical analysis and an experimental study of Cerenkov radiation from an anisotropic ferrite are reported in this paper. Extensive curves of the interaction resistance R_{λ} , measured per unit wavelength of interaction distance, are presented as functions of the several ferrite and geometric parameters. Values in excess of 10^3 ohms per wavelength of interaction distance are noted. The conditions for Cerenkov radiation in the ferrite are derived from consideration of plane-wave propagation through the ferrite. X-band output powers of approximately one watt were observed using a 0.88 Mev bunched electron-beam with a peak current of 18 ma.

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Abstracts

Bunching an Electron Beam by Deflection Modulation

J.R. Baird and P.D. Coleman. "Bunching an Electron Beam by Deflection Modulation." 1963 Transactions on Microwave Theory and Techniques 11.5 (Sep. 1963 [T-MTT]): 312-317.

The coherence properties of a deflection modulated electron beam are studied for harmonic generation of electromagnetic energy in the low millimeter and possibly submillimeter wavelength region of the spectrum. A fourth-harmonic, beam-coupling experiment, at 36 Gc using a Fabry-Perot type coupler, is described. Based on these results, a proposal is presented for a beam-coupling circuit whose transverse dimensions can be made physically large compared to the free-space wavelength.



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Multiple Quantum Effects at Millimeter Wavelengths

R.H. Pantell and R.G. Smith. "Multiple Quantum Effects at Millimeter Wavelengths." 1963 Transactions on Microwave Theory and Techniques 11.5 (Sep. 1963 [T-MTT]): 317-324.

When a quantum mechanical system interacts with a radiation field it may do so by multiple as well as single quantum processes. These multiple quantum processes give rise to nonlinear effects such as harmonic generation and parametric amplification and oscillation. The density matrix formulation is used to describe these multiple quantum processes. Two- and three-level systems are considered as forms of harmonic generators and some of the desired properties of the materials to be used are described. Two methods of generating submillimeter radiation starting with optical signals are also discussed.



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TE/sub 01/ Mode Components in the 3-mm Region

A.J. Simmons. "TE/sub 01/ Mode Components in the 3-mm Region." 1963 Transactions on Microwave Theory and Techniques 11.5 (Sep. 1963 [T-MTT]): 324-332.

In the 3-mm region (94 Gc) it is desirable to use waveguide components operating in the low loss TE/sub 01/ mode in circular waveguide rather than in fundamental-mode rectangular waveguide. Because this is a higher mode, mode purity is of major concern. A method of identifying undesired modes and their amplitudes is by means of radiation patterns from the end of the waveguide. Components developed to operate in this mode include a transition from rectangular to circular waveguide, standing wave detector, variable attenuator, directional coupler, flexible waveguide, fixed 90° bend and rotary joint.



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A Range of 2 and 1 Millimeter Waveguide Components

R. Meredith and G.H. Preece. "A Range of 2 and 1 Millimeter Waveguide Components." 1963 Transactions on Microwave Theory and Techniques 11.5 (Sep. 1963 [T-MTT]): 332-338.

A variety of components have been made in wave-guides RG136 and RG139 by techniques which include the use of extruded waveguide, copper-gold eutectic bonding, precision milling and, in particular, of electroforming. Performances of several RG136 components are given, together with the loss in RG139 waveguide and in oversized guide tapered from RG139.

Ferrite devices, including isolators, 3 port switches and amplitude modulators, using Ferramic R1, have been quite successful. A typical isolator has an insertion loss of $1\frac{1}{4}$ db and an isolation of 30 db, magnetically tunable over at least 133 to 145 Gc. An RG136 slotted line, at a coupling ratio of 20 db, has an inherent mismatch of 1.05 with good reproducibility over the $2\frac{1}{2}$ wavelengths traverse of the one-mil Wollaston wire probe. The main waveguide is milled and broached from brass and gold plated. Electroformed matched hybrid tees in RG136 split power to $\pm\frac{1}{4}$ db, have a discrimination of 30 db, a loss of $1\frac{1}{4}$ db and a match looking into any arm of better than 1.4. Rotary and flap-type attenuators, phase shifters, variable short circuits, matching units, crystal diodes and their mounts, bolometers and dry calorimeters, etc., have been made, and for transmission over moderate distances the vastly overmoded TE/sub 01/ waveguide was used.



Abstracts

Submillimeter Components Using Oversize Quasi-Optical Waveguide

J.J. Taub, H.J. Hindin, O.F. Hinckelmann and M.L. Wright. "Submillimeter Components Using Oversize Quasi-Optical Waveguide." 1963 Transactions on Microwave Theory and Techniques 11.5 (Sep. 1963 [T-MTT]): 338-345.

Components such as directional couplers, attenuators, introduction and phase shifters have been developed using optical techniques in oversize rectangular waveguide. These components were designed for operation in the 300- to 350-Gc range. They were scaled from a design that was successful at 27 Gc. Preliminary data taken at 330 Gc indicates the feasibility of this technique. The advantages of oversize waveguide as compared with conventional waveguide and freespace optical components are 1) lower attenuation and 2) simpler construction.



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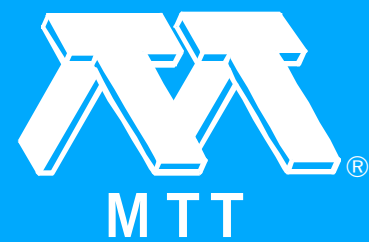
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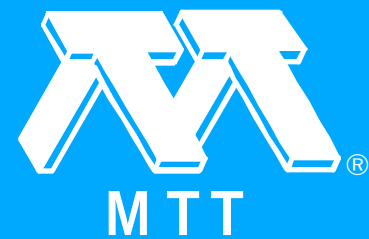
Millimeter Resonance Isolators Utilizing Hexagonal Ferrites

D.R. Taft, G.R. Harrison and L.R. Hodges, Jr.. "Millimeter Resonance Isolators Utilizing Hexagonal Ferrites." 1963 Transactions on Microwave Theory and Techniques 11.5 (Sep. 1963 [T-MTT]): 346-356.

Ferrimagnetic resonance isolators operating over waveguide bandwidths have been developed in K, V and Q bands using hexagonal ferrites. Preliminary results on similar isolators operating in M and W bands have also been obtained. The materials employed in these isolators are highly anisotropic uniaxial hexagonal compounds. The compounds of interest for the first three frequency bands are from the $\text{Ni}/\text{sub } 2/\text{W}$ family. The anisotropy field of $\text{Ni}/\text{sub } 2/\text{W}$ is 12.6 kilo-oersteds (Koe). This uniaxial anisotropy field can be controlled over the range of 4 to 12.6 Koe by producing solid solutions of the above compound with that of $\text{Zn}/\text{sub } 2/\text{W}$ and/or $\text{Co}/\text{sub } 2/\text{W}$, and controlled over the range of 12.6-19.0 Koe by aluminum substitutions. The following operating characteristics have been obtained over the full waveguide bands: K band (18-26.5 Gc), isolation (minimum)---25 db, insertion loss (maximum)---0.7 db, VSWR (maximum)---1.15, applied field---1000 oersteds, length---4 1/2 inches weight---6 1/2 ounces; v band (26.5-40 Gc), isolation (minimum)---25 db, insertion loss (maximum)---1.25 db, VSWR (maximum)---1.15, applied field---1000 oersteds, length---4 inches, weight---6 ounces; Q band (33-50 Gc), isolation (minimum)---25 db, insertion loss (maximum) ---1.5 db, VSWR (maximum)---1.15, applied field---1000 oersteds, length---3 1/2 inches, weight---5 1/2 ounces. Improved attenuation ratios and size are obtained when the band-width is reduced. Examples of this are K band where a ratio of 40 to 1 is maintained over a 4-Gc bandwidth in a 3-inch unit, and V band where a ratio of 40 to 1 is maintained over a 5-Gc bandwidth in a 2-inch unit. At the present time the M (50-75 Gc) and W (75-110 Gc) band units provide attenuation ratios exceeding 10 to 1 over 5-Gc bandwidths.

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Magnetic Materials for Millimeter Wave Applications

G.P. Rodrigue. "Magnetic Materials for Millimeter Wave Applications." 1963 Transactions on Microwave Theory and Techniques 11.5 (Sep. 1963 [T-MTT]): 351-356.

Magnetic materials of interest at millimeter wavelengths can be grouped under four headings: 1) conventional polycrystalline ferrites with cubic crystal structure, 2) yttrium iron garnet and similar single crystals, 3) ferrites having hexagonal crystal structures, and 4) antiferromagnetic materials. The conventional polycrystalline ferrites have been used in constructing millimeter wave phase shifters, circulators, and Faraday rotation isolators. Yttrium iron garnet single crystals are distinguished by their extremely small damping and resultant narrow ferromagnetic resonance absorption line, of the order of 0.3 oersted at X-band frequencies. The small damping of the processing magnetization makes this material useful as a relatively high V, tunable, resonant circuit with Q's of the order of 3000. Magnetic materials with hexagonal crystal structure whose preferred direction of magnetization lies along the C axis are said to be uniaxial, and their effective internal anisotropy fields range from virtually zero to greater than 30,000 oersteds. The uniaxial materials are useful in compact, light weight resonance load isolators, harmonic suppressors, etc., in any application where their large effective internal field can be used to advantage. The antiferromagnetic materials have extremely large effective internal fields and can be used in resonance devices in the frequency range from 2 millimeters into the submillimeter region.





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Backward Diodes for Low-level Millimeter-Wave Detection

C.A. Burrus, Jr.. "Backward Diodes for Low-level Millimeter-Wave Detection." 1963 Transactions on Microwave Theory and Techniques 11.5 (Sep. 1963 [T-MTT]): 357-362.

Backward diodes (low peak current tunnel diodes) suitable for small-signal detection applications in the millimeter-wave region have been fabricated from n-type germanium. The diodes have the dimensions and geometry of point-contact diodes. For millimeter-wave signal levels below about - 20 dbm, the current sensitivity of these units is an order of magnitude greater than that of selected existing diodes for this frequency range. When employed as millimeter-wave frequency converters, the minimum conversion loss is comparable to that of conventional diodes, but the beating oscillator power requirements may be somewhat reduced. The diode noise factor at megacycle IF frequencies is comparable to that of conventional units, and in the low audio IF range it is expected to be markedly decreased. The fabrication of these diodes is described and their initial performance at selected frequencies from 11 Gc to 300 Gc is discussed.

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Tunable Submillimeter Interferometers of the Fabry-Perot Type

R. Ulrich, K.F. Renk and L. Genzel. "Tunable Submillimeter Interferometers of the Fabry-Perot Type." 1963 Transactions on Microwave Theory and Techniques 11.5 (Sep. 1963 [T-MTT]): 363-371.

Fabry-Perot Interferometers (FPI's) have been constructed for the far infrared and submillimeter wave region with metal grids as reflectors. Two-dimensional grids with square holes (metallic mesh) can be used for unpolarized radiation, too, and they are more convenient for the construction than one-dimensional (parallel wire) grids. The performance of several FPI's has been measured in the 100-600 μ wavelength region. Q values in first-order range from 5 to 30, and peak transmissions up to 0.9 have been reached. The experimental results are in qualitative agreement with the theory of thin parallel wire gratings. The influence of the unevenness of the reflectors is studied theoretically. Applications of a submillimeter FPI include its use as the dispersion element in a spectrometer, as a narrow-band filter to check the radiation purity of a grating spectrometer, and as a separator of the harmonics from a crystal harmonic generator.

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Spherical Mirror Fabry-Perot Resonators

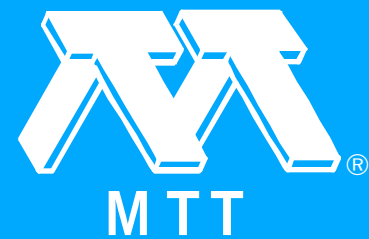
R.W. Zimmerer. "Spherical Mirror Fabry-Perot Resonators." 1963 Transactions on Microwave Theory and Techniques 11.5 (Sep. 1963 [T-MTT]): 371-379.

An experimental investigation of the Fabry-Perot interferometer (FPS) using spherical mirrors is reported. The FPS was operated as a microwave resonant cavity at 60 to 70 Gc. Measurements were made of the loss and coupling as a function of mirror spacing. The electric field variation within the resonator was also measured. Other characteristics of the spherical Fabry-Perot resonator were observed and are discussed. A qualitative discussion of the behavior of a spheroidal cavity resonator is presented and its relation to the FPS and beam waveguide is demonstrated.

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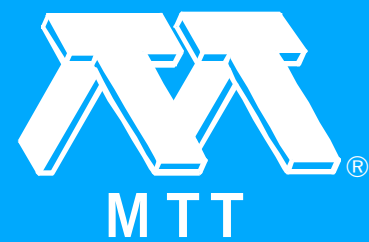
Microwave Type Bolometer for Submillimeter Wave Measurements

J.F. Byrne and C.F Cook. "Microwave Type Bolometer for Submillimeter Wave Measurements." 1963 Transactions on Microwave Theory and Techniques 11.5 (Sep. 1963 [T-MTT]): 379-384.

An approach to the problem of submillimeter wave measurement through the extension of microwave techniques has led to the development of a submillimeter bolometer with the sensitivity requisite to calibration with a thermal source. The sensor employs conventional components, horn, waveguide and coaxial line, with a novel coax-to-guide transition consisting of part of the bolometer element, the rest of which serves as a center conductor of the coaxial lines. The entire set of submillimeter components is contained in a ¼-inch block of metal. Fundamental problems of detection in this band are discussed with application to the sensor. Calibration techniques and data taken with the instrument are reported.

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A Submillimeter Measurement System Using a Harmonic Mixing Superheterodyne Receiver

J.M. Cotton. "A Submillimeter Measurement System Using a Harmonic Mixing Superheterodyne Receiver." 1963 Transactions on Microwave Theory and Techniques 11.5 (Sep. 1963 [T-MTT]): 385-389.

A measurement system for use in the submillimeter wavelength region has been assembled and evaluated. This system utilizes two 70-Gc klystron sources and operates as high as the sixth harmonic. One of these sources provides the fundamental input power for a crystal harmonic generator which serves as the transmitter. The other klystron serves as a fundamental local oscillator for the harmonic mixing receiver. Incorporation of harmonic mixing techniques provides identification and selection of individual harmonics and simultaneously affords improved sensitivity over crystal video detection. The dynamic range of the measurement system is here defined as the difference (in db) between the maximum signal level at a specified harmonic, and that level for which the signal-to-noise ratio is unity. Dynamic ranges were measured to be 61 db at 210 Gc, 46 db at 280 Gc, 32 db at 350 Gc, and 29 db at 420 Gc, selection of any of these frequencies is accomplished by inserting an appropriate filter in the receiver's IF amplifier. Techniques are described which can be used to improve substantially the dynamic range at the above-mentioned frequencies. The system is suitable for many types of measurements in the short millimeter and the submillimeter region, and has good possibilities for frequency extension by increasing the frequency of the fundamental signal. Some data are included on measured transmission losses of dominant mode, and oversized, overmoded waveguide. The latter type is seen to offer advantages of reasonably low loss and simple construction when transmission over moderate path lengths is needed.





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New Technique for Microwave Radiometry

M.W. Long and J.C. Butterworth. "New Technique for Microwave Radiometry." 1963 Transactions on Microwave Theory and Techniques 11.5 (Sep. 1963 [T-MTT]): 389-397.

An interference modulation technique for microwave radiometry is described. Use of the technique is considered for the development of a radiometer for tuning over a wide range of frequencies, a radiometric device for determining the absolute sensitivity of detectors over a wide range of frequencies, and a means for determining the power level of coherent sources as a function of frequency. A device using this technique does not require the use of a coherent source, and the technique is applicable to wavelengths well into the low millimeter region. A tunable radiometer using interference modulation has been operated as a measurements system within the 50-90 Gc region. Successful performance required the use of a sensitive detector which consisted of a barretter operated in an evacuated atmosphere. A noise source having known temperature was used as the source of microwaves for determining the sensitivity of detectors as a function of frequency. It has been found that the sensitivity of barretters is greatly improved by a reduction in air pressure and that, when evacuated, a commercially available barretter will provide a sensitivity of approximately 6×10^{-11} watts for an audio bandwidth of one cycle per second. The technique discussed provides the opportunity for developing a calibrated power meter for millimicrowatt levels from coherent sources.





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Superheterodyne Radiometers for Use at 70 Gc and 140 Gc

R. Meredith and F.L. Warner. "Superheterodyne Radiometers for Use at 70 Gc and 140 Gc." 1963 Transactions on Microwave Theory and Techniques 11.5 (Sep. 1963 [T-MTT]): 397-411.

In this paper four different millimeter wave equipments, which have been made for plasma diagnostic work, are described. They are: 1) A straightforward 70-Gc superheterodyne radiometer with an over-all noise factor of 13 db; 2) An early 140-Gc radiometer, with second harmonic mixing, which has an over-all noise factor of about 25 db; 3) A later and more sensitive 140-Gc radiometer which contains a fundamental local oscillator, VX 3352 mixer crystals and a 408-Mc IF amplifier commencing with an Adler tube; 4) A very simple 140-Gc transmission measuring equipment containing a 1-watt source and a crystal video receiver which has a tangential sensitivity of ---42 dbm. The last part of this paper discusses the minimum temperature changes which can be detected, at short millimeter wavelengths, with various types of superheterodyne radiometers, the Golay cell, the barretter, the crystal video radiometer, the 1.5°K carbon bolometer and the 1.5°K InSb photoconductive detector. The performances expected from straight traveling-wave tube radiometers and traveling-wave masers at short millimeter wavelengths are also considered. The Appendices are devoted to mixer crystal performance in the millimeter and submillimeter regions, a theory of second harmonic mixing and the voltage sensitivity of a forward biased detector crystal.



Analysis of the Frequency and Power Performances of Tunnel Diode Generators

H.J. Oguey. "Analysis of the Frequency and Power Performances of Tunnel Diode Generators." 1963 Transactions on Microwave Theory and Techniques 11.5 (Sep. 1963 [T-MTT]): 412-419.

This analysis shows the order of magnitude of the highest frequency and power to be expected from a single tunnel diode generator. An optimization on the circuit level indicates how to make the best use of a given device. The influence of the dimensions and the geometry is considered and relates the performances of the circuit with bulk and junction properties of the semiconductor. On the basis of empirical data, a correlation between bulk and junction properties is established and relates all of them to the doping level and the basic semiconductor used. Numerical data show the physical limitations to be expected with germanium and gallium-arsenide in with two idealized cavity geometries. As dimensions cannot be arbitrarily reduced, nor the impedance be arbitrarily low, they introduce other limitations which prevent in some cases the possibility of optimum performances and show comparable merits of the two geometries. It is concluded that a power output of 5 mw at 30 kMc for a GaAs tunnel diode generator is an optimistic figure close to the technical limit.



A Frequency Modulator with Gain for a Space Array

E.M. Rutz-Philipp and E. Kramer. "A Frequency Modulator with Gain for a Space Array." 1963 Transactions on Microwave Theory and Techniques 11.5 (Sep. 1963 [T-MTT]): 420-426.

An active microwave frequency modulator is described which has been devised for a retrodirective space array. In this modulator one tunnel diode simultaneously functions as amplifier, frequency translator, and frequency modulator. The modulator is an image frequency converter with a local oscillator signal injected into the modulator circuit. The frequency of the image signal is modulated by varying the frequency of the local oscillator. The image frequency is the difference between the second harmonic of the local oscillator and the signal frequency. The frequency deviation of the image frequency signal is twice the frequency deviation of the local oscillator signal. Since the image frequency signal is the lower modulation side-band, its phase is inverted in reference to the phase of the incoming signal. The retrodirective characteristic of the modulated space antenna is realized by the phase inversion property of the modulator. Each array element is terminated with one modulator, and the local oscillator signals that are directed to the modulators must be of equal phase. No nonreciprocal device is required to separate incoming and reradiated signals in the antenna array. In order to determine the optimum operating conditions the analysis of the image frequency converter was derived and an experimental model was tested at 2 Gc. Amplification of the image frequency signal over the incoming signal of 27 db was obtained. The local oscillator power required by one modulator is 10 μ w; the dc bias power is less than 100 μ w.

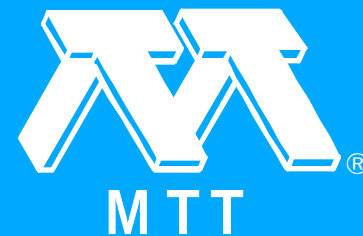


Abstracts

Status Report on International Millimeter Waveguide Flange Standards (Correspondence)

T.N. Anderson. "Status Report on International Millimeter Waveguide Flange Standards (Correspondence)." 1963 Transactions on Microwave Theory and Techniques 11.5 (Sep. 1963 [T-MTT]): 427-429.

A variety of approaches to the design of flanges for millimeter waveguide use coupled with the research nature of the work in this field has made standardization a difficult task.



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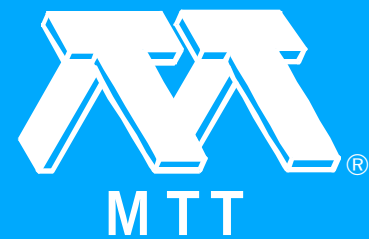
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Millimeter Transmission by Oversize and Shielded-Beam Waveguides (Correspondence)

G.R. Valenzuela. "Millimeter Transmission by Oversize and Shielded-Beam Waveguides (Correspondence)." 1963 Transactions on Microwave Theory and Techniques 11.5 (Sep. 1963 [T-MTT]): 429-430.

A transmission line for the interconnection of systems was required for frequencies above 100 Gc. This requirement is different from the point-to-point propagation. For this particular application the transmission line should have low attenuation, reasonable manufacturing cost, simplicity in component construction and system adaptability.

Click on title for a complete paper.



Abstracts

A Wide-Band Rectangular-to-Circular Mode Transducer for Millimeter Waves (Correspondence)

P.H. Wolfert. "A Wide-Band Rectangular-to-Circular Mode Transducer for Millimeter Waves (Correspondence)." 1963 Transactions on Microwave Theory and Techniques 11.5 (Sep. 1963 [T-MTT]): 430-431.

Mode transducers are used in microwave transmission systems to transform a certain mode of one waveguide into a predetermined mode of another waveguide. Of particular importance is the transformation from the rectangular TE/sub 10/ mode to the circular TE/sub 01/ mode because the circular mode has a low transmission loss and is frequently used where long waveguide runs are necessary.



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Abstracts

Proposal: The Generation of Coherent Infrared Radiation from a Diffraction Grating (Correspondence)

G.R. Bird. "Proposal: The Generation of Coherent Infrared Radiation from a Diffraction Grating (Correspondence)." 1963 Transactions on Microwave Theory and Techniques 11.5 (Sep. 1963 [T-MTT]): 432-432.

The generation of optical radiation from a diffraction grating has been described by Smith and Purcell and by Salisbury. This communication will report a set of improvements on their method which can lead to coherent radiation. Simple calculations have been performed for two special cases to obtain estimates of the output power available. It appears that such a device could give powers from a microwatt to 0.2 mw in the region of 0.1 to 0.5 mm wavelength. Output power levels of this order are entirely adequate for experiments in high resolution spectroscopy and related problems.



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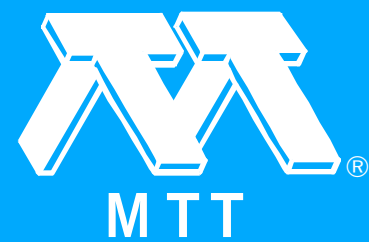
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A Simple Grating System for Millimeter and Submillimeter Wavelength Separation (Correspondence)

K.B. Mallory, R.H. Miller and P.A. Szente. "A Simple Grating System for Millimeter and Submillimeter Wavelength Separation (Correspondence)." 1963 Transactions on Microwave Theory and Techniques 11.5 (Sep. 1963 [T-MTT]): 433-434.

In the course of a series of tests on a harmonic generator which multiplied a 10-Gc fundamental to frequencies as high as 700 Gc (0.4 mm wavelength), it was necessary to separate and identify the various harmonics that were generated simultaneously. A device to serve the function of a filter was required. High accuracy of wavelength measurement was not essential since the fundamental frequency was known to one part in 10. It was necessary only to identify which harmonic was being selected. In order to obtain high efficiency, an echelette grating spectrometer was constructed, in emulation of many, thus working with millimeter waves and the infrared. A spectrometer similar to that of Coates was considered, but expediency dictated a simpler system. The final design emphasized convenience in use by separating input and output paths, and simplicity of construction by having but one moving part. In Figs. 1 and 2 it may be seen that the grating merely rotates on fixed bushings; no other optical parts are moved.

Click on title for a complete paper.



Abstracts

Submillimeter Photon Counting In Ruby (Correspondence)

R.J. Strain and P.D. Coleman. "Submillimeter Photon Counting In Ruby (Correspondence)." 1963 Transactions on Microwave Theory and Techniques 11.5 (Sep. 1963 [T-MTT]): 434-435.

A microwave detection process very similar to Bloembergen's quantum counting has been observed in the vicinity of 500 Gc using the fluorescence of ion pairs in red ruby. The detector which has been realized quite sensitive and particularly simple because it uses polychromatic light for pumping, The results reported here are preliminary, and the apparatus is not refined for detection beyond the stage at which feasibility has been shown.



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Abstracts

A Measurement of Bolometer Mount Efficiency at Millimeter Wavelengths (Correspondence)

R.H. Miller, K.B. Mallory and P.A. Szente. "A Measurement of Bolometer Mount Efficiency at Millimeter Wavelengths (Correspondence)." 1963 Transactions on Microwave Theory and Techniques 11.5 (Sep. 1963 [T-MTT]): 435-436.

In recent studies of a pulsed source of millimeter and submillimeter waves the average power of the signals generated was below the sensitivity of common power meters that utilize barrettes or thermistors. A device was required that measured peak power or energy per pulse.



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Injection Phase Locking of Two-Cavity Klystron Oscillators (Correspondence)

W.R. Day, Jr.. "Injection Phase Locking of Two-Cavity Klystron Oscillators (Correspondence)." 1963 Transactions on Microwave Theory and Techniques 11.5 (Sep. 1963 [T-MTT]): 436-436.

Injection phase locking of reflex klystron oscillators was recently reported by Mackey in these Transactions. Two-cavity-klystron oscillators may be phase locked in a similar manner. Injection locking affords a means of two-cavity oscillator stabilization that obviates the necessity for elaborate beam voltage and temperature control. Excellent frequency stability may be obtained by locking the two-cavity oscillator to a signal derived from either a crystal oscillator or a frequency standard. Fig. 1 shows a two-cavity oscillator injection locking system.

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TEM Mode in a Parallel-Plate Waveguide Filled with a Gyrotropic Dielectric (Correspondence)

S.R. Seshadri. "TEM Mode in a Parallel-Plate Waveguide Filled with a Gyrotropic Dielectric (Correspondence)." 1963 Transactions on Microwave Theory and Techniques 11.5 (Sep. 1963 [T-MTT]): 436-437.

The purpose of this communication is to point out that a parallel-plate waveguide filled with a gyrotropic dielectric, can support a TEM mode which has special characteristics.



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Boundary Excitation of Waveguides Containing Anisotropic Media (Correspondence)

J. Van Bladel. "Boundary Excitation of Waveguides Containing Anisotropic Media (Correspondence)." 1963 Transactions on Microwave Theory and Techniques 11.5 (Sep. 1963 [T-MTT]): 437-438.

Several methods can be utilized to launch electromagnetic waves along an ionized column contained in a cylindrical duct. An often used one shown in Fig. 1 where the waveguide is aperture-coupled to a surrounding resonant cavity. In this configuration, the fields inside the waveguide are produced by boundary excitation, and the fields are uniquely determined by the assignment of the tangential component of E in the aperture. It is our purpose to present explicit equations for the various field components in terms of the value of E_{tang} . The contribution from the volume sources J and J_{m} is also included for the sake of completeness. The detailed derivation follows the methods of Bresler and Marcuvitz and is given elsewhere.

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Line Width and Bandwidth of Millimeter-Wave Resonance Isolators (Comments)

I. Bady, P. Vilmur and K. Ishii. "Line Width and Bandwidth of Millimeter-Wave Resonance Isolators (Comments)." 1963 Transactions on Microwave Theory and Techniques 11.5 (Sep. 1963 [T-MTT]): 439-442.

The writer cannot agree with some of the principal conclusions in the article by P. Vilmur and K. Ishii. The authors report a very narrow line width for a single crystal barium ferrite slab. The line width is very frequency sensitive, ranging from 3.5 oersteds at 58 Gc to 13 oersteds at 59 Gc. The authors derive a formula for line width which they claim fits the experimental data. However, it is believed that the narrow line width is not necessarily an intrinsic property of the material, but is influenced by the relatively large thickness of the slab used. Also this writer does not agree with the formula for line width derived by the authors.

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Abstracts

Ferromagnetic Line Width of Nonoriented Polycrystalline Hexagonal Ferrites with Large Magnetic Anisotropy Fields (Correspondence)

I. Bady and G. McCall. "Ferromagnetic Line Width of Nonoriented Polycrystalline Hexagonal Ferrites with Large Magnetic Anisotropy Fields (Correspondence)." 1963 Transactions on Microwave Theory and Techniques 11.5 (Sep. 1963 [T-MTT]): 442-443.

Data on the line widths of oriented polycrystalline, hexagonal ferrites with large magnetic anisotropy fields have shown that the uniaxial ferrites (easy direction of magnetization along the C axis) have a considerably larger line width than that of planar ferrites (easy plane of magnetization perpendicular to the C axis).



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E-Plane 3-Port X-Band Waveguide Circulators (Correspondence)

L.E. Davis and S.R. Longley. "E-Plane 3-Port X-Band Waveguide Circulators (Correspondence)." 1963 Transactions on Microwave Theory and Techniques 11.5 (Sep. 1963 [T-MTT]): 443-445.

When a circulator is used with a parametric amplifier or maser, the noise contribution of the circulator may be reduced by cooling it in liquid nitrogen or liquid helium. Compact devices are required to put the dewar and, depending on the microwave frequency, a compromise may be necessary in choosing between a compact stripline circulator and a comparatively bulky H-plane waveguide circulator, because waveguide feeds will have lower loss than coaxial line. This problem may be eased by using a very compact E-plane waveguide circulator, as shown in Fig. 1(a).

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Abstracts

Pulse Waveform Degradation Due to Dispersion in Waveguide (Comments)

C.M. Knop and G.I. Cohn. "Pulse Waveform Degradation Due to Dispersion in Waveguide (Comments)." 1963 Transactions on Microwave Theory and Techniques 11.5 (Sep. 1963 [T-MTT]): 445-447.

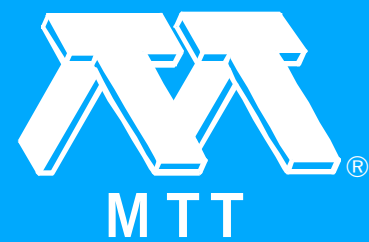
Recent work at The Hallicrafters Company concerned with the analysis of the transmission of pulsed electromagnetic energy through dispersive media has caused the writers to review the above work of R. S. Elliott. In this review it was noted that (14) of that work contains an error (which has been brought to the attention of R. S. Elliott, who agrees that it does exist).



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Temperature Stabilization of Gyromagnetic Couplers (Correspondence)

J. Clark, J. Brown and D.E. Tribby. "Temperature Stabilization of Gyromagnetic Couplers (Correspondence)." 1963 Transactions on Microwave Theory and Techniques 11.5 (Sep. 1963 [T-MTT]): 447-449.

A gyromagnetic coupler using a single-crystal YIG sphere as a coupling element suffers from two significant sources of temperature instability. One of these is anisotropy drift, a characteristic that is internal to the coupling element, since it stems directly from temperature induced variations in crystalline anisotropy. The other is appropriately characterized as external; it derives from temperature induced variations in the magnetic biasing source. Either or both of these variations will result in a change in the resonant frequency of a gyromagnetic coupler. The 3-db bandwidth of a low loss YIG coupler may be of the order of 40 Mc, hence a change in resonant frequency of as little as 5 Mc will be detected as an increase in insertion loss at the original frequency. It is therefore quite desirable that the variations which contribute to this instability be reduced to a minimum. Means have been developed for eliminating both of these instabilities, thus rendering the gyromagnetic coupler a much more practical device under a variety of environmental conditions.



Abstracts

An S-Band Wide-Band Degenerate Parametric Amplifier (Correspondence)

*B.T. Henoch. "An S-Band Wide-Band Degenerate Parametric Amplifier (Correspondence)."
1963 Transactions on Microwave Theory and Techniques 11.5 (Sep. 1963 [T-MTT]): 449-449.*

This communication reports some experimental results for an S-band wide-band degenerate parametric amplifier designed with a method earlier described by the author.



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Abstracts

Phaseshift of Electromagnetic Waves Propagating Through Waveguide Junctions (Correspondence)

D.E. Schumacher and K. Ishii. "Phaseshift of Electromagnetic Waves Propagating Through Waveguide Junctions (Correspondence)." 1963 Transactions on Microwave Theory and Techniques 11.5 (Sep. 1963 [T-MTT]): 449-450.

This work was activated by the lack of information in literature about the effect of an H-plane branch upon electromagnetic waves traveling through the collinear arms of the branch. Most literature about the subject predicts zero degrees phaseshift across the trivial 90° branch or clear expressions of the phaseshift are not made.



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Abstracts

A New High-Power Variable Attenuator (Correspondence)

L.R. Whicker and G.J. Neumann. "A New High-Power Variable Attenuator (Correspondence)." 1963 Transactions on Microwave Theory and Techniques 11.5 (Sep. 1963 [T-MTT]): 450-451.

This communication describes a design for a variable attenuator which can operate at very high peak and average power levels propagating in any chosen mode in a single or a multimode waveguide. This attenuator offers the desirable characteristics of dissipating energy in external loads rather than within the internal structure and utilizes only one coupling mechanism. The device consists of a coupled wave structure between two modes in adjacent primary and secondary waveguides, and a suitable mechanism for varying the phase constant of the secondary waveguide.



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Abstracts

VSWR of Broad-Band Waveguide Series-T Junction (Correspondence)

R.M. Kurzrok. "VSWR of Broad-Band Waveguide Series-T Junction (Correspondence)." 1963 Transactions on Microwave Theory and Techniques 11.5 (Sep. 1963 [T-MTT]): 452-452.

The technique of using $\lambda/4$ transformers in a waveguide series-T junction to obtain low VSWR'S over broad bandwidths has already been presented in the literature. VSWR's less than 1.15 for transmission through the aligned arms, and less than 1.30 for transmission around the bend, were reported for bandwidths of 17.4 per cent.



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A Wide Stop Band UHF Coaxial Band-Pass Filter (Correspondence)

J.F. Lally and R.R. Ciehoski. "A Wide Stop Band UHF Coaxial Band-Pass Filter (Correspondence)." 1963 Transactions on Microwave Theory and Techniques 11.5 (Sep. 1963 [T-MTT]): 452-452.

A narrow-band coaxial filter is described which has a stop band fourteen times the fundamental frequency, and is relatively simple to design. Since the well-known multiresonator coaxial band-pass filter having quarter-wavelength resonators is probably the most commonly used coaxial filter for narrow-band frequency selection, the design to be described herein is most meaningful. Identical construction techniques used in the common quarter-wavelength filter can also be used for this design. Rather than employing the normal quarter-wavelength resonators, the filter being described here makes use of resonators which are approximately one-tenth of a wavelength long. The one-tenth wavelength coaxial sections are made to resonate by capacitively loading the open-circuit end of the cavities. The capacitors are formed by placing a disk on the end of the center conductor and inserting a low-loss dielectric between the disk and the end wall of the cavity. Fig. 1 shows a cutaway view of a four-stage filter using the above loading scheme. The dielectric section is bonded to the end of the cavity and the center conductor disk is completely captured by the dielectric in order to insure complete support of the center conductor under extreme vibration. It has been found that this type of capacitive loading does not appreciably reduce the unloaded cavity Q nor cause an increase in insertion loss of the filters.



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Conditions for Maximum Power Transfer (Comments)

H.F. Mathis. "Conditions for Maximum Power Transfer (Comments)." 1963 Transactions on Microwave Theory and Techniques 11.5 (Sep. 1963 [T-MTT]): 453-453.

In recent correspondences by Shulman Castaguetto and IMatheau, there are discussions of the conditions for maximum power transfer. In Shuhnan's notation, the source impedance is $Z_{s/} = R_{s/} + jX_{s/} = R_{s/}(1 + jx_{s/})$, the load impedance is $Z = R + jX = R_{s/}(y + jx)$, P is the power delivered to the load, and $P_{0/}$ is the maximum power available from the source. A very simple procedure is to plot $Z' = r + j(x + x_{s/})$ on a Smith Chart. Maximum power transfer occurs when Z' is the closest to the center of the chart.

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Abstracts

Graphical Analysis of Q Circuits (Correspondence)

D. Kajfez. "Graphical Analysis of Q Circuits (Correspondence)." 1963 Transactions on Microwave Theory and Techniques 11.5 (Sep. 1963 [T-MTT]): 453-454.

The parameters of a resonator which is coupled to a transmission line can be determined in a straightforward way from the measurement of the reflectance on the line. However, graphical methods of evaluating the resonator parameters are based on the assumption that the inductance of the coupling loop can be neglected in comparison with the involved impedances. A simple method of graphical evaluation of the resonator parameters which takes into account the coupling inductance too will be described here.



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Calculating Coaxial Transmission-Line Step Capacitance (Correspondence)

P.I. Somlo. "Calculating Coaxial Transmission-Line Step Capacitance (Correspondence)." 1963 Transactions on Microwave Theory and Techniques 11.5 (Sep. 1963 [T-MTT]): 454-454.

As a frequent user of the curves given by J. R. Whinnery, H. W. Jamieson and T. E. Robbins, I found it useful to arrive at a simple polynomial in powers of alpha and tau, which makes it possible to incorporate the step-capacitance calculation in a subroutine in a computer program dealing with transmission line calculations in coaxial lines.



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Abstracts

Field Measurements Using Active Scatterers (Correspondence)

R.F. Harrington. "Field Measurements Using Active Scatterers (Correspondence)." 1963 Transactions on Microwave Theory and Techniques 11.5 (Sep. 1963 [T-MTT]): 454-455.

A general theory for analyzing scattering from loaded scatterers is available, and has been applied to small scatterers suitable for electromagnetic field measurements. The theory is valid for both passive and active loads, as long as the load is linear. Ryerson has proposed the use of tunnel diodes to provide a negative resistance load, thereby enhancing the scattered signal. His predictions have been verified experimentally by measurements on dipoles and tunnel diodes at S band. The use of scatterers and tunnel diodes for field measurements is discussed in this communication.



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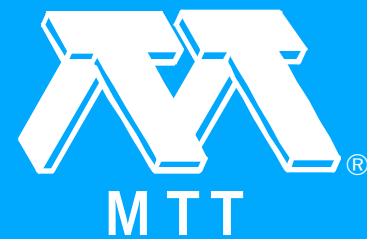
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Contributors (Sep. 1963 [T-MTT])

J.R. Baird, E. Brannen, C.A. Burrus, Jr., J.C. Butterworth, J.F. Byrne, P.D. Coleman, C.F. Cook, J.M. Cotton, Jr., H.R. Froelich, L. Genzel, G.R. Harrison, O.F. Hinckelmann, H.J. Hindin, L.R. Hodges, Jr., E. Kramer, M.W. Long, R. Meredith, H.J. Oguey, R.H. Pantell, G.H. Preece, K.F. Renk, F.J. Rosenbaum, G.P. Rodrigue, E.M. Rutz-Philipp, A.J. Simmons, R.G. Smith, A.W. Straiton, D.R. Taft, F.J. Tischer, J.J. Taub, C.W. Tolbert, R. Ulrich, F.L. Warner, M.L. Wright and R.W. Zimmerer. "Contributors (Sep. 1963 [T-MTT])." 1963 Transactions on Microwave Theory and Techniques 11.5 (Sep. 1963 [T-MTT]): 455-459.



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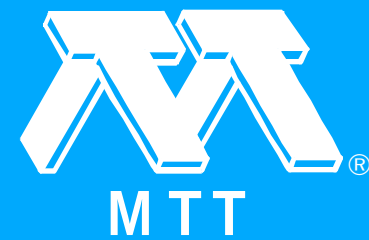
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Call for Papers - 1964 PTGMTT International Symposium (Sep. 1963 [T-MTT])

"Call for Papers - 1964 PTGMTT International Symposium (Sep. 1963 [T-MTT])." 1963 Transactions on Microwave Theory and Techniques 11.5 (Sep. 1963 [T-MTT]): 460-460.



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"Table of Contents (Nov. 1963 [T-MTT])." 1963 Transactions on Microwave Theory and Techniques 11.6 (Nov. 1963 [T-MTT]): 461-461.



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Radiation from a Uniformly Moving Charge in an Anisotropic Plasma

H.S. Tuan and S.R. Seshadri. "Radiation from a Uniformly Moving Charge in an Anisotropic Plasma." 1963 Transactions on Microwave Theory and Techniques 11.6 (Nov. 1963 [T-MTT]): 462-471.

The radiation from a point charge moving uniformly in a plasma is investigated when the charge is moving in the direction of an external magnetic field. In general there are two modes, for each of which all the components of the electric and magnetic field are present. The two parameters of interest in this problem are the ratio u/c of the velocity of the charges to the free-space velocity of electromagnetic waves and the ratio R of the gyromagnetic frequency to the plasma frequency of the electrons. For two sets of values of these parameters the frequency and the angular spectrum of the emitted radiation are obtained. In certain cases, as many as three Cerenkov rays are found to propagate in the same direction; these multiple rays, however, correspond to different frequency components and to different modes of propagation. The motivation for this investigation is indicated briefly.





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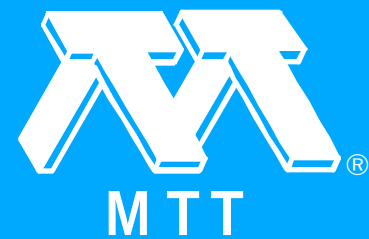
Some Aspects of the Measurement of the Q Factor of Transmission Lines

P.I. Somlo. "Some Aspects of the Measurement of the Q Factor of Transmission Lines." 1963 Transactions on Microwave Theory and Techniques 11.6 (Nov. 1963 [T-MTT]): 472-478.

This paper deals with two basic problems in the measurement of the Q factor of low-loss transmission lines: 1) long lines and 2) short lines with appreciable direct coupling between the driving and pickup probes. The results are given as relative ordinates on the (distorted) resonance curve which correspond to the correct values of $\pm \frac{1}{2} \Delta / \text{spl } \text{iota} /$ or $\pm \frac{1}{2} \Delta / \text{spl } \text{conint} /$ defined by $Q = \text{spl } \text{conint} / \Delta / \text{spl } \text{conint} = \text{spl } \text{iota} / \Delta / \text{spl } \text{iota} /$.

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A Nonuniform Coaxial Line with an Isoperimetric Sheath Deformation

N. Seshagiri. "A Nonuniform Coaxial Line with an Isoperimetric Sheath Deformation." 1963 Transactions on Microwave Theory and Techniques 11.6 (Nov. 1963 [T-MTT]): 478-486.

For impedance matching in transmission lines, nonuniform lines, obeying laws of taper like the exponential, the Dolph-Chebyshev etc., are used. For the nonuniform coaxial line, constructional advantages can be derived for the same electrical performance if it has a uniform circular inner conductor with an outer conductor having an isoperimetric transition, from circular to elliptic cross section, in conformity with the established laws of taper. This problem has been examined in the paper, and the required design formulas as well as the design charts are developed. The effect of an impedance and geometric discontinuity at the low-impedance junction of such a nonuniform line and the concentric circular uniform line is discussed. The use of the isoperimetric transition line in microwave components is indicated.

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Prototypes for Use in Broadbanding Reflection Amplifiers

W.J. Getsinger. "Prototypes for Use in Broadbanding Reflection Amplifiers." 1963 Transactions on Microwave Theory and Techniques 11.6 (Nov. 1963 [T-MTT]): 486-497.

This paper tabulates, as functions of reflection gain and ripple, the element values of negative-resistance terminated, prototype, low-pass, lumped-element ladder networks of normalized impedance and bandwidth. (The values are calculated using known synthesis methods.) Next, it provides a technique for relating the characteristics of any actual narrow-band, negative-resistance device to the value of the prototype susceptible element adjacent to the negative resistance. When an actual negative-resistance device has been related to a prototype in this manner, the performance of the device with one, two or three additional cascaded resonators can be predicted from given graphs. This allows trade-offs among gain, ripple, and bandwidth, within limits. Finally, the predicted performance can be used with simple formulas and the table of prototype element values to design suitable resonators to broadband the actual amplifier. The tables and techniques of this paper are used successfully to broadband tunnel-diode, maser and parametric-amplifier circuits. This paper allows the practical engineer to estimate the broad-banding potential of any given negative-resistance device and provides him with the proper element values to do so with only a few very simple calculations required.

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A New Technique for Measuring an Electromagnetic Field by a Coil Spring

K. Iizuka. "A New Technique for Measuring an Electromagnetic Field by a Coil Spring." 1963 Transactions on Microwave Theory and Techniques 11.6 (Nov. 1963 [T-MTT]): 498-505.

A thin coil spring whose length can be varied periodically by mechanical means has been used as a probe to measure the electric field intensity. The vibrating probe acts as a reradiating antenna with periodically varying length that modulates and scatters the component of the E /sup bar/ field which is parallel to the axis of the spring. The scattered signal is picked up by a receiving antenna (the sending antenna was used also as a receiving antenna) and amplified with an amplifier that is locked-in with the frequency of the mechanical vibration of the coil. Measurements were made with coil springs of three different dimensions, and a gain constant K , which should be independent of the product of the axial length of the coil and the magnitude of the vibration, was experimentally checked. Measurements of the field of a half-wave dipole antenna as measured with the spring probe are in general agreement with theory. An expression for the ratio between the scattered and incident waves is obtained based upon the field-pattern method and the approximations involved in the reciprocity-theorem method are clarified. It is also demonstrated (in the appendix) that the effective length of a thin helical antenna with a triangular current distribution equals one-half of the axial length of the helix.





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Theoretical Design of Symmetrical Junction Stripline Circulators

J.B. Davies and P. Cohen. "Theoretical Design of Symmetrical Junction Stripline Circulators." 1963 Transactions on Microwave Theory and Techniques 11.6 (Nov. 1963 [T-MTT]): 506-512.

The results of detailed calculations based on Bosma's theory of 3-port stripline circulators are presented. The analysis has been modified to enable the scattering matrix, and therefore the circulator bandwidth, to be found. The equations of the 4-port junction have been derived and an expression for the scattering matrix of the general m-port junction is given. A comparison of experimental and theoretical results for the 3-port junction shows good agreement for circulators designed in the frequency band 2-3 Gc.

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Radiometry in the Submillimeter Region Using the Interferometric Modulator

R.A. Williams and W.S.C. Chang. "Radiometry in the Submillimeter Region Using the Interferometric Modulator." 1963 Transactions on Microwave Theory and Techniques 11.6 (Nov. 1963 [T-MTT]): 513-522.

Radiometry in the submillimeter and far infrared regions involves problems of a type not encountered in the centimeter region which require solutions using techniques different from those used in centimeter-wavelength radiometry. The nonlinear variation of the magnitude of the black-body radiation spectral density with temperature and wavelength, the limitation of antenna beamwidth by factors connected with the size of the noncoherent detector and the antenna focal length (rather than by diffraction effects and the antenna aperture) and the heavy absorption of submillimeter radiation by atmospheric water vapor are typical of the problems normally not encountered in centimeter radiometry. The unavailability of microwave techniques (i.e., waveguides, coherent receivers, etc.) makes necessary the use of quasi-optical techniques in this wavelength region. The interferometric modulator, which has already been used in far infrared spectrometers, is proposed in this paper as the major component of a practical submillimeter radiometer. Its use as the wave-number-selection device in a radiometer is analyzed and estimates are obtained for the sensitivity of this submillimeter radiometer. It is estimated that a 0.2° minimum detectable temperature differential is achievable with this radiometer. Also discussed are the effects of atmospheric water vapor absorption and the sensitivity of a number of different types of radiation detectors suitable for use in the submillimeter-wavelength region.

Click on title for a complete paper.



Abstracts

Some Considerations in the Design of Narrow-Band Waveguide Filters

L. Young. "Some Considerations in the Design of Narrow-Band Waveguide Filters." 1963 Transactions on Microwave Theory and Techniques 11.6 (Nov. 1963 [T-MTT]): 522-527.

It is natural that design considerations common to all kinds of filters should have received most attention in the literature. Some design considerations which are peculiar to waveguide filters (being due to the dispersive property of waveguides) are treated in this paper. It is shown that there are waveguide dimensions which minimize the filter dissipation loss and also the filter pulse power capacitance and which keep the nearest spurious-frequency response farthest from the fundamental pass band. Graphical data are presented to show how much is to be gained or lost by departing from the usual dimensions.



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Tunable, Dielectric-Loaded Microwave Cavities Capable of High Q and High Filling Factor

E.O. Ammann and R.J. Morris. "Tunable, Dielectric-Loaded Microwave Cavities Capable of High Q and High Filling Factor." 1963 Transactions on Microwave Theory and Techniques 11.6 (Nov. 1963 [T-MTT]): 528-542.

Many applications require the presence of a dielectric inside a microwave resonator. This paper presents a new type of dielectric-loaded cavity and contains a detailed analysis of its properties. The cavity consists of a waveguide of arbitrary but uniform cross section, filled with dielectric for part of its length, with movable shorting plungers in the guide beyond one or both ends of the dielectric. Such a structure supports resonances at frequencies where a particular waveguide mode is above cutoff in the dielectric, but below cutoff outside. These resonances can have high Q's, especially when the cavity ends are open. Frequency tuning is possible via the movable plungers. The present analysis investigates resonant frequency, tuning range, and electric and magnetic filling factors. Wall losses are calculated for the particular case of a circular cross section. All results are plotted as universal design curves. The results indicate that this configuration is quite versatile and should be useful in numerous applications, including microwave solid-state masers, microwave light modulators, and the study of "ghost mode" resonances in waveguide windows.

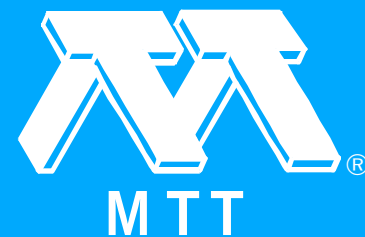


Abstracts

Propagation Constants for TE and TM Surface Waves on an Anisotropic Dielectric Cylinder

P.R. Longaker and C.S. Roberts. "Propagation Constants for TE and TM Surface Waves on an Anisotropic Dielectric Cylinder." 1963 Transactions on Microwave Theory and Techniques 11.6 (Nov. 1963 [T-MTT]): 543-546.

Maxwell's equations for wave propagation in a cylindrical anisotropic dielectric rod have been solved for various values of the longitudinal and transverse dielectric constants with the help of an IBM 7090 computer. The solutions are limited to modes having no rotational dependence about the direction of propagation. Families of curves for various ratios of longitudinal to transverse dielectric constants are given, showing the relationship between the guided wavelength and the diameter of the rod. Equations for the cutoff and asymptotic behavior are also given.



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Abstracts

Further Formulas for Calculating Approximate Values of the Zeros of Certain Combinations of Bessel Functions (Correspondence)

J.A. Cochran. "Further Formulas for Calculating Approximate Values of the Zeros of Certain Combinations of Bessel Functions (Correspondence)." 1963 Transactions on Microwave Theory and Techniques 11.6 (Nov. 1963 [T-MTT]): 546-547.

In a recent letter Gunston has presented a wonderfully simple approximate formula for the smallest z zero of the Bessel function equation.



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Abstracts

Transmission Line Measurement of Narrow Linewidth Ferromagnetic Samples (Correspondence)

G.R. Jones. "Transmission Line Measurement of Narrow Linewidth Ferromagnetic Samples (Correspondence)." 1963 Transactions on Microwave Theory and Techniques 11.6 (Nov. 1963 [T-MTT]): 547-548.

Measurement of ferromagnetic resonance linewidths over a range of microwave frequencies is facilitated by the use of a nonresonant waveguide system. The loading effect encountered in such a transmission line system, however, becomes significant when the linewidth is less than a few tens of oersteds. The effect of transmission line loading was avoided by the use of an automatic compensation network.



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Abstracts

A Note on Strip-Line Band-Stop Filters with Narrow Stop Bands (Correspondence)

R.D. Standley and A.C. Todd. "A Note on Strip-Line Band-Stop Filters with Narrow Stop Bands (Correspondence)." 1963 Transactions on Microwave Theory and Techniques 11.6 (Nov. 1963 [T-MTT]): 548-549.

Design criteria for band-stop filters having bandwidths up to few per cent have been presented by Young, Matthaei, and Jones. The purpose of this correspondence is to extend their work to include a new type of strip-line resonator which is easier to construct and adjust, and also permits the application of printed circuit fabrication.



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Abstracts

Maximum Efficiency of a Two Arm Waveguide Junction (Comments)

S. Lefevre. "Maximum Efficiency of a Two Arm Waveguide Junction (Comments)." 1963 Transactions on Microwave Theory and Techniques 11.6 (Nov. 1963 [T-MTT]): 549-549.

In connection with a recent communication by Beatty I wish to advise you that we have been studying the two-arm dissipative waveguide junction in our laboratory. Two years ago I published a new demonstration of Deschamp's method for measuring scattering coefficients and the general properties of those coefficients.



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Abstracts

A Uniform Coaxial Line with an Elliptic-Circular Cross Section (Correspondence)

N. Seshagiri. "A Uniform Coaxial Line with an Elliptic-Circular Cross Section (Correspondence)." 1963 Transactions on Microwave Theory and Techniques 11.6 (Nov. 1963 [T-MTT]): 549-551.

Analysis and design of a nonuniform coaxial line with an isoperimetric sheath deformation has been reported. The object of this note is to show that the procedure followed therein can be adopted for evaluating some of the essential features of an infinitely long ideal transmission line with an elliptic sheath and a circular inner conductor. Apart from its reported use with the nonuniform line, this type of structure may also be found in medium and large sized electronuclear machines.



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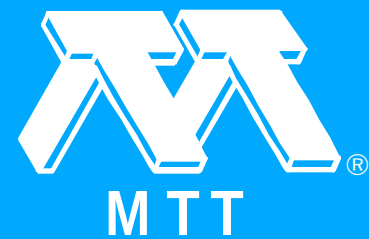
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Discontinuity Effects in Single Resonator Traveling Wave Filters (Correspondence)

R.D. Standley and A.C. Todd. "Discontinuity Effects in Single Resonator Traveling Wave Filters (Correspondence)." 1963 Transactions on Microwave Theory and Techniques 11.6 (Nov. 1963 [T-MTT]): 551-552.

In a previous correspondence the exact frequency response of the single resonator traveling wave directional filter was presented assuming that all transmission lines had characteristic impedances equal to the terminating impedance of the network. The purpose of this correspondence is to extend the previous work to take into account the case where the transmission lines connecting the parallel coupled lines have an arbitrary characteristic impedance Z_0 . The resulting structure is shown in Fig. 1.

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A Wall-Current Detector for Use with Beam Waveguides (Correspondence)

M.D. Sirkis and C.S. Kim. "A Wall-Current Detector for Use with Beam Waveguides (Correspondence)." 1963 Transactions on Microwave Theory and Techniques 11.6 (Nov. 1963 [T-MTT]): 552-552.

A crystal detector mount which is well suited for use with beam waveguides of either the refracting or reflecting type is based on the same concept as the wall-current detector of deRonde. The geometry of one form of the detector is shown in Fig. 1.

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Abstracts

Solution of the Fourier Heat Flow Equation in Waveguides Filled with Lossy Dielectrics (Correspondence)

W.J. Gallagher. "Solution of the Fourier Heat Flow Equation in Waveguides Filled with Lossy Dielectrics (Correspondence)." 1963 Transactions on Microwave Theory and Techniques 11.6 (Nov. 1963 [T-MTT]): 552-553.

The temperature distribution within a waveguide filled with a lossy dielectric, and propagating a specified mode, may be conveniently obtained by the Green's function method. Such a solution is useful for describing the temperature distribution in vacuum windows, for example.



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Abstracts

A Vacuum Forming Technique for the Fabrication of Spherical or Prolate Spheroidal Reflectors (Correspondence)

J.E. Degenford and M.D. Sirkis. "A Vacuum Forming Technique for the Fabrication of Spherical or Prolate Spheroidal Reflectors (Correspondence)." 1963 Transactions on Microwave Theory and Techniques 11.6 (Nov. 1963 [T-MTT]): 553-553.

A quick and inexpensive way of making spherical or prolate spheroidal reflectors for use in the millimeter wave range has been developed. This technique is based upon the fact that for small deflections a circular membrane stretched uniformly by a vacuum assumes approximately the shape of a spherical cap, and an elliptical membrane assumes approximately the shape of a prolate spheroidal cap. In making the reflectors, 0.001 inch aluminum foil is used as the membrane because of its low elastic limit. Once the foil is stretched, it retains its shape, eliminating the need for continual pumping.



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A Method of Improving the Response of Waveguide Directional Couplers (Correspondence)

L. Sweet. "A Method of Improving the Response of Waveguide Directional Couplers (Correspondence)." 1963 Transactions on Microwave Theory and Techniques 11.6 (Nov. 1963 [T-MTT]): 554-554.

This communication describes a technique for decreasing the frequency variation of coupling of multihole broadwall waveguide directional couplers. The usual curve of coupling vs frequency is shown in Fig. 1 and has a peak-to-peak variation of 1.0 db. The proposed method, which is similar to the use of multiple sections in coaxial couplers, perturbs the coupled voltage by adding a small voltage that is in phase at midband where the coupling is looser and out of phase near the band edges. The required perturbation is produced by means of the coupling structure shown in Fig. 2, where the phase of one coupled voltage is delayed with respect to the other coupled voltage because of an added path length ΔL .



Abstracts

The Characteristic Impedance of Square Coaxial Line (Nov. 1963 [T-MTT])

H.E. Green. "The Characteristic Impedance of Square Coaxial Line (Nov. 1963 [T-MTT])." 1963 Transactions on Microwave Theory and Techniques 11.6 (Nov. 1963 [T-MTT]): 554-555.

Recent attempts to design a precision coaxial to strip line transformer have raised the need to know accurately the characteristic impedance of square coaxial line (i.e. a concentric line, as shown in Fig. 1, having inner and outer conductors of square cross section) which forms an intermediate part of the proposed transformer.



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Postscript to Two Papers on Waffle-Iron Filters (Correspondence)

L. Young. "Postscript to Two Papers on Waffle-Iron Filters (Correspondence)." 1963 Transactions on Microwave Theory and Techniques 11.6 (Nov. 1963 [T-MTT]): 555-557.

Waffle-iron filters are waveguide "low-pass" filters, that is, they have a wide stop band above their pass band. They are useful for both low-power and high-power applications. A brief history of the development of this filter at Stanford Research Institute is given by Young and Schiffman. A new design principle which makes it possible to extend the pass band from (typically) about 10 per cent to about 40 per cent is also described; the pass band of that filter covers almost the whole of the recommended waveguide band, while its stop band extends from the second to the fourth harmonic, inclusive.

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Abstracts

The Effect of Increased Design Bandwidth upon Direct-Coupled-Resonator Filters (Correspondence)

K. Whiting. "The Effect of Increased Design Bandwidth upon Direct-Coupled-Resonator Filters (Correspondence)." 1963 Transactions on Microwave Theory and Techniques 11.6 (Nov. 1963 [T-MTT]): 557-560.

The Cohn synthesis is generally preferred as a convenient design technique for direct-coupled waveguide filters covering a moderate bandwidth. Approximations inherent in the theory result in considerable deviations from the theoretical pass band response as the design bandwidth increases. The magnitude of the deviations is difficult to predict and proves troublesome in designs requiring a low pass band VSWR.



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Tunnel Diodes as Millimeter Wave Detectors and Mixers (Correspondence)

P.E. Chase and K.K.N. Chang. "Tunnel Diodes as Millimeter Wave Detectors and Mixers (Correspondence)." 1963 Transactions on Microwave Theory and Techniques 11.6 (Nov. 1963 [T-MTT]): 560-561.

Backward diodes and tunnel diodes have been successfully operated as detectors and mixers at microwave frequencies. The extension of their usage from microwave frequencies to millimeter wave frequencies is a natural outgrowth of earlier work.



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Abstracts

Group Delay and Dissipation Loss in Transmission-Line Filters (Correction)

L. Young. "Group Delay and Dissipation Loss in Transmission-Line Filters (Correction)." 1963 Transactions on Microwave Theory and Techniques 11.6 (Nov. 1963 [T-MTT]): 561-561.

In the above Correspondence, on page 216, in (17), the numerical factor should be 27.3, and not 2.73.



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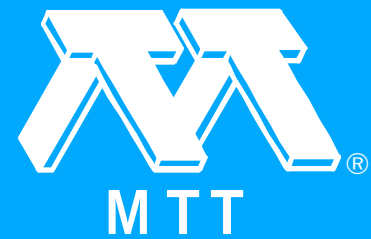


Abstracts

Direct-Coupled Cavity Filters for Wide and Narrow Bandwidths (Correction)

L. Young. "Direct-Coupled Cavity Filters for Wide and Narrow Bandwidths (Correction)." 1963 Transactions on Microwave Theory and Techniques 11.6 (Nov. 1963 [T-MTT]): 561-561.

In the above paper, on page 170, the A symbols were omitted in (34) and (35).



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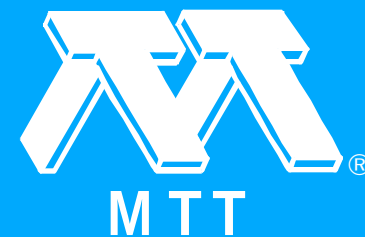
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Contributors (Nov. 1963 [T-MTT])

E.O. Ammann, W.S.C. Chang, P. Cohen, J.B. Davies, W.J. Getsinger, K. Iizuka, P.R. Longaker, R.J. Morris, C.S. Roberts, S.R. Seshadri, N. Seshagiri, P.I. Somlo, H.-S. Tuan, R.A. Williams and L. Young. "Contributors (Nov. 1963 [T-MTT])." 1963 Transactions on Microwave Theory and Techniques 11.6 (Nov. 1963 [T-MTT]): 562-563.



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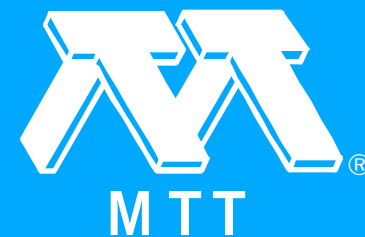
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Index, IEEE Transactions on Microwave Theory and Techniques, Volume MTT-11, 1963

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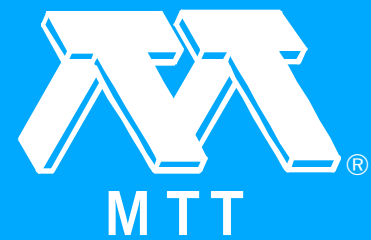
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Abstracts

Leonard Lewin, Microwave Prize Winner

"Leonard Lewin, Microwave Prize Winner." 1964 Transactions on Microwave Theory and Techniques 12.1 (Jan. 1964 [T-MTT]): 2-3.



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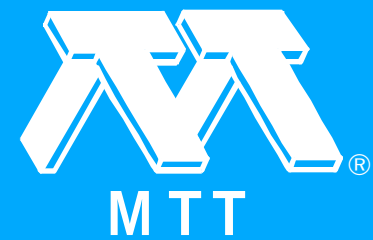
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Abstracts

1963 PTGMTT National Symposium (Jan. 1964 [T-MTT])

"1963 PTGMTT National Symposium (Jan. 1964 [T-MTT])." 1964 Transactions on Microwave Theory and Techniques 12.1 (Jan. 1964 [T-MTT]): 4-5.



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Abstracts

Exact Design of Band-Stop Microwave Filters (Jan. 1964 [T-MTT])

B.M. Schiffman and G.L. Matthaei. "Exact Design of Band-Stop Microwave Filters (Jan. 1964 [T-MTT])." 1964 Transactions on Microwave Theory and Techniques 12.1 (Jan. 1964 [T-MTT]): 6-15.

An exact method for the design of band-stop filters which adapts synthesis techniques due to Ozaki and Ishii is discussed. This method places no theoretical limit on the width of the stop-band, although, for practical reasons, different (but equivalent) circuit configurations are used for stop-bands of different widths. These configurations include a form having open-circuited shunt stubs separated by lengths of line; a second form using resonators which are separate from the main line but parallel to it, so that coupling takes place by way of fringing fields; and a third form in which the resonators are attached directly to the main line, but are folded parallel to it so that coupling is both by direct connection and by fringing fields. Easy to use formulas are given for the exact design of band-stop filters from low-pass prototype filters and equations are given for converting from one form of filter structure to any of the other equivalent forms. The experimental results of trial designs are presented.



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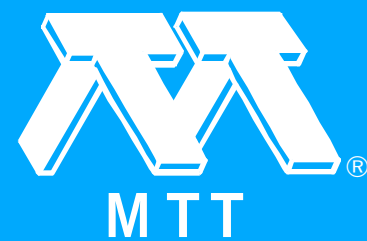


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A New Microwave Measurement Technique to Characterize Diodes and an 800-Gc Cutoff Frequency Varactor at Zero Volts Bias (Jan. 1964 [T-MTT])

B.C. De Loach. "A New Microwave Measurement Technique to Characterize Diodes and an 800-Gc Cutoff Frequency Varactor at Zero Volts Bias (Jan. 1964 [T-MTT])." 1964 Transactions on Microwave Theory and Techniques 12.1 (Jan. 1964 [T-MTT]): 15-20.

A means has been found which enables one to make negligible the complicating effects of posts and shunting cartridge capacitance usually present in microwave diode circuits. This simplification permits the representation of the diode by a simple equivalent circuit and the determination of the effective diode parameters from transmission measurements. Parameters so obtained at X band (8.2 to 12.4 Gc) are compared with audio frequency bridge measurements. Measurements at M band (50-60 Gc) of a new 800-Gc cutoff frequency varactor are also described. This varactor has zero bias junction capacitance in the 0.016 pf range and spreading resistance on the order of 12 Ω . It is expected to extend the useful range of parametric devices well into the millimeter region.



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Abstracts

Octave Bandwidth Tunnel-Diode Amplifier

J.H. Lepoff and G.J. Wheeler. "Octave Bandwidth Tunnel-Diode Amplifier." 1964 Transactions on Microwave Theory and Techniques 12.1 (Jan. 1964 [T-MTT]): 21-26.

Two tunnel-diode amplifiers for the frequency ranges 2 to 3 Gc and 3 to 4 Gc are combined with hybrids and low-pass filters to provide an octave bandwidth amplifier. The amplifier design is based on band-pass filter techniques. The gain exceeds 10 db over this band with noise figure better than 4 db.



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Abstracts

Microwave Breakdown Near a Hot Surface (Jan. 1964 [T-MTT])

M. Gilden and J. Pergola. "Microwave Breakdown Near a Hot Surface (Jan. 1964 [T-MTT])." 1964 Transactions on Microwave Theory and Techniques 12.1 (Jan. 1964 [T-MTT]): 26-33.

Microwave breakdown near a hot surface in a waveguide system was studied to determine its dependence upon the thickness of the adjacent film of hot gas and its associated temperatures. The effect of the variation of the film thickness with the flow rate of the bulk of the gas was of particular interest. To carry out the theoretical analysis, a more general breakdown equation was derived to account for the temperature gradients. Experimental results supporting the theory also are presented. The study shows that, although the breakdown threshold of a waveguide system is lowered by the presence of a hot surface, a sufficiently rapid flow of the bulk gas tends to restore the threshold as a result of the reduction in the thickness of the film of hot gas. This effect occurs in addition to that reduction resulting from cooling the surface.



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The Application of the Focussed Fabry-Perot Resonator to Plasma Diagnostics

R.I. Primich and R.A. Hayami. "The Application of the Focussed Fabry-Perot Resonator to Plasma Diagnostics." 1964 Transactions on Microwave Theory and Techniques 12.1 (Jan. 1964 [T-MTT]): 33-42.

The use of a focussed Fabry-Perot resonator at microwave frequencies for plasma diagnostics is discussed. It is shown theoretically that improvements in sensitivity in the measurements of the properties of transparent plasmas and dielectrics of two to three orders in magnitude can be expected. Losses have been neglected. It is indicated that under certain circumstances, refractive index changes in the gaseous environment may be significant. A method of measuring these changes is included. The extension of these techniques to the optical part of the spectrum is discussed and is shown to be promising. Experimental results, obtained with the use of a cavity at 70 Gc, are presented and appear to confirm the main predicted features.

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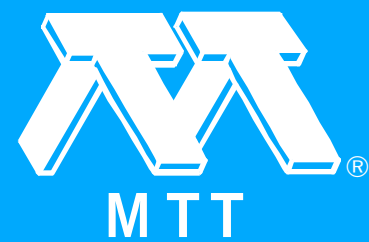


Four-Port Crossed-Waveguide Junction Circulators

L.E. Davis, M.D. Coleman and J.J. Cotter. "Four-Port Crossed-Waveguide Junction Circulators." 1964 Transactions on Microwave Theory and Techniques 12.1 (Jan. 1964 [T-MTT]): 43-47.

A detailed account is given of the experimental investigation which has led to the design of 4-port circulators at frequencies from 2.5 to 25 Gc. The complex behaviour of these devices is clarified by establishing the modes of circulation in any particular waveguide passband. The modes are defined in terms of the static magnetic field (H) required, the microwave frequency (f) and the direction of circulation. The shape of the mode characteristic depends upon the ferrite/brass configuration in the center of the junction and the mode charts are given for two possible ferrite arrangements. The fixed-field bandwidths of the two configurations are, respectively, 2-4 per cent and 4-8 per cent. The performances are: isolation (ports 1-4) >20 db, cross-coupling (ports 1-3) >20 db, VSWR <1.2 and insertion loss (ports 1-2), respectively, <0.5 db and <1.0 db for the two configurations. The tunable bandwidth depends upon the mode of circulation and varied from 5 to 15 per cent. The positions of the modes in the waveguide pass-band can be adjusted by changing the diameter of the center ferrite/brass post. This shifting of the center frequency is described in detail for both ferrite arrangements and, for particular modes of circulation, figures are given of the frequency shift per 0.001" change in ferrite and brass diameter.





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The Investigation of an Electron Resonance Spectrometer Utilizing a Generalized Feedback Microwave Oscillator (Jan. 1964 [T-MTT])

J.B. Payne, III. "The Investigation of an Electron Resonance Spectrometer Utilizing a Generalized Feedback Microwave Oscillator (Jan. 1964 [T-MTT])." 1964 Transactions on Microwave Theory and Techniques 12.1 (Jan. 1964 [T-MTT]): 48-54.

In this investigation, an entirely different approach is taken toward the development of a "self-stabilized" paramagnetic resonance (EPR) spectrometer system which eliminates the usual low-power klystron oscillator, electronic frequency stabilizing equipment, and the complex superheterodyne detector without sacrificing loss of detection sensitivity. This system which is known as an oscillator spectrometer consists of a microwave amplifier containing a sample-carrying network element in the positive feedback loop. The microwave device oscillates at the network's central resonant frequency with essentially instantaneous frequency stability. Expressions relating the change in power level and frequency of oscillation as a function of the change in the network attenuation and phase at magnetic resonance are derived. The system's ultimate sensitivity is determined by analyzing the noise within the oscillator loop. In general, the noise that limits the detection of the resonance signal is principally that generated by the amplifier, and thus a simple video detector can be used. The sensitivity of this spectrometer was found to be comparable with that of the conventional bridge type spectrometer.

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A High-Power Rotary Waveguide Joint

P.H. Smith and G.H. Mongold. "A High-Power Rotary Waveguide Joint." 1964 Transactions on Microwave Theory and Techniques 12.1 (Jan. 1964 [T-MTT]): 55-58.

A conceptually new type of contactless multichannel rotary waveguide joint is described. Power handling capability without pressurization exceeds that of the associated waveguides. Electrical features include elimination of impedance and phase variations with rotation, exceptionally low loss and power leakage. Operation is possible over a 10 per cent frequency band with a maximum VSWR of 1.15. Experimental results on a C-band model are given. Both electrical and mechanical design features are presented for a compactly folded design for operation at multimegawatt peak powers.

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A Harmonic Rejection Filter Designed by an Exact Method

B.M. Schiffman. "A Harmonic Rejection Filter Designed by an Exact Method." 1964 Transactions on Microwave Theory and Techniques 12.1 (Jan. 1964 [T-MTT]): 58-60.

An exact design procedure for band-stop filters is used to design a transmission-line filter with one point of perfect match at a fundamental frequency and one point of infinite attenuation at a harmonic frequency. This design method is based on the mapping of the response of a low-pass prototype into that of a transmission line filter. Here a three-element Chebyshev filter is chosen as the prototype and the otherwise general procedure is adapted for the special case of rejection of the second harmonic.

Click on title for a complete paper.



Abstracts

On Stripline Y-Circulation at UHF

H. Bosma. "On Stripline Y-Circulation at UHF." 1964 Transactions on Microwave Theory and Techniques 12.1 (Jan. 1964 [T-MTT]): 61-72.

The simplified boundary-value problem of the circular strip-line Y-circulator is stated and, following experimental results, is solved approximately. The circulation parameters are calculated and discussed. The frequency characteristics are evaluated and a general method for broadbanding the device is presented. From the calculated and measured field distribution, an explanatory description of the circulation mechanism is given. Finally, other possible solutions and the features for use at UHF are discussed.



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Direct- and Quarter-Wave-Coupled Microwave Band-Pass Filters with Adjustable Transmission Characteristics and Fixed Center Frequencies

B.C. De Loach. "Direct- and Quarter-Wave-Coupled Microwave Band-Pass Filters with Adjustable Transmission Characteristics and Fixed Center Frequencies." 1964 Transactions on Microwave Theory and Techniques 12.1 (Jan. 1964 [T-MTT]): 73-77.

A theoretical study of the properties of "constant-phase" two-ports is presented which leads to a simple experimental synthesis technique for a broad class of microwave band-pass filters. "Constant-phase" two-ports consisting of modified step-twist-junctions are employed in experimental multiple cavity direct-coupled filter configurations which have the unique property of continually adjustable bandpass characteristics and fixed center frequency. These experimentally obtained characteristics are predicted from the theory.



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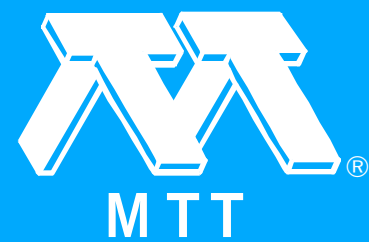
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Some Aspects of the Design of Wide-Band Up-Converters and Nondegenerate Parametric Amplifiers

W.J. Getsinger and G.L. Matthaei. "Some Aspects of the Design of Wide-Band Up-Converters and Nondegenerate Parametric Amplifiers." 1964 Transactions on Microwave Theory and Techniques 12.1 (Jan. 1964 [T-MTT]): 77-87.

Proper design of the diode-resonating circuit is seen to be extremely important if large bandwidth is desired in a varactor-diode parametric amplifier. Cases where there is one resonance of the diode-resonating circuit at a frequency between the frequencies of the signal-input and the sideband resonances are examined in some detail. It is shown that the frequency of this intermediate resonance can greatly influence the bandwidth capabilities of an amplifier design, and the optimum frequency for such a resonance is given for upper-sideband up-converters. The optimum frequency of such a resonance is greatly different if the diode is resonated in series than it is if the diode is resonated in shunt. It is believed that the same results would also apply for lower-sideband up-converters and nondegenerate parametric amplifiers. Some upper-sideband up-converter designs were worked out and their computed responses are given including the effects of all of the parasitic elements of the diode. Bandwidths of the order of an octave are obtained. A systematic sign procedure is given for wide-band nondegenerate parametric amplifiers which use the diode parasitic resistance as the idler termination. Some designs of this type were also worked out and their computed responses (including effects of all diode parasitic parameters) are presented. Bandwidths as large as 33 per cent are obtained depending on the peak gain and operating frequency range.

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Abstracts

A Technique for the Design of Multiplexers Having Contiguous Channels

E.G. Cristal and G.L. Matthaei. "A Technique for the Design of Multiplexers Having Contiguous Channels." 1964 Transactions on Microwave Theory and Techniques 12.1 (Jan. 1964 [T-MTT]): 88-93.

A general procedure for the design of multiplexer having contiguous channel frequency bands is presented. Using this procedure, the individual channel band-pass filters are designed from low-pass prototype filters having a resistive termination at one end only. The use of parallel-connected band-pass filters designed in this fashion, along with a susceptance-annulling network, is shown to be capable of giving a nearly constant input conductance across the operating band of a multiplexer. A three-channel design example using comb-line band-pass filters was worked out and its input admittance and attenuation characteristics were computed. This design was also constructed and tested. The computer and experimental results demonstrated the validity of the theory.



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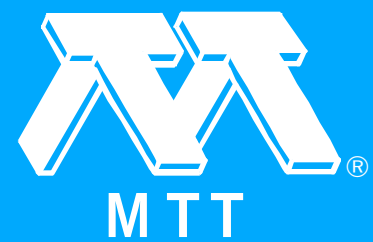
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Exact Design of TEM Microwave Networks Using Quarter-Wave Lines

R.J. Wenzel. "Exact Design of TEM Microwave Networks Using Quarter-Wave Lines." 1964 Transactions on Microwave Theory and Techniques 12.1 (Jan. 1964 [T-MTT]): 94-111.

Modern network theory procedures, based on Ozaki-Ishii synthesis techniques, are reviewed for application in the design of TEM mode microwave networks using parallel coupled bars and/or series and shunt stubs. The circuit equivalences and identities obtained are theoretically valid over the entire frequency spectrum and lead to several physical configurations having identical response functions. These equivalent circuits often allow simplification of the physical circuitry and realization of both broad and narrow bandwidths. The problem of practical circuit configurations is discussed from the viewpoint of bandwidth and circuit element values.

Neglecting multiple responses, TEM low-pass, high-pass and band-pass butterworth filters are shown to offer steeper bandedge characteristics than those of corresponding lumped element filters. The use of complementary filters to match a source and load over a wide frequency range is outlined and TEM realizations of these complements are obtained. A simple procedure for obtaining element values of butterworth complements is described. An analysis of parallel coupled filters is made and a simplified equivalent circuit is obtained. An exact synthesis procedure for parallel coupled bar filters and their equivalent forms is given. Construction details and experimental results are described for two filters which use series stubs.





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A Universal Wall-Current Detector

F.C. de Ronde. "A Universal Wall-Current Detector." 1964 Transactions on Microwave Theory and Techniques 12.1 (Jan. 1964 [T-MTT]): 112-117.

A universal X-band waveguide detector has been developed which offers the possibilities of a broad-band untuned detector with a stable frequency characteristic. The wall-current detector is a reflectionless two-port with an insertion loss, less than 0.05 db, no extra phase-shift, a sensitivity of about 10 mv/mw and a frequency characteristic which repeats within ± 0.1 db over the 8.2-12.4 Gc band for any 1N26. This performance made it possible to flatten the output of a Hewlett-Packard sweep oscillator (as seen by another wall-current detector) within ± 0.15 db over the whole X band. As a result many frequency-dependent measurements can now be done automatically with reasonable precision. Plotters and reflectometers will be simplified, resulting in a higher precision. Circular and ridge waveguide types have also been made. The latter seems very promising for an ultra broad-band detector. A sum detector and a difference detector have been made. They can be used for phase-sensitive detection, zero measurements, etc. The wall-current detector can easily be scaled down to mm waves.

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Abstracts

First-Order Theory for Oblate and Prolate Anisotropic Artificial Dielectrics

R.C.C. Leite and C.T. Tai. "First-Order Theory for Oblate and Prolate Anisotropic Artificial Dielectrics." 1964 Transactions on Microwave Theory and Techniques 12.1 (Jan. 1964 [T-MTT]): 117-122.

Equivalent expressions for the electric permittivity and magnetic permeability tensors of artificial dielectrics are derived. These are expressed as functions of particle dimension, shape and density and also as a function of the incident electromagnetic beam direction with respect to the orientation of the particle. Only the case of a uniform density of equally oriented particles is considered. The results are valid in first order for prolate and oblate spheroids. Spheres and disks are obtained as limiting cases.



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Theory of a Strip-Line Cavity for Measurement of Dielectric Constants and Gyromagnetic-Resonance Line-Widths

R.A. Waldron. "Theory of a Strip-Line Cavity for Measurement of Dielectric Constants and Gyromagnetic-Resonance Line-Widths." 1964 Transactions on Microwave Theory and Techniques 12.1 (Jan. 1964 [T-MTT]): 123-131.

The cavity consists of a half-wavelength or wavelength of strip-line, short-circuited at both ends, and open along the sides. For measurements of dielectric and magnetic properties of samples, it has two apparent advantages over the more usual coaxial line method: the sample is simpler in shape, and it can be inserted without dismantling the cavity. Perturbation formulas are obtained for the frequency shift and change of "Q" on inserting a sample into a position of zero electric or zero magnetic field. The "Q" of the cavity in the absence of a sample is calculated by a perturbation method. The limiting sample size for a given accuracy to be obtained is also discussed.

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On the Synthesis of Dual-Resonant Coaxial Cavities

F.M. Waltz. "On the Synthesis of Dual-Resonant Coaxial Cavities." 1964 Transactions on Microwave Theory and Techniques 12.1 (Jan. 1964 [T-MTT]): 132-138.

Mathematical analyses of multisection coaxial cavities predict the possibility of shifting one of the spurious resonant frequencies (present in all coaxial cavities) to a desired frequency, thus allowing one cavity to do the work of two. The specific problem considered in this paper is the design of cavities to resonate a terminating capacitance (e.g., tube capacitance, "varactor" capacitance) at two harmonically-related frequencies, with the additional requirement that the two frequencies remain very nearly in the desired ratio despite wide variations in the magnitude of the terminating capacitance. (As one obvious application, a cavity meeting these requirements would make possible an inherently-aligned single-cavity frequency multiplier.) Curves based on computed results for specific cases are presented. Experimental cavities constructed according to the predicted designs have exhibited performance which is in very close agreement with the analysis, thus verifying both the validity of the method of analysis and the feasibility of the desired result. Application of the same techniques to other and more general problems (e.g., single-cavity mixers, voltage-tunable filters) are suggested.

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Noise Performance of Traveling-Wave Masers (Correspondence)

W.H. Higa. "Noise Performance of Traveling-Wave Masers (Correspondence)." 1964 Transactions on Microwave Theory and Techniques 12.1 (Jan. 1964 [T-MTT]): 139-139.

In this communication, a review of the noise performance of traveling-wave masers (TWM) is given. It is shown in particular that when the gain per unit length of structure is low, the equivalent noise temperature of the TWM can become appreciable.

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Millimeter Frequency Multiplication with an In-Line Harmonic Generator (Correspondence)

E.G. Wessel and R.J. Strain. "Millimeter Frequency Multiplication with an In-Line Harmonic Generator (Correspondence)." 1964 Transactions on Microwave Theory and Techniques 12.1 (Jan. 1964 [T-MTT]): 139-141.

When building a crystal frequency multiplier to generate harmonics in the millimeter region, one may improve conversion efficiencies by one of two basic techniques: selecting an improved nonlinear junction, or improving the physical and electrical environment of that junction. This communication will describe an in-line frequency multiplier designed to facilitate changing semiconductors and whiskers to evaluate their efficacy in generating the third and fourth harmonics of a 22-Gc drive signal. In addition, the test results on several different semiconductors will be presented.

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Abstracts

TM and TE Mode Surface Waves on Grounded, Anisotropic, Inhomogeneous, Lossless, Dielectric Slabs (Correspondence)

D.A. Holmes. "TM and TE Mode Surface Waves on Grounded, Anisotropic, Inhomogeneous, Lossless, Dielectric Slabs (Correspondence)." 1964 Transactions on Microwave Theory and Techniques 12.1 (Jan. 1964 [T-MTT]): 141-141.

J.H. Richmond has given the WKB solutions for the field distribution of surface waves on inhomogeneous, isotropic, plane layers. It is the purpose of this letter to extend his work to include a simple anisotropy in the dielectric constant by considering a diagonalized relative permittivity tensor with components ϵ_{xx} , ϵ_{yy} , and ϵ_{zz} . The geometry is the same as before except that a perfectly conducting plane is now positioned at $x = 0$. For easy reference we have used the same notation as Richmond, except where specified otherwise. Compactness in notation has been achieved by expressing the integrations from 0 to x and by considering the x variations outside the slab to be $\exp\{\alpha(x-\alpha)\}$.



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Application of Corner Mirrors for Ultramicrowave Interferometers (Correspondence)

M. Kloza. "Application of Corner Mirrors for Ultramicrowave Interferometers (Correspondence)." 1964 Transactions on Microwave Theory and Techniques 12.1 (Jan. 1964 [T-MTT]): 141-142.

The Michelson type and Fabry-Perot type interferometers are often used in the field of ultramicrowaves; the latter replace conventional cavity resonators in the millimeter and submillimeter wave range.



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High-Order Varactor Multipliers (Correspondence)

S. Rossen and W. Engle. "High-Order Varactor Multipliers (Correspondence)." 1964 Transactions on Microwave Theory and Techniques 12.1 (Jan. 1964 [T-MTT]): 142-143.

The following correspondence is a report of the experimental results that have been obtained with a single-varactor-diode frequency multiplier. This circuit is a times sixteen (X 16) single-stage varactor multiplier operating from 350 to 5600 Mc. The high efficiencies predicted theoretically for single-stage, high-order varactor multipliers are now being achieved with these practical circuits. They should have wide application in microwave systems where reliability and size are major considerations.



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Application of a Fast Microwave Switch to High-Peak-Power Plasma Diagnostic Experiments (Correspondence)

H. Goldie and L. Lapson. "Application of a Fast Microwave Switch to High-Peak-Power Plasma Diagnostic Experiments (Correspondence)." 1964 Transactions on Microwave Theory and Techniques 12.1 (Jan. 1964 [T-MTT]): 143-144.

The purpose of this communication is to report a unique method which eliminates difficulties encountered when observing a microwave pulse of high energy transmitted through a plasma. It has become increasingly important to observe the characteristics of low-pressure plasmas being irradiated with high power microwave pulses. Knowing the time dependency of electron density during the time in which the high power pulse is irradiating, the plasma gives an insight into recombination, diffusion, degree of ionization, etc.



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Dominant Mode Propagation in Ge and Si with Carrier Density Decaying Exponentially in Time (Correspondence)

D.A. Holmes and D.L. Feucht. "Dominant Mode Propagation in Ge and Si with Carrier Density Decaying Exponentially in Time (Correspondence)." 1964 Transactions on Microwave Theory and Techniques 12.1 (Jan. 1964 [T-MTT]): 144-145.

Nag and Das have recently made a theoretical study of microwave propagation in a semiconductor-filled rectangular waveguide when the semiconductor has a time dependent carrier density. They have assumed epsilon and sigma to be time dependent in the wave equation for the TE/sub 01/ mode wave and obtained a solution for the electric field E/sub x/ by perturbation techniques for small changes in carrier density. An equivalent propagation constant can be obtained for Germanium and Silicon by solving the wave equation for E/sub x/, assuming no time variations in epsilon and sigma, and then later inserting their dependence. This is an implicit physical assumption is an earlier work of Jacobs, et al.



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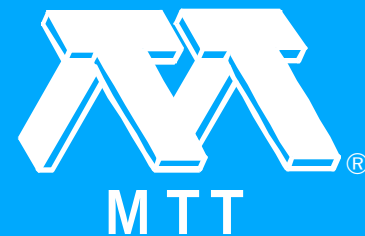
Abstracts

Letter to the Editor (Correspondence)

B.O. Weinschel. "Letter to the Editor (Correspondence)." 1964 Transactions on Microwave Theory and Techniques 12.1 (Jan. 1964 [T-MTT]): 145-145.

The following paper is felt to be of interest to workers in the microwave measurements field:

B. E. Rabinovich, "Method free from mismatching errors for measuring the loss of attenuators," *Izmeritel'naya Tekhnika*, no. 3, pp. 44-47; March, 1962.



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Abstracts

A Simple Relation Between Cavity Q and Maximum Rejection for Narrow-Band Microwave Band-Stop Filters (Correspondence)

P.D. Lubell. "A Simple Relation Between Cavity Q and Maximum Rejection for Narrow-Band Microwave Band-Stop Filters (Correspondence)." 1964 Transactions on Microwave Theory and Techniques 12.1 (Jan. 1964 [T-MTT]): 145-145.

In the course of designing band reject filters, one must often determine the unloaded cavity $Q(Q_{\text{sub } u})$ required to achieve a predetermined maximum rejection. This situation is analogous to that of determining the $Q_{\text{sub } u}$ required to give a specific midband loss (due to dissipation) in bandpass filters.



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A Simple Technique for the Generation of Short Rectangular RF Pulses from a CW Source (Correspondence)

R.V. Row. "A Simple Technique for the Generation of Short Rectangular RF Pulses from a CW Source (Correspondence)." 1964 Transactions on Microwave Theory and Techniques 12.1 (Jan. 1964 [T-MTT]): 146-146.

A gated traveling wave amplifier or klystron amplifier can be used to produce pulses from an essentially CW source. In the case of the TWT amplifier, rise times as short as a few millimicroseconds have been observed. This communication points out how millimicrosecond RF pulses have been produced using an inexpensive mercury contact switch installed in the center conductor of a coaxial line. The first use of a mercury contact switch for discharging a transmission line to generate rectangular dc pulses was reported by Garwin. Such pulsers based on this switch are now commercially available. With an appropriate transmission line configuration using the switch in the center conductor, RF pulses can be generated from a CW source. With reference to Fig. 1, the switching element from a Western Electric 276 mercury contact relay was removed and installed in the 3/8-inch center conductor of a 50-ohm rigid transmission line. The active element of the switch is caused to move from one set of contacts to the other by a 60 cycle magnetic field. Fig. 2 shows the complete assembly.



Abstracts

Propagation on Modulated Corrugated Rod (Correspondence)

*S.J. Blank and A. Hessel. "Propagation on Modulated Corrugated Rod (Correspondence)."
1964 Transactions on Microwave Theory and Techniques 12.1 (Jan. 1964 [T-MTT]): 146-147.*

In reviewing the literature on the subject of modulated surface wave antennas, we came across the paper "Propagation on Modulated Corrugated Rods" by C. C. Wang and E. T. Kornhauser in which the authors study, both theoretically and experimentally, slow-wave propagation on modulated corrugated rod structures excited in the circularly symmetric TM mode.



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H. Bosma, M.D. Coleman, J.J. Cotter, E.G. Cristal, L.E. Davis, W.J. Getsinger, M. Gilden, R.A. Hayami, R.C.C. Leite, B.C. De Loach, Jr., J.H. Lepoff, G.L. Matthaei, G.H. Mongold, J.B. Payne, III, J.J. Pergola, R.I. Primich, F.C. de Ronde, B.M. Schiffman, P.H. Smith, C.T. Tai, R.A. Waldron, F.M. Waltz, R.J. Wenzel and G.J. Wheeler. "Contributors (Jan. 1964 [T-MTT])." 1964 Transactions on Microwave Theory and Techniques 12.1 (Jan. 1964 [T-MTT]): 148-150.



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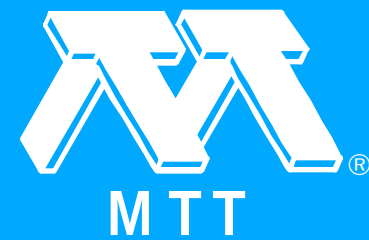
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Call for Papers - 1964 Conference in Tokyo (Jan. 1964 [T-MTT])

"Call for Papers - 1964 Conference in Tokyo (Jan. 1964 [T-MTT])." 1964 Transactions on Microwave Theory and Techniques 12.1 (Jan. 1964 [T-MTT]): 151-151.



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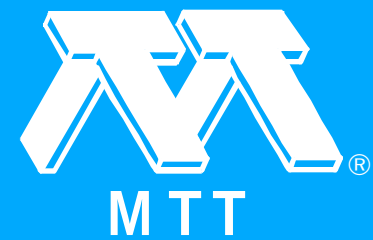
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Abstracts

Propagation in Rectangular Waveguide Containing Inhomogeneous, Anisotropic Dielectric

D.A. Holmes. "Propagation in Rectangular Waveguide Containing Inhomogeneous, Anisotropic Dielectric." 1964 Transactions on Microwave Theory and Techniques 12.2 (Mar. 1964 [T-MTT]): 152-155.

The Wentzel, Kramers and Brillouin (WKB) approximation is used to solve the wave equations for propagation of guided waves in rectangular waveguide containing an inhomogeneous dielectric. The simplest form of anisotropy is used to characterize the relative dielectric constant, i.e., it is assumed that the relative permittivity tensor is diagonalized with respect to the waveguide coordinants. Each of the elements of the relative permittivity tensor is allowed to vary continuously across the broad dimension of the waveguide. The TE/sub nm/ and TM/sub nm/ cases are analyzed for the instance of completely filled guide, while the TE/sub no/ modes are considered for slab-loaded guide.



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Thin-Film Waveguide Bolometers for Multimode Power Measurement

B.M. Schiffman, L. Young and R.B. Larrick. "Thin-Film Waveguide Bolometers for Multimode Power Measurement." 1964 Transactions on Microwave Theory and Techniques 12.2 (Mar. 1964 [T-MTT]): 155-163.

Thin-film bolometers have been developed for measuring the total (unwanted) power that could be transmitted in any or all possible modes and at many frequencies above the normal operating band. The bolometer is a thin metal film which is placed so that it intercepts all the power flowing down the waveguide. When the power in the fundamental frequency is filtered out and only power at higher frequencies remains in the waveguide containing the bolometer, then it can be used to measure the total spurious power emitted by a high-power transmitter above its fundamental frequency band. Measurements have been made up to 15 Gc in S-band waveguide. A variety of materials and shapes were tested and the bolometers were shown to be capable of measuring equally well several different modes and frequencies separately and in combination.

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Five Layer Optical Maser Amplification

H. Jacobs, D. Holmes, F.A. Brand and L. Hatkin. "Five Layer Optical Maser Amplification." 1964 Transactions on Microwave Theory and Techniques 12.2 (Mar. 1964 [T-MTT]): 163-170.

The optical maser is treated in the manner of a Fabry-Perot resonator with an active medium. Five layers are considered: air, reflector, active medium (ruby), reflector, and air. General equations are derived using the method of boundary value problems in which it is assumed that incident coherent radiation falls normally on the surface. It is suggested that the presence of lossless one-quarter wavelength reflectors will enhance the amplification of the device in that less pumping may be required for a given length of ruby. The role of the reflectors in oscillation conditions is shown to be of importance. Methods are indicated for the calculation of amplitude and phase for an idealized amplifier.

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Dielectric-Lined Circular Waveguide with Increased Usable Bandwidth

P.J. Meier and H.A. Wheeler. "Dielectric-Lined Circular Waveguide with Increased Usable Bandwidth." 1964 Transactions on Microwave Theory and Techniques 12.2 (Mar. 1964 [T-MTT]): 171-175.

This report describes how the useful (single-mode) bandwidth of circular waveguide can be significantly increased by using a smaller diameter with dielectric lining. The increased bandwidth results from an increase in the ratio of the cutoff frequency of the second, or TM-01, mode over that of the dominant, or TE-11 mode. A cavity test is described which permits the measurement of mode separation for any thickness of dielectric lining. A lining with a dielectric constant in the vicinity of 4 appears to be near optimum for maximum single-mode bandwidth. For a dielectric constant of 3.8 (fused silica), the greatest mode separation is obtained if the dielectric cross section has about 0.44 of the area of the entire cross section, in which case the useful bandwidth is about doubled (perhaps increased from 8 to 16 per cent, if the entire band is to clear the TE-11 cutoff frequency by 20 per cent). Over the useful bandwidth of such a waveguide, the guide wavelength may be calculated approximately by the simple waveguide formula in terms of the equivalent dielectric constant, as determined by the cavity measurement. Applications which would benefit from increased dominant-mode bandwidth in circular waveguide include rotary joints carrying circular polarization, rotary attenuators and phase shifters, and array radiators.

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Conditions of Oscillation for Waveguide Mounted Tunnel Diodes

C.C. Hoffins and K. Ishii. "Conditions of Oscillation for Waveguide Mounted Tunnel Diodes." 1964 Transactions on Microwave Theory and Techniques 12.2 (Mar. 1964 [T-MTT]): 176-183.

Double frequency oscillation was observed in a waveguide mounted tunnel diode circuit, due to the frequency dependency of the waveguide's distributed parameters. A general analysis of the frequency dependent diode load is made and conditions of oscillation are formulated. The analysis is extended to a 1N3219A diode mounted in a tapered RG-52/U waveguide used as an oscillator. The load impedance to the tunnel diode is derived with the diode mounted at the center of the waveguide. A numerical example involving the RG-52/U waveguide mount is presented verifying the existence of double frequency oscillation and exemplifying the oscillation conditions stated. Off center diode mounting is examined. It is concluded that the waveguide mount's distributed parameters are highly frequency dependent at the center of the guide and thus double frequency oscillation can exist when a tunnel diode is mounted at that point. With the diode mounted at any other point, only one oscillation frequency can be observed. The frequencies of oscillation of a waveguide mounted tunnel diode oscillator are determined only by the real roots of the resistive component of the total tunnel diode load impedance.

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Matrix Description of Waveguide Discontinuities in the Presence of Evanescent Modes

H. Haskal. "Matrix Description of Waveguide Discontinuities in the Presence of Evanescent Modes." 1964 Transactions on Microwave Theory and Techniques 12.2 (Mar. 1964 [T-MTT]): 184-188.

The properties of the impedance and scattering matrix describing waveguide discontinuities are examined; both propagating and evanescent modes are considered. It is shown how different normalization conditions for the normal mode solutions in the guide affect the impedance matrix. A suitable choice of normalization always leads to a symmetric imaginary impedance matrix for a lossless structure. The scattering matrix is no longer symmetric or unitary. The simple relationship $S = (Z - U)(Z + U)^{-1}$ is shown to hold only under special normalization conditions. Next the matrices describing a plane of lossless obstacles arranged in a periodic array are examined. A different type of normalization condition must be used here, since the normal modes are orthogonal in the conjugate sense (biorthogonal). Although the structure is reciprocal, none of the matrices is symmetric. A suitable normalization leads to a skew-hermitian impedance matrix and to a unitary submatrix of the scattering matrix corresponding to propagating modes.

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Surface Waves on Plasma-Clad Metal Rods

T. Tamir and S. Palocz. "Surface Waves on Plasma-Clad Metal Rods." 1964 Transactions on Microwave Theory and Techniques 12.2 (Mar. 1964 [T-MTT]): 189-196.

Surface waves guided along a metal rod which is surrounded by a concentric isotropic plasma sheath are investigated for both the principal and the higher modes by employing a rigorous formulation. It is shown that all these modes exhibit a high frequency cutoff phenomenon; the two first modes propagate down to dc, whereas all the other modes possess a finite low frequency cut off and thus exhibit band-pass characteristics. Backward wave propagation is shown to exist when the plasma sheath is thin; dispersion curves are calculated and compared with previous data obtained by means of quasi-static approximations whose limitations and inaccuracies are also indicated. All the results are derived for the plasmaclad rod being placed either in free space or in a dielectric medium, and the dispersion features for both situations are represented in terms of universal curves.

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Experiments with the Forbidden Regions of Open Periodic Structures: Application to Absorptive Filters

C.K. Birdsall and R.M. White. "Experiments with the Forbidden Regions of Open Periodic Structures: Application to Absorptive Filters." 1964 Transactions on Microwave Theory and Techniques 12.2 (Mar. 1964 [T-MTT]): 197-202.

Experiments with open periodic structures are presented which show a large change in transmission at the transition from allowed to forbidden regions. At the boundaries of the forbidden regions, the radial distribution of the fields of a wave impressed upon the structure changes from one corresponding to slow-wave propagation to a field distribution corresponding to radiation. At these boundaries, the local field shapes do not change very much. However, at the boundary a large decrease in transmission through the structure is found, but with little change in input VSWR; this implies a change from real characteristic impedance to about the same value of radiation resistance. This behavior suggests applications to sharp cutoff absorptive filters.



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On the Correlation Radiometer Technique

K. Fujimoto. "On the Correlation Radiometer Technique." 1964 Transactions on Microwave Theory and Techniques 12.2 (Mar. 1964 [T-MTT]): 203-212.

The correlation radiometer is a system in which two antenna-receiver systems are employed, the outputs of the two systems being correlated electronically. This paper studies the two basic types of correlation radiometers, the intermediate-frequency correlation (IF) type and the video-frequency correlation (ENV) type. The SNR's, the minimum detectable temperature sensitivities, the effects of receiver gain and phase fluctuations and the uses of the two types are studied. A comparison of the various characteristics of the two types of correlation radiometers with the same characteristics of the Dicke-type radiometer is made.

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Some Aspects of Beam Waveguides for Long Distance Transmission at Optical Frequencies

G. Goubau and J.R. Christian. "Some Aspects of Beam Waveguides for Long Distance Transmission at Optical Frequencies." 1964 Transactions on Microwave Theory and Techniques 12.2 (Mar. 1964 [T-MTT]): 212-220.

Two types of beam waveguides are discussed in this paper, the iris-type and the lens-type. Both appear applicable to guided long distance transmission of light with theoretical losses of less than 1 db/km. However, there are problems concerning their practicability which require experimental investigation. Such problems are the alignment of the irises or the lenses, the effects of turbulence and stratification of air along the light path, and the required tolerance in the construction of the lenses. Since the lens-type guide offers a simple possibility for compensating misalignments, an experimental waveguide of this type has been constructed, having a length of approximately 1 km and comprising 10 iterations. The light path is enclosed by a 4 inch aluminum pipe which is supported within a 6 inch aluminum pipe. The first series of experiments which is reported in this paper indicated that there are no serious alignment problems. However, it was found that the effects of turbulence and air stratification are usually very severe and it appears necessary to provide an evacuated light path to obtain constant transmission conditions. It was also found that the available lenses add considerably higher iteration loss than expected. This increased loss was primarily caused by inadequate surface coating. A theoretical study of beam propagation in a misaligned lens-type guide is included in the Appendix.

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Observation of Nanosecond Carrier Pulses

K. Miyauchi. "Observation of Nanosecond Carrier Pulses." 1964 Transactions on Microwave Theory and Techniques 12.2 (Mar. 1964 [T-MTT]): 221-230.

The present paper describes theory and experiments on the observation of nanosecond carrier pulses in the microwave region. The advancement of microwave nanosecond techniques requires measurement of waveforms which is more accurate than conventional methods. The measuring method described here was developed to satisfy this requirement. The new method, using a synchronous or heterodyne detector, gives accurate and complete information on nanosecond pulse waveforms in the microwave region. Applying this method, we constructed an experimental system to generate and observe the nanosecond pulses in the 11-Gc region. The over-all rise and fall time and delay resolution of this system are as small as 0.5 nsec. Pulse modulators, detectors and filters were measured or adjusted with this experimental system. The experimental results are described in this paper. The pulse generation and observation system developed here is expected to be useful for measuring and adjusting microwave nanosecond pulse devices with accuracy.



Coupling Holes Between Resonant Cavities or Wave-Guides Evaluated in Terms of Volume Ratios

H.A. Wheeler. "Coupling Holes Between Resonant Cavities or Wave-Guides Evaluated in Terms of Volume Ratios." 1964 Transactions on Microwave Theory and Techniques 12.2 (Mar. 1964 [T-MTT]): 231-244.

A hole in a common wall is used to provide coupling between two resonant cavities (k =coefficient of coupling) or between two waveguides (x or b =normalized reactance or susceptance) or between cavity and waveguide (p =loading power factor of cavity). Referring to either side of a thin common wall, the field intensity in the center of a small hole is $\frac{1}{2}$ what it would have been at that location on the wall. Between two equal regions, the coupling (k , x or b) by magnetic or electric field is expressed as $\frac{1}{4}$ the ratio of the effective volume of the hole over the effective volume of each region, by duality (Booker's principle), the effective volume (related to the polarizability) of an aperture in a thin wall is identified with that of an analogous thin body in a uniform field. For a resonant cavity loaded by coupling to a waveguide, the loading power factor is $p=kx$; this theorem is proved by reference to an equivalent network. Various cases of coupling by two-dimensional and three-dimensional fields are formulated in terms of area or volume ratios, especially between pillbox resonators (rectangular, circular, or coaxial-circular) and between rectangular waveguides with common side walls or top and bottom walls. The effective area or volume of a small hole in a thin conducting wall is given for various symmetrical shapes, in a magnetic or electric field.



Abstracts

The Cutoff Characteristics of the Channel Waveguide (Correspondence)

J.P. Roth and K. Ishii. "The Cutoff Characteristics of the Channel Waveguide (Correspondence)." 1964 Transactions on Microwave Theory and Techniques 12.2 (Mar. 1964 [T-MTT]): 245-247.

In order to increase the power-handling capacity of a TE/sub 10/ mode rectangular waveguide, the channel waveguide as shown in Fig. 1 was proposed. To the authors' knowledge, the application of channel waveguides for this purpose is not yet known in the United States, although in a paper by Iashikin received on September 26, 1956 by the A. S. Popov Technical Society of Radio Engineering and Telecommunications U.S.S.R., the author states that channel waveguides "are widely used at present."



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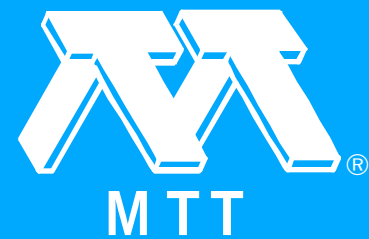
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A Coaxial Adjustable Sliding Termination (Correspondence)

W.E. Little and J.P. Wakefield. "A Coaxial Adjustable Sliding Termination (Correspondence)." 1964 Transactions on Microwave Theory and Techniques 12.2 (Mar. 1964 [T-MTT]): 247-248.

The accuracy of impedance measurements using modified reflectometer techniques depends mainly upon the tuning of the reflectometer. This tuning is accomplished by sliding first a low-reflection termination and, then, a high-reflection termination (sliding short circuit) in the output waveguide of the reflectometer. The actual error that can occur due to imperfect tuning can be computed and depends to a large extent upon the size of the reflection coefficient of the low-reflection sliding termination. The lower this reflection coefficient is, the smaller the error will be. The adjustable sliding termination described in this paper was developed to reduce this reflectometer tuning error hence, the main emphasis was on obtaining a stable, very low-reflection coefficient.

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Abstracts

Approximate Method of Determining the Cutoff Frequencies of Waveguides of Arbitrary Cross Section (Correspondence)

M. Chi and P.A. Laura. "Approximate Method of Determining the Cutoff Frequencies of Waveguides of Arbitrary Cross Section (Correspondence)." 1964 Transactions on Microwave Theory and Techniques 12.2 (Mar. 1964 [T-MTT]): 248-249.

Electromagnetic propagation in a long, prismatic waveguide obeys the scalar Helmholtz equation.



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Abstracts

Design Problems and Performance of Millimeter-Wave Fabry-Perot Reflector Plates (Correspondence)

H. Welling and H.G. Andresen. "Design Problems and Performance of Millimeter-Wave Fabry-Perot Reflector Plates (Correspondence)." 1964 Transactions on Microwave Theory and Techniques 12.2 (Mar. 1964 [T-MTT]): 249-250.

The parallel plate Fabry-Perot interferometer and its application have been described by several authors. It is particularly useful as a resonator for which a very high Q value and excellent transmission are required.



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Abstracts

A Differential Microwave Phase Shifter (Correspondence)

R.W. Beatty. "A Differential Microwave Phase Shifter (Correspondence)." 1964 Transactions on Microwave Theory and Techniques 12.2 (Mar. 1964 [T-MTT]): 250-251.

It is well known that a standard phase shifter can be constructed by combining a short-circuited section of uniform waveguide and a tuned, single directional coupler type of reflectometer, as shown in Fig. 1. In operation, the phase of the side arm output tracks the position of the short-circuiting plunger, once the tuning adjustments have been correctly made.



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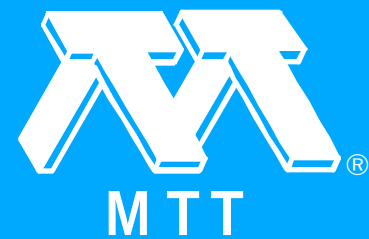
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An Extension of the TE/sub 01n/ Resonator Method of Making Measurements on Solid Dielectrics (Correspondence)

D.T. Paris. "An Extension of the TE/sub 01n/ Resonator Method of Making Measurements on Solid Dielectrics (Correspondence)." 1964 Transactions on Microwave Theory and Techniques 12.2 (Mar. 1964 [T-MTT]): 251-252.

Dielectric measurements using cylindrical cavities resonating in the TE/sub 01n/ mode are discussed by several authors. The cavity is physically arranged as illustrated in Fig. 1, and the dielectric properties of the specimen are determined from three experimentally observed variables: the resonant frequency, the phase shift constant of the empty resonator and the Q of the cavity. The dielectric constant and loss tangent of the specimen are then calculated using formulas which are strictly valid only if the losses of the sample-filled cavity are very small.

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Abstracts

Bounds on the Elements of the Susceptance Matrix for Asymmetrical Obstacles in Waveguides (Correspondence)

K. Kalikstein and B. Schuldiner. "Bounds on the Elements of the Susceptance Matrix for Asymmetrical Obstacles in Waveguides (Correspondence)." 1964 Transactions on Microwave Theory and Techniques 12.2 (Mar. 1964 [T-MTT]): 252-253.

There exists a method for the determination of upper and lower bounds on the elements of the reactance matrix B , or the equivalent network elements, for multi-channel scattering. This technique was applied to specific examples of lossless obstacles in a rectangular waveguide, which are symmetric with respect to some plane perpendicular to the axis of the waveguide. The problem was analyzed in terms of uncoupled even and odd standing waves.



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Note on Tabulations of Constants for Rigid Hollow Metal Rectangular Waveguide (Correspondence)

M.M. Brady. "Note on Tabulations of Constants for Rigid Hollow Metal Rectangular Waveguide (Correspondence)." 1964 Transactions on Microwave Theory and Techniques 12.2 (Mar. 1964 [T-MTT]): 253-254.

Precise four decimal place tables of freespace and waveguide wavelength and related ratios for rigid hollow metal rectangular waveguides were computed by the Sperry Microwave Electronics Company and published in this journal in 1956. This set of tables was later extended to cover 28 American waveguide sizes and appeared in a handbook. Booth has published a set of microwave data tables including waveguide wavelength to three decimal places for ten commonly used British rectangular waveguide sizes.



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The Use of the Rayleigh-Ritz Method in Nonself-Adjoint Problems (Correspondence)

S. Kaplan and S.P. Morgan. "The Use of the Rayleigh-Ritz Method in Nonself-Adjoint Problems (Correspondence)." 1964 Transactions on Microwave Theory and Techniques 12.2 (Mar. 1964 [T-MTT]): 254-255.

This communication is a comment on the very interesting paper by S. P. Morgan in the May issue of these Transactions. It may be of interest to point out that problems similar to those discussed by Morgan arise in nuclear reactor theory. Here the operators are not, as in footnote, complex symmetric integral operators but they are nonselfadjoint, and there is considerable interest in finding their eigenvalues and eigenvectors by Rayleigh-Ritz methods. Morgan is correct, of course, in pointing out that the usual maximum and minimum criteria are lacking in these cases and that there are no bounds or error estimates. However the conclusion that it is impossible to use the methods may be overly pessimistic. The methods have been used in reactor theory with considerable success (measured by comparison with exact solutions), and this fact gives hope that they may be useful in laser applications.

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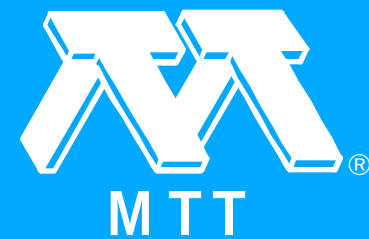


Abstracts

Broadband Microwave Discriminator (Comments)

S.J. Robinson. "Broadband Microwave Discriminator (Comments)." 1964 Transactions on Microwave Theory and Techniques 12.2 (Mar. 1964 [T-MTT]): 255-256.

The frequency discriminator described by R. J. Mohr is capable of a simple extension to give a device with important advantages and many practical applications.



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Harmonic Generation by an Array (Correspondence)

D.D. King, F. Sobel and J.W. Dozier. "Harmonic Generation by an Array (Correspondence)." 1964 Transactions on Microwave Theory and Techniques 12.2 (Mar. 1964 [T-MTT]): 256-256.

In the millimeter region, harmonic generators have long served as convenient signal sources. However, the power handling capacity of the diode elements is very limited. At the short-wave end of the millimeter spectrum, the dominant mode waveguide terminal of a harmonic generator may also be less desirable than a quasi-optical or beam output. These factors have led to the investigation of a diode array as a millimeter wave source. The results obtained show that such an array is feasible but uneconomic with presently available diodes.

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Analogous Propagation Modes in Inhomogenous Plasma and Tapered Waveguide (Correspondence)

H. Lashinsky. "Analogous Propagation Modes in Inhomogenous Plasma and Tapered Waveguide (Correspondence)." 1964 Transactions on Microwave Theory and Techniques 12.2 (Mar. 1964 [T-MTT]): 256-258.

An interesting analogy exists between the propagation of transverse electromagnetic (TE) waves in a plasma (with no magnetic field) and in conventional waveguide. This analogy reflects the similar roles played by the volume conduction current in the plasma and the wall conduction current in the waveguide and is of interest in that it provides insight into plasma propagation and suggests the possibility of simulating certain microwave properties of inhomogeneous plasma by means of appropriate waveguide configurations.

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Abstracts

The Diffraction Loss Curve for Nonconfocal Spherical Mirrors (Correspondence)

T. Omori. "The Diffraction Loss Curve for Nonconfocal Spherical Mirrors (Correspondence)." 1964 Transactions on Microwave Theory and Techniques 12.2 (Mar. 1964 [T-MTT]): 258-258.

The diffraction loss curve vs Fresnel number for confocal spherical mirrors was shown by Fox and Li and by Goubau and Schwering. Boyd and Gordon suggested a possibility of applying the above theory to a nonconfocal mirror system, by assuming the diffraction loss to be equal to that of an equivalent confocal system having the same spot size.



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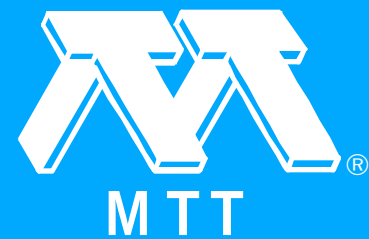
Semiconductor Switching and Limiting Using 3-db Short-Slot (Hybrid) Couplers (Correspondence)

V.J. Higgins. "Semiconductor Switching and Limiting Using 3-db Short-Slot (Hybrid) Couplers (Correspondence)." 1964 Transactions on Microwave Theory and Techniques 12.2 (Mar. 1964 [T-MTT]): 258-259.

The silver-bonded germanium varactor diode has been successfully used as a switch and a limiter of microwave power when Operated in a series mode between 9.0 and 9.6 Gc. This report gives details of shunt mode switching and limiting using these same type diodes in conjunction with 3-db short-slot (hybrid) couplers. The technique of using 3-db short-slot (hybrid) couplers, but with other type diodes (e.g., 1N263, MA-450, PIN's), has been reported by other investigators.

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A Note on N-Way Hybrid Power Dividers (Correspondence)

J.J. Taub and B. Fitzgerald. "A Note on N-Way Hybrid Power Dividers (Correspondence)." 1964 Transactions on Microwave Theory and Techniques 12.2 (Mar. 1964 [T-MTT]): 260-261.

An N-way hybrid power divider having excellent isolation between ports was described by Wilkenson and subsequently by Peterson. The equivalent network is shown Fig. 1. Wilkenson and Peterson determined the values of transmission-line impedances and resistances at midband for conditions of input match and perfect isolation. The theoretical performance of this device at other frequencies was not given. This communication analyzes the isolation and the input SWR as a function of frequency.

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Abstracts

Contributors (Mar. 1964 [T-MTT])

C.K. Birdsall, F.A. Brand, J.R. Christian, K. Fujimoto, G. Goubau, H. Haskal, L. Hatkin, C.C. Hoffins, D.A. Holmes, K. Ishii, H. Jacobs, R.B. Larrick, P.J. Meier, K. Miyauchi, S. Palocz, B.M. Schiffman, T. Tamir, H.A. Wheeler, R.M. White and L. Young. "Contributors (Mar. 1964 [T-MTT])." 1964 Transactions on Microwave Theory and Techniques 12.2 (Mar. 1964 [T-MTT]): 262-264.



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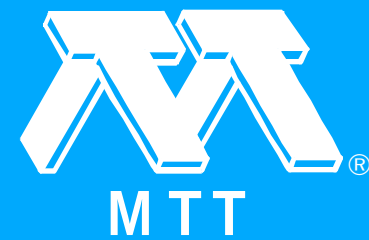
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1964 PTGMTT International Symposium (Mar. 1964 [T-MTT])

"1964 PTGMTT International Symposium (Mar. 1964 [T-MTT])." 1964 Transactions on Microwave Theory and Techniques 12.2 (Mar. 1964 [T-MTT]): 265-271.



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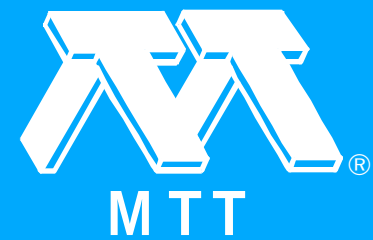
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Table of Contents (May 1964 [T-MTT])

"Table of Contents (May 1964 [T-MTT])." 1964 Transactions on Microwave Theory and Techniques 12.3 (May 1964 [T-MTT]): 273-273.



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Abstracts

Editorial (May 1964 [T-MTT])

R.W. Beatty. "Editorial (May 1964 [T-MTT])." 1964 Transactions on Microwave Theory and Techniques 12.3 (May 1964 [T-MTT]): 274-274.

It is natural to pause, after a year as editor of these transactions, and to try to sum up what has happened, note any trends that seem to be indicated, and make some guess as to the future. In some cases, an observation time of one year is not sufficient to determine a trend. For example, the growth of the transactions as noted by the previous editor, D. D. King, in January 1963, seems to have leveled off, if one compares the 563 pages of 1963 to the 624 pages of 1962. However, a similar drop occurred in 1961 with 596 pages compared with 692 for 1960.



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Abstracts

Tables for Asymmetric Multi-Element Coupled-Transmission-Line Directional Couplers

R. Levy. "Tables for Asymmetric Multi-Element Coupled-Transmission-Line Directional Couplers." 1964 Transactions on Microwave Theory and Techniques 12.3 (May 1964 [T-MTT]): 275-279.

Tables are presented for the design of TEM-mode asymmetric multi-element coupled-transmission-line directional couplers, having a very broad-band Chebyshev equal-ripple coupling response. Coupler designs of 2 to 6 elements having bandwidths up to 20:1 and mean couplings of 3, 6, 10, 15 and 20 db are tabulated.



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Abstracts

Transmission-Line Properties of Parallel Wide Strips by a Conformal-Mapping Approximation

H.A. Wheeler. "Transmission-Line Properties of Parallel Wide Strips by a Conformal-Mapping Approximation." 1964 Transactions on Microwave Theory and Techniques 12.3 (May 1964 [T-MTT]): 280-289.

A transmission line is made of a symmetrical pair of strip conductors, face-to-face, or a single strip parallel to a ground plane. The strip width is nominally greater than the separation, but may be somewhat less than the separation. The field configuration is evaluated by a conformal mapping procedure which gives a very close approximation in terms of ordinary functions (exponential and hyperbolic) rather than the exact solution in terms of difficult functions (elliptic). Computation procedures are given for synthesis or analysis, the former following more naturally from the derivation. For the transitional case of strip width equal to separation, the mapping approximation is found to leave a relative error of the order of 10^{-8} , in the wave resistance or shape ratio. Simple, explicit, practical formulas are developed for practical use with slide-rule accuracy. Emphasis is placed on establishing and specifying the residual error of each formula.



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Realizable Limits of Error for Dissipationless Attenuators in Mismatched Systems

D.C. Youla and P.M. Paterno. "Realizable Limits of Error for Dissipationless Attenuators in Mismatched Systems." 1964 Transactions on Microwave Theory and Techniques 12.3 (May 1964 [T-MTT]): 289-299.

A tutorial exposition for the exact physical error limits due to mismatch for dissipationless attenuators is presented. The results given yield smaller errors than previous existing formulas due to the inclusion of the physical realizability constraint of passivity. Graphs are included for rapidly determining the largest error for a prescribed set of conditions. This work is based on an analysis prepared by D. C. Youla which had a limited circulation.



Nonuniform Waveguide High-Pass Filters with Extremely Steep Cutoff

C.C.H. Tang. "Nonuniform Waveguide High-Pass Filters with Extremely Steep Cutoff." 1964 Transactions on Microwave Theory and Techniques 12.3 (May 1964 [T-MTT]): 300-309.

The design of a tapered waveguide high-pass filter with very steep cutoff characteristics near the cutoff frequency and very low reflections for frequencies beyond the cutoff is studied on the basis of nonuniform or inhomogeneous transmission line theory. The complex input reflection coefficient due to the presence of a section of nonuniform waveguide is obtained through a new approach by formulating the problem in terms of a pair of coupled differential equations of forward wave and reflected wave with varying propagation constants and nonuniform coupling coefficients. The solution of the reflection coefficient appears in the form of an infinite series of integrals and can be reduced, for the case of very gentle tapering to the simple form of fourier integral previously obtained by others. The general solution thus obtained is valid even if 1) the tapering along the waveguide is not gradual, and 2) the tapered section is terminated in an arbitrary impedance. It is shown that among many illustrated simple trial functions of impedance variation along the taper, the exponential function raised to cosine square yields reflection characteristics with the steepest rise near the cutoff and the lowest reflections for all frequencies beyond the cutoff. The steep rise near cutoff frequency is phenomenal, since, for example, at the nominal cutoff of 55 kMc the reflection reduces to about -50 db within 0.18 kMc, i.e., the transition region from the stop band to pass band at -50 db reflection is only about 0.33 per cent of cutoff. The same design procedure for the high-pass filter can be used for waveguide transitions of extremely wide band and very low reflections.



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Matching into Band-Pass Transmission Structures

M.L. Hensel and E.O. Schulz-DuBois. "Matching into Band-Pass Transmission Structures." 1964 Transactions on Microwave Theory and Techniques 12.3 (May 1964 [T-MTT]): 309-315.

This paper describes a method for broad banding the matching transition from a low-dispersion transmission line to a high-dispersion iterated filter structure. A good match can be obtained over essentially the entire pass band of the filter structure. To accomplish this the band at the end of the structure is widened beyond both nominal cutoff frequencies. It is narrowed down to the regular structure bandwidth in a taper extending over a few filter elements. In the comb structure used for traveling wave masers, a return loss of 20 db (VSWR = 1.2) or better is realized over 90 per cent of the pass band with a taper including four comb fingers. Several examples of suitable taper designs are given. Each of these, however, requires empirical adjustment in order to produce an optimum match.

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Carrier Pulses at Microwave and Millimeter-Wave Frequencies

A.F. Dietrich and W.M. Sharpless. "Carrier Pulses at Microwave and Millimeter-Wave Frequencies." 1964 Transactions on Microwave Theory and Techniques 12.3 (May 1964 [T-MTT]): 316-322.

This paper discusses some recent experimental results obtained using special gallium arsenide point-contact diodes for the generation of phase-locked carrier pulses in the microwave and millimeter-wave bands. Several methods of generating such pulses are described. 11.2-Gc microwave phase-locked carrier pulses of about 1.0-nanosecond base duration have been generated at a 160-megabit/second rate. These microwave pulses, which are generated directly from a baseband signal, normally have peak power levels in excess of 0.5 mw. Millimeter-wave phase-locked carrier pulses have also been generated at 56 Gc. These very high frequency pulses have a base duration as short as 0.25 nanosecond and occur at a 160-megabit/second rate. Furthermore, phase-locked carrier pulses have been generated at frequencies as high as 89.6 Gc. A simple method of generating nonphase-locked 0.3-nanosecond millimeter-wave carrier pulses directly from 1.92 gigabit/second rate baseband pulses has also been investigated. The experimental arrangement used to demonstrate the "turn on" and "turn off" principle of transient carrier pulse generation is described.

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Wave Propagation in Sinusoidally Stratified Dielectric Media

T. Tamir, H.C. Wang and A.A. Oliner. "Wave Propagation in Sinusoidally Stratified Dielectric Media." 1964 Transactions on Microwave Theory and Techniques 12.3 (May 1964 [T-MTT]): 323-335.

The dispersion properties and the fields of electromagnetic waves are investigated for propagation in a stratified infinite medium. The stratification is characterized by a dielectric constant which, along one coordinate, is modulated sinusoidally about an average value. A systematic and comprehensive study is presented for the case of H modes for which the pertinent wave equation is in the form of a Mathieu differential equation. The modes and dispersion characteristics are analyzed in terms of a "stability" chart, which is customary in the study of the Mathieu equation. Results are obtained for an unbounded medium and for a waveguide filled with the modulated medium. Also, the reflection occurring at an interface between free space and a semi-infinite medium of this type is examined. In addition to these rigorous results for arbitrary values of modulation, simple analytical expressions are given for all of these cases where the modulation in the dielectric is small. It is shown that the fields are then expressible in terms of the fundamental and the two nearest space harmonics. The fields within a unit cell in the stratified medium are calculated for both small and large modulation and for frequencies up through the second pass band. It is of interest that the variation of the fields is not, in general, simply related to the variation of the dielectric constant within a cell.

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Abstracts

The Coupled-Cavity Transmission Maser-Analysis

T.R. O'Meara. "The Coupled-Cavity Transmission Maser-Analysis." 1964 Transactions on Microwave Theory and Techniques 12.3 (May 1964 [T-MTT]): 336-348.

This paper discusses an analysis of a maser amplifier structure (developed at Hughes Research Laboratories) consisting of a cascade of iris-coupled $\pi/2$ cavities intermixed with isolators. Starting from the basic media susceptibility, narrow-band equivalent networks and matrix representations are derived for maser and isolator cavities. A rational function approximation to the over-all gain function is thereby derived by matrix methods. From one viewpoint, the over-all amplifier may be regarded as a negative-resistance inverse-feedback amplifier. The key design parameter is shown to be the isolator roundtrip attenuation. Excess isolation yields an overly rounded gain-frequency characteristic, while deficient isolation yields a characteristic with excess ripple or instability in the extreme cases. The feedback effects associated with intermediate "optimum" values of isolation reduce the effective gain per cavity below the normal gain of a single cavity, but in return one obtains a reduced gain sensitivity which may be reduced to a value comparable to or lower than that of the pure traveling-wave maser.



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The Coupled-Cavity Transmission Maser-Engineering Design

F.E. Goodwin, J.E. Kiefer and G.E. Moss. "The Coupled-Cavity Transmission Maser-Engineering Design." 1964 Transactions on Microwave Theory and Techniques 12.3 (May 1964 [T-MTT]): 349-358.

The experimental design of an X-band microwave maser amplifier which uses a new type of slow-wave circuit is described. A detailed theoretical analysis of the circuit is presented in a companion paper. The slow-wave circuit consists of a cascade of iris-coupled ruby resonators separated by garnet isolators. This unit provides significant reduction in size and weight over previously reported maser slow-wave circuits. The microwave properties of the solid ruby resonator are treated in detail, and the passive bandwidth of the single transmission cavity and its relation to the iris susceptance are shown. Experimental techniques involved in obtaining and measuring precise iris susceptance are presented. A step-by-step procedure for designing an amplifier having a given gain and tuning range is also presented. Typical performance characteristics include a gain of 30 db, instantaneous bandwidth of 25 Mc and a noise temperature of 15°K. An electronic tuning range of 200 Mc has been achieved in one configuration with a 20 db gain and a 25-Mc bandwidth. The weight of the maser-dewar unit, filled with 6 liters of helium for 24 hours of operation is less than 40 pounds. The design of the dewar enables the cryogenic system to work over a wide range of vertical angles, thus facilitating the use of the maser at the feed of a large steerable antenna.



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A Low Input VSWR Coaxial Diode Switch for the UHF Band (Correspondence)

W.L. Ecklund. "A Low Input VSWR Coaxial Diode Switch for the UHF Band (Correspondence)." 1964 Transactions on Microwave Theory and Techniques 12.3 (May 1964 [T-MTT]): 359-359.

A unique SPDT coaxial diode switch has been developed at the Boulder Laboratories of the National Bureau of Standards, Boulder, Colo. By using a system of outer conductor reducers, special blocking capacitors and a series of tuning screws, an input VSWR of less than 1.07 is achieved over a broad frequency band centered at 1000 Mc. The characteristic impedance of the switch is 50 ohms, the isolation in one arm is greater than 63 db, the insertion loss is about 1.5 db, the switching time is 20 nsec and it has a power handling capability of 3 w CW.

Click on title for a complete paper.



Abstracts

Electrolytic Pointing of Fine Wires (Correspondence)

J.W. Dozier and J.D. Rodgers. "Electrolytic Pointing of Fine Wires (Correspondence)." 1964 Transactions on Microwave Theory and Techniques 12.3 (May 1964 [T-MTT]): 360-360.

In the fabrication of point contact or pulse alloyed diodes for millimeter wavelengths, junction area restrictions require wire points with radii of the order of 10^{-4} inches or less. This paper describes a device and technique for electrolytically pointing metal wires of various sizes to meet these requirements.



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Abstracts

Analogy Between a Modulated Electron Beam in a Plasma and Transmission Lines (Correspondence)

G.F. Freire. "Analogy Between a Modulated Electron Beam in a Plasma and Transmission Lines (Correspondence)." 1964 Transactions on Microwave Theory and Techniques 12.3 (May 1964 [T-MTT]): 360-361.

We shall consider a modulated electron beam passing through a plasma medium, The following assumptions shall be made in the analysis which closely follows Bloom and Peter.



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Abstracts

A Method for Measuring the Directivity of Directional Couplers (Correction)

G.E. Schafer and R.W. Beatty. "A Method for Measuring the Directivity of Directional Couplers (Correction)." 1964 Transactions on Microwave Theory and Techniques 12.3 (May 1964 [T-MTT]): 361-361.

B. C. Yates of the Radio Standards Laboratory, National Bureau of Standards, Boulder, Colo., has brought to the attention of the authors of the above paper errors in some of the equations for error limits. The authors have investigated the difficulty and derived correct equations. If one uses the erroneous expressions, error limits are obtained which are much too conservative.



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Abstracts

Multifrequency Microwave Generation Using a Large Capacitance Tunnel Diode (Correspondence)

S.V. Jaskolski and K. Ishii. "Multifrequency Microwave Generation Using a Large Capacitance Tunnel Diode (Correspondence)." 1964 Transactions on Microwave Theory and Techniques 12.3 (May 1964 [T-MTT]): 361-362.

Fundamental, simultaneous oscillation at two discrete microwave frequencies has been experimentally verified using an inexpensive tunnel diode. The diode possesses relatively high junction capacitance of 90 pf (see Fig. 1).



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Abstracts

An Improved Mode-Selecting Coupler (Correspondence)

*G.B. Sleeper, Jr.. "An Improved Mode-Selecting Coupler (Correspondence)." 1964
Transactions on Microwave Theory and Techniques 12.3 (May 1964 [T-MTT]): 362-363.*

A mode-selecting coupler which couples two orthogonally oriented rectangular waveguides into circular or square waveguide for simultaneous orthogonal transmission has been previously reported by Ohm. It has been found that by adding an additional septum to the coupler configuration the bandwidth can be substantially improved.



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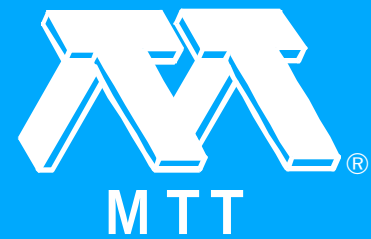


Abstracts

A New Formula for Attenuation in Coaxial Cables (Correspondence)

C.H. Spaderna. "A New Formula for Attenuation in Coaxial Cables (Correspondence)." 1964 Transactions on Microwave Theory and Techniques 12.3 (May 1964 [T-MTT]): 363-364.

Attenuation in matched coaxial cables is expressed by the formula for 100 feet (db).



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Broad-Band Coaxial-to-Stripline Transitions (Correspondence)

J.R. Pyle. "Broad-Band Coaxial-to-Stripline Transitions (Correspondence)." 1964 Transactions on Microwave Theory and Techniques 12.3 (May 1964 [T-MTT]): 364-365.

Butt transitions between coaxial line and shielded stripline are simple and economical to manufacture. Levy has pointed out that such transitions are not properly matched because the fringing field of the stripline is intercepted by the outer conductor of the coaxial line, and in addition the inner conductors of the two lines have different dimensions. His broad-band coaxial-to-stripline transition requires a tapered length of rectangular coaxial line and he deduced that the VSWR of this system is less than 1.02 up to 11 kMc.

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Abstracts

Experimental Verification of the Phase Relationships in Parametric Amplifiers (Correspondence)

W.G. Matthei. "Experimental Verification of the Phase Relationships in Parametric Amplifiers (Correspondence)." 1964 Transactions on Microwave Theory and Techniques 12.3 (May 1964 [T-MTT]): 365-367.

The purpose of this communication is to present experimental evidence to show that the phase of the amplified signal in a three-frequency parametric amplifier is independent of the phase of the pump, while the phase of the idler varies directly with the phase of the pump.



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Inline Waveguide Attenuator (Correspondence)

W. Larson. "Inline Waveguide Attenuator (Correspondence)." 1964 Transactions on Microwave Theory and Techniques 12.3 (May 1964 [T-MTT]): 367-368.

A new inline attenuator fabricated in the manner of the common multihole directional coupler has qualities for use as an interlaboratory standard. Calibrations of one model of this attenuator and experiments with conventional waveguide compoueuents indicate improvements incalibration results with simplified calibration procechure.

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Abstracts

High-Speed Microwave Switches Using Silver-Bonded Diodes in the 11-Gc Region (Correspondence)

K. Miyauchi and O. Ueda. "High-Speed Microwave Switches Using Silver-Bonded Diodes in the 11-Gc Region (Correspondence)." 1964 Transactions on Microwave Theory and Techniques 12.3 (May 1964 [T-MTT]): 368-369.

This communication describes a highspeed microwave switch with a switching time as small as 0.5 nsec in the 11-Gc region. It employs silver-bonded diodes which have been originally developed as variable capacitance elements for use in parametric amplifiers.



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Abstracts

An Exact Method for Synthesis of Microwave Band-Stop Filters (1977 [MWSYM] Addendum)

E.G. Cristal. "An Exact Method for Synthesis of Microwave Band-Stop Filters (1977 [MWSYM] Addendum)." 1964 Transactions on Microwave Theory and Techniques 12.3 (May 1964 [T-MTT]): 369-382.

An algorithm is presented that enables a designer to compute efficiently and quickly the design parameters of microwave band-stop filters that are based on the exact synthesis technique previously discussed by Schiffman and Matthaei. Tables of band-stop filter designs that give maximally flat and Chebyshev responses are presented for ten typical stop-band fractional bandwidths.



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Abstracts

Cerenkov Radiation in Anisotropic Ferrites (Comments)

L.W. Zelby. "Cerenkov Radiation in Anisotropic Ferrites (Comments)." 1964 Transactions on Microwave Theory and Techniques 12.3 (May 1964 [T-MTT]): 383-383.

I have read with great interest the above paper since the Applied Physics group here at RCA has been engaged in analysis and experiments in Cerenkov radiation during the last few years. In the interest of historical as well as scientific accuracy, however, I should like to point out that the "problem of simulating an unbounded dielectric" was first solved, though not rigorously, by I. A. Getting, and not by C. E. Enderby, as the article seems to imply.



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Measuring the Directivity of a Directional Coupler Using a Sliding Short-Circuit and an Adjustable Sliding Termination (Correspondence)

R.W. Beatty. "Measuring the Directivity of a Directional Coupler Using a Sliding Short-Circuit and an Adjustable Sliding Termination (Correspondence)." 1964 Transactions on Microwave Theory and Techniques 12.3 (May 1964 [T-MTT]): 383-383.

A method for measuring the directivity of directional couplers has been previously described in which one uses an adjustable sliding termination and a sliding short-circuit. One first adjusts the tuner shown in Fig. 1 so as to eliminate multiple reflections in the waveguide in which the sliding terminations are inserted. Then one determines the ratio of two detector outputs, first the average level as the short-circuit slides in the waveguide and second the level obtained when the sliding termination is adjusted for zero reflection. An alternate procedure substitutes for this second level that which is obtained when the sliding termination is first adjusted to produce a detector null and is then slid without further adjustment until the detector output is maximum.





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A Possible Method of Generating Submillimeter Wave (Correspondence)

A.F. Rashid. "A Possible Method of Generating Submillimeter Wave (Correspondence)." 1964 Transactions on Microwave Theory and Techniques 12.3 (May 1964 [T-MTT]): 384-384.

For the last few years there has been considerable effort to generate, transmit and detect ultramicrowave energy. This effort has yielded substantial progress, but as yet, there has been no break through on the problem. In this brief communication, we would like to introduce a possible method of microwave frequency multiplication. Consider a microwave signal of frequency ω which is made to propagate through a medium whose dielectric constant is a prescribed function of time. The electromagnetic wave interacts with this variable dielectric constant in such a way that its frequency at the output of the medium is A/ϵ where A is the frequency multiplication factor of the medium.

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A Method for Rapidly Orienting Single-Crystal Garnet Spheres (Correspondence)

R.E. Willoughby and J. Brown, Jr.. "A Method for Rapidly Orienting Single-Crystal Garnet Spheres (Correspondence)." 1964 Transactions on Microwave Theory and Techniques 12.3 (May 1964 [T-MTT]): 385-386.

In today's rapidly expanding microwave technology, more and more devices utilizing spheres of single crystal yttrium iron garnet (or hybrid variations of YIG) are being developed. The most common of these are the gyromagnetic coupler-type power limiter and the tunable YIG filter. In each of these applications, a sphere of single crystal YIG is used as the coupling element between two otherwise isolated transmission lines, and is biased to ferromagnetic resonance by means of an applied dc magnetic field perpendicular to the orthogonal RF magnetic field components at the sphere.

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Abstracts

Superconducting Pulse Power Supply (Correspondence)

P.R. Wiederhold. "Superconducting Pulse Power Supply (Correspondence)." 1964 Transactions on Microwave Theory and Techniques 12.3 (May 1964 [T-MTT]): 386-386.

A method of storing large quantities of of electrical energy inductively, using super-conducting coils operating in liquid helium, has been developed. The stored energy can be released in the form of a high-power pulse of short duration in the order of milliseconds. An experimental device consisting of a 1200-joule storage coil and a superconducting discharge switch was operated successfully in the circuit shown in Fig. 1.



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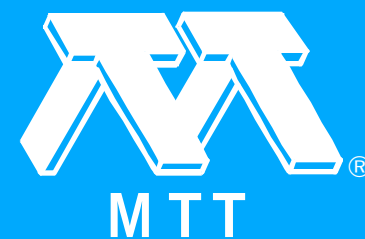
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Abstracts

Contributors (May 1964 [T-MTT])

A.F. Dietrich, F.E. Goodwin, M.L. Hensel, J.E. Kiefer, R. Levy, G.E. Moss, A.A. Oliner, T.R. O'Meara, P.M. Paterno, E.O. Schulz-DuBois, W.M. Sharpless, T. Tamir, C.C.H. Tang, H.-C. Wang, H.A. Wheeler and D.C. Youla. "Contributors (May 1964 [T-MTT])." 1964 Transactions on Microwave Theory and Techniques 12.3 (May 1964 [T-MTT]): 387-389.



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Exploratory Study of a Millimeter Resonance Isolator for the Circular Electric Waveguide Mode

R.A. Henschke. "Exploratory Study of a Millimeter Resonance Isolator for the Circular Electric Waveguide Mode." 1964 Transactions on Microwave Theory and Techniques 12.4 (Jul. 1964 [T-MTT]): 392-400.

A feasibility study was made on a TE/sub 01/ mode circular waveguide resonance isolator at frequencies near 35 Gc. A design was developed which utilized circumferentially oriented and magnetized thin rings of hexagonal ferrite material in contact with the inner or outer surface of a ring of alumina ceramic mounted concentrically in the waveguide. Approximate experimental measurements indicated that appreciable nonreciprocal attenuation could be obtained without severe degradation of the mode purity. Expressions are given for the field distributions in the dielectric ring loaded wave guide and for the ellipticity of the magnetic fields at the surfaces of the ring. Magnetic field ellipticity is computed as a function of a "slow-wave mode" cutoff constant for an experimental ring configuration. For sufficiently large values of this constant, the magnetic fields at the boundary are almost circularly polarized and are relatively independent of mean ring radius. The analytical results tend to support the experimental findings.

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Abstracts

Modes in Coupled Optical Resonators with Active Media

J.R. Fontana. "Modes in Coupled Optical Resonators with Active Media." 1964 Transactions on Microwave Theory and Techniques 12.4 (Jul. 1964 [T-MTT]): 400-405.

A general method is proposed to analyze the properties of optical systems composed of several coupled resonators. It is shown that by using appropriate matrices to represent the fields in the resonators and the couplings between them, an equation can be written, often by inspection, for the eigenvalue $s = \sigma + j\omega$ which gives the frequency and the rate of growth of the fields for all the modes of a given system. A re-entrant coupled system with loss and gain regions is discussed as an example. The effects of changes in mirror transmission, resonator length and medium properties are studied using the method.



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Traveling-Wave Maser Experiments Using Ruby at X Band

G.I. Haddad and D.H. Paxman. "Traveling-Wave Maser Experiments Using Ruby at X Band." 1964 Transactions on Microwave Theory and Techniques 12.4 (Jul. 1964 [T-MTT]): 406-414.

The characteristics of a traveling-wave maser using ruby and a Karp-type slow-wave structure in the X-band frequency range are presented. Several possible operating points in ruby in this frequency range were examined and the inversion ratio, linewidth, paramagnetic absorption, and electronic gain at these points were measured. The experimental results are compared with the theoretical predictions. The problems involved in the design of the traveling-wave maser are discussed and the performance that may be expected of a maser using good ruby crystals, a well matched structure, and sufficient pump power is evaluated. Experimental results on YIG slabs employed in the maser for isolation are presented and compared with theoretical predictions.



Abstracts

The Application of a New Class of Equal-Ripple Functions to Some Familiar Transmission-Line Problems

H.J. Riblet. "The Application of a New Class of Equal-Ripple Functions to Some Familiar Transmission-Line Problems." 1964 Transactions on Microwave Theory and Techniques 12.4 (Jul. 1964 [T-MTT]): 415-421.

Chevyshev's procedure for determining equal-ripple rational functions with preassigned poles is extended to functions with double-valued singularities. As long as the number of elements is small, design equations for the class of transmission-line filters consisting of shunt-resonant elements spaced a quarter wavelength apart are readily obtained by identifying the unknown coefficients with those of the desired equal-ripple function. This is carried out in some detail for three and four element filters and applied to the design of broad-band stub supports and quarter-wave-spaced broad-band TR tubes. Experimental confirmation is presented.



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A Broad Tunable Bandwidth Traveling-Wave Maser

L.C. Morris and D.J. Miller. "A Broad Tunable Bandwidth Traveling-Wave Maser." 1964 Transactions on Microwave Theory and Techniques 12.4 (Jul. 1964 [T-MTT]): 421-428.

A new type of traveling-wave maser (TWM) has been developed, employing the meander line as the slow-wave circuit and rutile as the active maser crystal. This amplifier has achieved net gains in excess of 23 db across the band from 2.0 to 3.0 Gc, with an over-all noise temperature of $8^{\circ} \pm 2^{\circ}\text{K}$. This marks the first time that rutile with a dielectric constant of 220 has been coupled to a slow-wave circuit. The maser material exhibited inversion ratios of 10:1 and saturated at an input signal of -47 dbm. In addition to the maser work, a ferrite material investigation was conducted, which led to the development of a gadolinium substituted yttrium iron garnet (YIG) as the ferrite isolator. Various concentrations of the gadolinium in YIG were investigated as ferrite isolators at 4.2°K and were found to have lower forward losses than pure YIG at S band.

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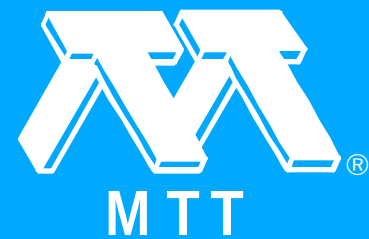
Coupled Circular Cylindrical Rods Between Parallel Ground Planes

E.G. Cristal. "Coupled Circular Cylindrical Rods Between Parallel Ground Planes." 1964 Transactions on Microwave Theory and Techniques 12.4 (Jul. 1964 [T-MTT]): 428-439.

The normalized self and mutual capacitances of periodic, circular cylindrical rods located between parallel ground planes are presented graphically. The capacitances were determined by solving the appropriate integral equation by numerical methods. Charts of self and mutual capacitance are given for rod diameter-to-ground plane spacing ratios varying from 0.05 to 0.8 and for very small to very large spacings between rods. Accuracy of the data is believed to be generally better than 2 per cent for the normalized mutual capacitance and generally better than 1 per cent for the normalized self capacitance. An approximate design method is also presented that permits using the data to synthesize filters (such as interdigital and comb-line filters) that require rods of nonequal diameters and spacings. An example of the design method is given, and a filter is constructed from the resulting data. The filter response was measured and found to agree closely with that called for by the theory.

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Quality of a Ferroelectric Material

S.N. Das. "Quality of a Ferroelectric Material." 1964 Transactions on Microwave Theory and Techniques 12.4 (Jul. 1964 [T-MTT]): 440-445.

The paper describes a simple method of measuring the nonlinear properties of a ferroelectric material at microwave frequencies. A composition of commercial polycrystalline barium titanate, of stated Curie temperature of 20°C, and of polythene powder was investigated. The incremental permittivity of the specimen at both increasing and decreasing biasing field was observed at X, C and S band. The effective dielectric constant of the specimen, for the same biasing field, was lower for increasing field, contrary to the theoretical analysis. Diamond's model of polycrystalline ferroelectric materials provides a qualitative explanation for the observed anomalous behavior of the specimens. An experimental arrangement for the observation of the microwave equivalent of a low-frequency ferroelectric loop is suggested.

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The Reflecting Beam Waveguide

J.E. Degenford, M.D. Sirkis and W.H. Steier. "The Reflecting Beam Waveguide." 1964 Transactions on Microwave Theory and Techniques 12.4 (Jul. 1964 [T-MTT]): 445-453.

In this paper a type of beam waveguide which uses appropriately shaped metal reflectors instead of dielectric lenses as the phase correcting devices is described. A theory has been developed which, subject to certain restrictions, describes the modes of this type of beam waveguide and predicts a loss of the order of 0.01 db per iteration. A reflecting beam waveguide comprising eight aluminum reflectors has been investigated at a wavelength of 4 millimeters. The measured loss per iteration is approximately 0.015 db which is in good agreement with the theoretical value. The cross-sectional electric field distribution has also been measured and found to be in satisfactory agreement with the theory. It is shown that the reflecting beam waveguide is a practical system for the transmission of power at submillimeter wavelengths.



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Abstracts

Analysis of a Differential Phase Shifter

D.A. Ellerbruch. "Analysis of a Differential Phase Shifter." 1964 Transactions on Microwave Theory and Techniques 12.4 (Jul. 1964 [T-MTT]): 453-459.

This paper presents the theory and analysis of a ganged pair of "line stretcher" microwave phase shifters. The error analysis shows that some of the errors inherent in a single phase shifter of this type can be reduced through the use of a differential system; however, the magnitudes of other errors may more than offset the reduction. Graphical data are included to facilitate the rapid determination of the limit of error for any specified angle measurement.



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Maximum Bandwidth Performance of Non-degenerate Parametric Amplifier with Single-Tuned Idler Circuit

J.T. DeJager. "Maximum Bandwidth Performance of Non-degenerate Parametric Amplifier with Single-Tuned Idler Circuit." 1964 Transactions on Microwave Theory and Techniques 12.4 (Jul. 1964 [T-MTT]): 459-467.

The single-tuned bandwidth and limiting flat bandwidth of a nondegenerate reflection-type diode parametric amplifier is calculated. The amplifier has a broad-banding filter structure in the signal circuit and a single-tuned idler circuit. An experimental low-noise, wide-band Z-band amplifier is described, and measurement results are presented. The amplifier has a triple-tuned signal circuit and a single-tuned idler circuit and is pumped at 11.3 Gc. A nearly flat bandwidth of 23 per cent at 7 db gain and an effective input noise temperature of 70°K at room temperature ambient and of 29°K at liquid nitrogen (77°K) ambient has been obtained.

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Abstracts

The Characteristic Impedance of Square Coaxial Line (Jul. 1964 [T-MTT])

S.W. Conning. "The Characteristic Impedance of Square Coaxial Line (Jul. 1964 [T-MTT])." 1964 Transactions on Microwave Theory and Techniques 12.4 (Jul. 1964 [T-MTT]): 468-468.

In a recent communication, Green has given approximate results for the characteristic impedance of a coaxial line with square section inner and outer conductors. It is the purpose of this communication to point out that Bowman has given an exact solution in terms of elliptic integrals, which is by no means computationally tedious.



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Abstracts

A Varactor Tuned UHF Coaxial Filter (Correspondence)

A.P. Benguerel and N.S. Nahman. "A Varactor Tuned UHF Coaxial Filter (Correspondence)." 1964 Transactions on Microwave Theory and Techniques 12.4 (Jul. 1964 [T-MTT]): 468-469.

The purpose of the following communication is to present a method for designing a varactor-tuned UHF coaxial filter. The method includes the means for determining the varactor diode characteristics necessary for a given tuning range and bandwidth.



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Abstracts

The Equivalent Circuit of a Plasma (Correspondence)

G.H. Bryant, R.N. Franklin and M.H.N. Potok. "The Equivalent Circuit of a Plasma (Correspondence)." 1964 Transactions on Microwave Theory and Techniques 12.4 (Jul. 1964 [T-MTT]): 469-470.

Several recent papers, e.g., Kaufmann and Steier, show how the plasma resonance can be used to achieve rejection and transmission filters.



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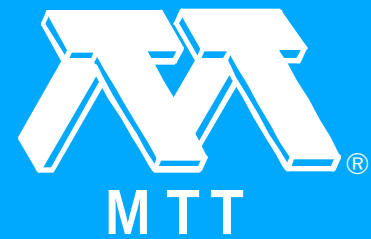


Abstracts

Intrinsic Attenuation (Jul. 1964 [T-MTT])

H. Baudrand and S. Lefeuvre. "Intrinsic Attenuation (Jul. 1964 [T-MTT])." 1964 Transactions on Microwave Theory and Techniques 12.4 (Jul. 1964 [T-MTT]): 470-471.

In connection with a recent paper by Beatty, we wish to advise that we have found a general method of decomposition of the two-arm dissipative waveguide junctions taking into account the intrinsic attenuation.



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Abstracts

Superheterodyne Radiometers for Use at 70 Gc and 140 Gc (Correction)

R. Meredith and F.L. Warner. "Superheterodyne Radiometers for Use at 70 Gc and 140 Gc (Correction)." 1964 Transactions on Microwave Theory and Techniques 12.4 (Jul. 1964 [T-MTT]): 471-471.

Each n in (15) and (17) should be an η ; and, in the equation immediately above (18), the large curly bracket should be an integral sign.



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Abstracts

Measurements of Varactor Diode Impedance (Correspondence)

D.A.E. Roberts. "Measurements of Varactor Diode Impedance (Correspondence)." 1964 Transactions on Microwave Theory and Techniques 12.4 (Jul. 1964 [T-MTT]): 471-475.

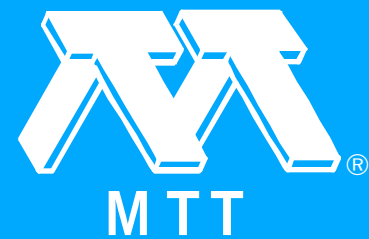
Impedance measurements of varactor diodes have been made on a slotted line in the frequency range 2-18 Gc. The experimental technique is described, and a method for deriving a simple lumped equivalent circuit is shown. Typical circuit values are quoted.



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Microwave Insertion Loss Test Set (Correspondence)

C.T. Stelzried and S.M. Petty. "Microwave Insertion Loss Test Set (Correspondence)." 1964 Transactions on Microwave Theory and Techniques 12.4 (Jul. 1964 [T-MTT]): 475-477.

A simple, accurate test set has been devised for measuring insertion losses at microwave frequencies. It is composed almost entirely of commercially available equipment and components. The short-term jitter is about 0.0004 db peak-to-peak, and long-term drift is typically 0.0015 db/hour. Accuracy of the measurements depends on the value of the insertion loss measured and is better than ± 0.001 to ± 3 percent for insertion loss measurements in the 0 to 25 db range. These accuracies include the non repeatability of connecting and disconnecting the waveguide flanges used in the system.

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Abstracts

Circular Polarization at Millimeter Waves by Total Internal Reflection (Correspondence)

H. Buizert. "Circular Polarization at Millimeter Waves by Total Internal Reflection (Correspondence)." 1964 Transactions on Microwave Theory and Techniques 12.4 (Jul. 1964 [T-MTT]): 477-478.

A plane wave traveling from a dielectric medium with dielectric constant ϵ_1 into a dielectric medium with dielectric constant ϵ_2 , for which $\epsilon_1 > \epsilon_2$, is totally reflected at an angle of incidence θ_i greater than the critical angle of incidence θ_c .



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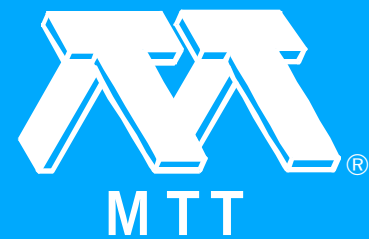
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Microwave Measurements on Semiconductor Filled Symmetrical Strip Transmission Line (Correspondence)

D.A. Holmes and D.L. Feucht. "Microwave Measurements on Semiconductor Filled Symmetrical Strip Transmission Line (Correspondence)." 1964 Transactions on Microwave Theory and Techniques 12.4 (Jul. 1964 [T-MTT]): 478-480.

A number of microwave techniques for studying semiconductor properties have recently been reported. In many of the techniques for measuring semiconductor conductivity, the guided wave approach has been utilized. The usual procedure is to mount a semiconductor sample of known dimensions in a waveguiding structure.

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Abstracts

Method Free from Mismatching Errors for Measuring the Loss of Attenuators (Correspondence)

A.N. Leber. "Method Free from Mismatching Errors for Measuring the Loss of Attenuators (Correspondence)." 1964 Transactions on Microwave Theory and Techniques 12.4 (Jul. 1964 [T-MTT]): 480-480.

In his recent communication, Weinschel called attention to a method by Rabinovich which employs two directional couplers for the measurement of the insertion loss of a microwave component. Rabinovich reports that his measurement technique results in a substantial reduction in mismatch error compared with the mismatch error which occurs with conventional attenuation measurement techniques.



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Abstracts

Microwave and High-Frequency Calibration Services of the National Bureau of Standards-- Part I (Correspondence)

"Microwave and High-Frequency Calibration Services of the National Bureau of Standards--Part I (Correspondence)." 1964 Transactions on Microwave Theory and Techniques 12.4 (Jul. 1964 [T-MTT]): 480-482.

Calibration services in the microwave and high-frequency regions available from the National Bureau of Standards presently extend in frequency from approximately 30 kHz to 26.5 GHz. These services include most of the usual electrical quantities of interest in precision measurements with limitations in frequency range, magnitude of quantity, and accuracy of calibration.



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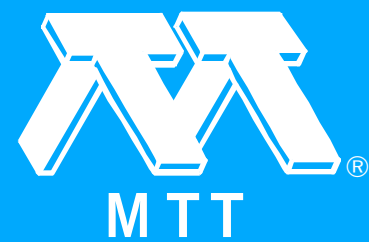
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The Confocal Resonator System with a Large Fresnel Number (V-Type Eigenmodes) (Correspondence)

H. Lotsch. "The Confocal Resonator System with a Large Fresnel Number (V-Type Eigenmodes) (Correspondence)." 1964 Transactions on Microwave Theory and Techniques 12.4 (Jul. 1964 [T-MTT]): 482-483.

Multimode resonators with open-walled structure pose a boundary value problem which cannot be solved analytically. It must be treated by methods of approximation. Several approaches, essentially based upon Huygens' Principle, have been reported in recent literature. The author has recognized that Huygens' Principle and the Huygens-Fresnel Principle may differ significantly if boundary conditions must be considered. He has developed a resonator theory which is applied to the V-type eigenmodes of a confocal resonator system (the individual wave trains travel along V-shaped paths). We summarize the essential results and refer to Lotsch for a detailed discussion. We define an eigenmode as an energy distribution which, when launched from the plane of symmetry, reproduces itself on this same mathematical plane after a complete round trip between the reflectors. We learn from Fig. 1 that an eigensolution is reproduced in the plane of symmetry after each reflection and thus four times per eigenmode. We postulate a self-consistent field distribution for such a section of an eigenmode. We assume that this distribution can be represented as $E_{\text{sub } y}(x, y) = E_{\text{sub } 0} X(x) Y(y)$, where $E_{\text{sub } 0}$ is a constant amplitude factor, $X(x)$ a function of x only and $Y(y)$ a function of y only.

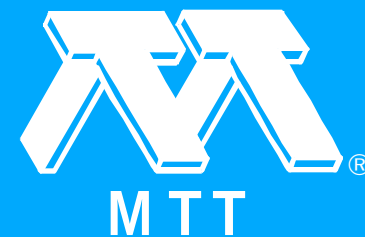
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Contributors (Jul. 1964 [T-MTT])

E.G. Cristal, S.N. Das, J.E. Degenford, D.A. Ellerbruch, J.R. Fontana, G.I. Haddad, R.A. Henschke, J.T. DeJager, D.J. Miller, L.C. Morris, D.H. Paxman, H.J. Riblet, M.D. Sirkis and W.H. Steier. "Contributors (Jul. 1964 [T-MTT])." 1964 Transactions on Microwave Theory and Techniques 12.4 (Jul. 1964 [T-MTT]): 484-485.



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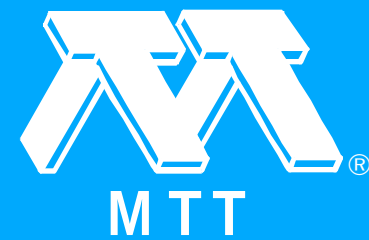
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New Associate Editor (Announcements) (Jul. 1964 [T-MTT])

"New Associate Editor (Announcements) (Jul. 1964 [T-MTT])." 1964 Transactions on Microwave Theory and Techniques 12.4 (Jul. 1964 [T-MTT]): 486-486.



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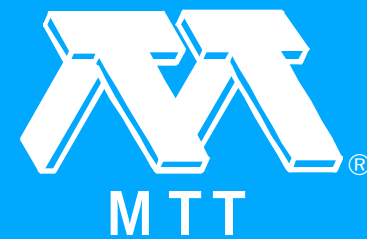
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"Table of Contents (Sep. 1964 [T-MTT])." 1964 Transactions on Microwave Theory and Techniques 12.5 (Sep. 1964 [T-MTT]): 487-487.



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Abstracts

Characteristic Impedance of Rectangular Coaxial Transmission Lines

O.R. Cruzan and R.V. Garver. "Characteristic Impedance of Rectangular Coaxial Transmission Lines." 1964 Transactions on Microwave Theory and Techniques 12.5 (Sep. 1964 [T-MTT]): 488-495.

The characteristic impedance of rectangular coaxial transmission lines can be readily and accurately computed by a simple equation when the capacitance per unit length is known. While the capacitance per unit length of the parallel sides is easily calculated, the calculation of the corner capacitance is a more difficult problem. This problem has been solved by Skiles and Higgins, using orthonormal block analysis. By using their formulas, the corner capacitances for a wide range of all variables were evaluated by means of a digital computer. The results are cataloged in graphical form.



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Propagation of the Quasi-TEM Mode in Ferrite-Filled Coaxial Line

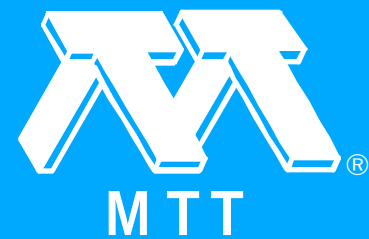
M.E. Brodwin and D.A. Miller. "Propagation of the Quasi-TEM Mode in Ferrite-Filled Coaxial Line." 1964 Transactions on Microwave Theory and Techniques 12.5 (Sep. 1964 [T-MTT]): 496-503.

The Suhl and Walker approximation for the propagation constant of the quasi-TEM mode in ferrite-filled parallel plane waveguide has been applied to the ferrite-filled coaxial line. The approximation is compared to exact solutions for a coaxial line filled with a lossless ferrite with close agreement. The propagation constant of the quasi-TEM mode is determined by measuring the complex reflection coefficient of a plane ferrite-air interface. The alpha and beta are compared to the Suhl and Walker approximation with losses, and qualitative agreement is found. In order to relate the measured values to the propagation constants, the boundary value problem of the reflection from a plane ferrite-air interface is investigated. Expressions are derived which relate the real and imaginary parts of the propagation constant in the ferrite to an approximation to the complex reflection coefficient of the TEM mode in the empty line.

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A Design Theory for Optimum Broadband Reflection Amplifiers

J.O. Scanlan and J.T. Lim. "A Design Theory for Optimum Broadband Reflection Amplifiers." 1964 Transactions on Microwave Theory and Techniques 12.5 (Sep. 1964 [T-MTT]): 504-511.

The design procedure for optimum broadband negative-resistance amplifiers is given, by reference to the work of Fano, on the broadband matching of arbitrary impedances. Complete sets of curves are given which indicate the limits on the gain-bandwidth performance which can be achieved for a particular negative-resistance device, while also showing the ripple in gain and the resulting phase response obtained. The optimum amplifiers are also compared with others of the same class, and it is found that considerable advantage in terms of ripple and phase response can be gained by using nonoptimum designs in certain cases. The paper also includes explicit formula for the element values of the matching network applicable to both optimum and nonoptimum designs. A design example is given for a tunnel-diode amplifier.

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A Multiharmonic Rejection Filter Designed by an Exact Method

B.M. Schiffman. "A Multiharmonic Rejection Filter Designed by an Exact Method." 1964 Transactions on Microwave Theory and Techniques 12.5 (Sep. 1964 [T-MTT]): 512-516.

The exact method for designing band-stop filters in transmission lines is here adapted to design a four-element filter that is perfectly matched at a fundamental frequency and has infinite attenuation (theoretically) at the second, third, and fourth harmonics. The form of the filter is suitable for construction in TEM-mode strip transmission lines. How to obtain other combinations of three infinite rejection frequencies is also shown. Each filter is derived from a Cauer-type prototype network obtained from published tables of element values. The computed response of a test design is seen to be a precise mapping of the response of the prototype.

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Electromagnetic Wave Propagation in Lossy Ferrites

F.J. Rosenbaum. "Electromagnetic Wave Propagation in Lossy Ferrites." 1964 Transactions on Microwave Theory and Techniques 12.5 (Sep. 1964 [T-MTT]): 517-528.

The square of the complex transverse propagation constant in a lossy, magnetized ferrite is found to be described approximately by a circle in the complex plane when the magnetic field is varied. A graphical method for obtaining approximate values for the transverse propagation constant when the wave number in the direction of the applied field is given and real is derived here. This method is used to find The power absorbed from an incident plane wave by A semi-infinite ferrite as a function of the magnetizing field amplitude.

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Surface Waves on an Anisotropic Plasma Sheath

S.R. Seshadri and W.F. Pickard. "Surface Waves on an Anisotropic Plasma Sheath." 1964 Transactions on Microwave Theory and Techniques 12.5 (Sep. 1964 [T-MTT]): 529-541.

A treatment of the excitation of unidirectional plane surface waves on a perfectly conducting screen covered with an anisotropic plasma sheath is given for the case in which the external magnetic field is oriented parallel to the screen but perpendicular to the direction of propagation. The dispersion relations for the surface waves and their dependence on the strength of the external magnetic field and the sheath thickness, are discussed. For sufficiently small sheath thickness, backward surface waves are found to exist. The powers carried by the surface waves and the space waves are evaluated, and the efficiency of excitation of the surface waves are determined as a function of sheath thickness for a typical set of parameters. The power carried by the forward and backward surface waves are compared for two cases in which, in a given direction, either one or both of these exist.

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Back-Scattering Measurements of a Slowly Moving Target

O.P. McDuff, H. Mott and C.S. Durrett, Jr.. "Back-Scattering Measurements of a Slowly Moving Target." 1964 Transactions on Microwave Theory and Techniques 12.5 (Sep. 1964 [T-MTT]): 541-546.

A basic problem in the measurement of back-scattering cross sections is the separation of the desired target-scattered signal from the undesired background reflections. An additional problem may be the separation from the target-scattered signal of signals directly coupled from the transmitter to the receiver. Historically, these have been overcome in several ways: 1) a reference signal has been used to cancel the undesired signals when measuring a fixed target, 2) a reference signal has been used to override the undesired signals when measuring a rapidly moving target, and 3) an average curve has been fitted to data taken with a target at several positions. Two useful alternative techniques are described herein. A cancellation procedure performed while the target is slowly moving is shown to be effective in a much poorer environment than the static nulling procedure. The use of a reference signal to override the undesired signals is shown to be directly applicable to a slowly moving target procedure, thus simplifying the mechanical problems in measuring bulky targets. With a simple experimental setup, back-scattering cross sections 33 db below a square wavelength at 11 Gc can be measured at a range of 150 cm when transmitting 400 mw. These readings can be taken in an environment 20 to 30 db worse than that usually considered necessary for scattering measurements by the static null procedure.



Abstracts

Regenerative and Pull-In Modes of Millimeter-Wave Reflex Klystron Amplifier (Correspondence)

G.E. Raue and K. Ishii. "Regenerative and Pull-In Modes of Millimeter-Wave Reflex Klystron Amplifier (Correspondence)." 1964 Transactions on Microwave Theory and Techniques 12.5 (Sep. 1964 [T-MTT]): 547-547.

A reflex klystron used as an amplifier can operate in both the regenerative and pull-in mode. From articles published regarding reflex klystron amplification, it appears that considerable confusion exists on this subject. It is the purpose of this communication to distinguish clearly between the two phenomena. The most readily noticeable differences occur in the frequency behavior and the input-output characteristics.



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Abstracts

An Additional Relation for "Design of Mode Transducers" (Correspondence)

D.B. Churchill. "An Additional Relation for "Design of Mode Transducers" (Correspondence)." 1964 Transactions on Microwave Theory and Techniques 12.5 (Sep. 1964 [T-MTT]): 547-548.

Solymar and Eaglesfield, and recently Wolfert, have disclosed analytical methods for designing the contours of tapered waveguide mode transducers to favor the desired modes and suppress the spurious modes. Basically, the methods are similar, but they differ in the selection of the mode weighting functions and in the methods of plotting the cross-sectional boundary contours.



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Abstracts

On the Focused Fabry-Perot Resonator in Plasma Diagnostics (Correspondence)

K.E. Lonngren, J.W. Mink and J.B. Beyer. "On the Focused Fabry-Perot Resonator in Plasma Diagnostics (Correspondence)." 1964 Transactions on Microwave Theory and Techniques 12.5 (Sep. 1964 [T-MTT]): 548-549.

In a recent paper, Primich and Hayami discussed the application of a Fabry-Perot resonator to plasma diagnostics. In particular, they studied plasma densities that are uniform in space and that have a plasma frequency much less than the operating frequency of the microwave system. They also restrict themselves to plasmas that are collisionless.



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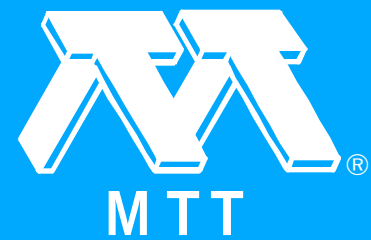


Abstracts

Step-Twist Diode Switch (Correspondence)

H.S. Jones, Jr. and R.V. Garver. "Step-Twist Diode Switch (Correspondence)." 1964 Transactions on Microwave Theory and Techniques 12.5 (Sep. 1964 [T-MTT]): 549-549.

Two X-band diode switches have been combined with a step-twist waveguide section to form a very compact broad-band step-twist diode switch.



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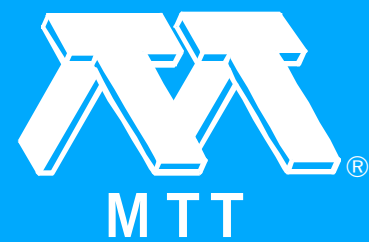
Dielectric Resonators for Microwave Applications (Correspondence)

R.V. D'Aiello and H.J. Prager. "Dielectric Resonators for Microwave Applications (Correspondence)." 1964 Transactions on Microwave Theory and Techniques 12.5 (Sep. 1964 [T-MTT]): 549-550.

The purpose of this communication is to report certain test results recently obtained with resonators made of single crystal rutile. Since rutile has a very high dielectric constant and a very low loss factor, microwave resonators made of rutile have several desirable characteristics. Compared to metallic resonators it is possible to reduce the size of the rutile resonator, which is especially useful at lower microwave frequencies. The Q factor of rutile resonators is very high and at room temperature may be of the order of several thousand, while at liquid helium temperature it may even reach 10^5 . It can be shown that the ratio of electric and magnetic field strengths of dielectric cavity to metallic cavity is proportional to $(E)^{1/4}$ and $(E)^{3/4}$, respectively. Therefore, with the same available power, an increase in field intensity can be obtained. Furthermore, these fields are not confined to the inside of the rutile resonator but extend beyond the dielectric surface into free space. Because of these characteristics rutile resonators are finding useful applications in traveling-wave masers, in harmonic generators (in conjunction with varactor diodes), in novel RF Hall-effect-devices, and in experiments with parametric superconducting devices.

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Letter Symbols to Designate Microwave Bands (Correspondence)

L. Lewin. "Letter Symbols to Designate Microwave Bands (Correspondence)." 1964 Transactions on Microwave Theory and Techniques 12.5 (Sep. 1964 [T-MTT]): 551-551.

At a recent meeting of RCRD 16(Waveguides), members discussed the question of the use of letters to designate microwave wavebands. It was noted that the use of these letters is historical, arising in the first instance from security considerations in wartime radar, and that the letters follow no logical sequence. Moreover, there is no unanimity, either in Great Britain or in the United States, as to the meaning of these letters, and there is much proliferation in some quarters, with consequent confusion. Accordingly, there appeared to be some case for dropping the existing system and either having a logical and systematic designation or, possibly, none at all. However, the members felt, despite this unpromising outlook, that the letters really did serve a useful purpose, and that some terms, such as X-band, are too ingrained to be dropped. It was suggested that these terms might be likened to the use of colors to designate parts of the optical spectrum. Although the edges of the band designated "yellow," for example, may not be too clearly defined, nevertheless it is a useful term to have; although in accurate scientific work one would naturally use the appropriate unit, Angstroms, wavenumber, or frequency. Overlap in color designation occurs, of course, and one can use phrases like yellow-green to describe them. Similarly, it was felt that with a suitable, small number of letter terms, phrases like X-band would take on a useful meaning, to be supplemented by accurate wavelength or frequency descriptions when appropriate. Terms like X-J might be used descriptively to denote overlap regions.





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Tangent Relation for Determining Immitance Inverter Parameters (Correspondence)

D.B. Churchill. "Tangent Relation for Determining Immitance Inverter Parameters (Correspondence)." 1964 Transactions on Microwave Theory and Techniques 12.5 (Sep. 1964 [T-MTT]): 551-552.

The immitance (impedance or admittance) inverter of Cohn and Matthaei can be described by a tangent relation similar to that of Weissfloch. The relationship leads to a simple method of extracting the inversion parameter and intrinsic angular length of a lossless, but otherwise arbitrary, discontinuity.

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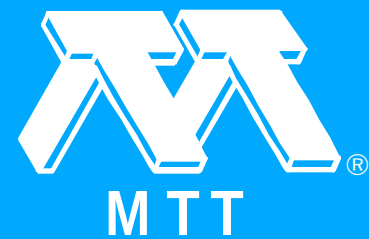


Integral Quotient in Measurements of Ambipolar Diffused Plasma with TE/sub 011/ Cavity (Correspondence)

P. Jaaskelainen. "Integral Quotient in Measurements of Ambipolar Diffused Plasma with TE/sub 011/ Cavity (Correspondence)." 1964 Transactions on Microwave Theory and Techniques 12.5 (Sep. 1964 [T-MTT]): 552-552.

Despite some known exact solutions of plasma loaded TM/010/ cavity, the TE/sub 011/ mode should be used due to measurement-technical reasons in the case of large electron densities and considerable losses. This communication is connected with the mathematical treatment of measurement results in the case of TE/sub 011/ mode and polar diffusion in discharge tube. The treatment is based on Slater's expression for discharge admittance and the assumption of small perturbations, but not on any special electron theoretically derived plasma conductivity formula.





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On "Status Report on International Millimeter Waveguide Flange Standards" (Correspondence)

L. Lewin. "On "Status Report on International Millimeter Waveguide Flange Standards" (Correspondence)." 1964 Transactions on Microwave Theory and Techniques 12.5 (Sep. 1964 [T-MTT]): 552-553.

In his communication, Anderson described the state of international standardization of millimeter waveguide flanges and concluded that in the absence of a suitable U. S. flange ". . . there is little to compete with the Philips flange as an International Standard." Earlier he had stated: "The British also developed flanges for millimeter-wave work using the Union-type principle, but these found little favor in the U.S." Although nowhere specifically stated, it is strongly implied that this British flange is not being put forward as an international standard. In fact, the situation is that the British Union-type flange, or C-type, has been accepted as an international standard and is listed in document IEC publication 154. It is widely used in Great Britain both for millimeter wave sizes and, in large quantity, at X-band (WG16).

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



Abstracts

K/sub A/ Band Klystron Replacement (Correspondence)

J. Munro and E. Feldman. "K/sub A/ Band Klystron Replacement (Correspondence)." 1964 Transactions on Microwave Theory and Techniques 12.5 (Sep. 1964 [T-MTT]): 553-553.

We have successfully fabricated a harmonic tripler from 11,620 Mc to 34,860 Mc using a diffused junction gallium arsenide varactor (Sylvania D5047C) with an efficiency of approximately 50 percent at an input power of 200 mw (Fig. 1).



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Microwave Transmission through a Plasma Sheath (Correspondence)

J. Willis and D.W. Czubiak. "Microwave Transmission through a Plasma Sheath (Correspondence)." 1964 Transactions on Microwave Theory and Techniques 12.5 (Sep. 1964 [T-MTT]): 553-555.

Propagation of an electromagnetic wave of a given frequency in a plasma will occur only if the plasma density is less than a critical value. When the density is expressed in terms of the plasma frequency $\epsilon_p^2 = ne^2 / m\omega_0^2$, propagation occurs if the plasma frequency is less than the frequency of the electromagnetic wave. When the plasma density is such that the plasma frequency is in excess of the signal frequency, the plasma acts like a conductor reflecting and severely attenuating the signal so that it cannot penetrate to any great depth into the plasma.

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A Low-Loss Launcher for the Beam Waveguide

R.J. Chaffin and J.B. Beyer. "A Low-Loss Launcher for the Beam Waveguide." 1964 Transactions on Microwave Theory and Techniques 12.5 (Sep. 1964 [T-MTT]): 555-555.

The beam waveguide shows great potential for providing an extremely low-loss method of guiding millimeter and submillimeter waves. However, the low-loss mode in the beam waveguide differs considerably in form from the fundamental modes of metal waveguides. This leads to the problem of finding an efficient way to couple from the metal waveguide to the beam waveguide or between the metal waveguide and devices such as resonators utilizing beam waveguide modes.

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



Abstracts

Cutoff Wavelengths of Waveguides with Unusual Cross Sections (Correspondence)

J.R. Pyle and R.J. Angle. "Cutoff Wavelengths of Waveguides with Unusual Cross Sections (Correspondence)." 1964 Transactions on Microwave Theory and Techniques 12.5 (Sep. 1964 [T-MTT]): 556-557.

This communication describes a method for computing the cut-off wavelength of waveguides of unusual cross section. This is achieved by reducing the cross section to a large number of simple rectangular strips.



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Abstracts

Circular Polarizers of Fixed Bandwidth (Correspondence)

J.R. Pyle. "Circular Polarizers of Fixed Bandwidth (Correspondence)." 1964 Transactions on Microwave Theory and Techniques 12.5 (Sep. 1964 [T-MTT]): 557-559.

This communication describes the design and performance of a circular polarizer comprising two metal plates set at 45° to the electric field vector, E (Fig. 1) in a circular waveguide of radius r carrying the TE_{11} mode.



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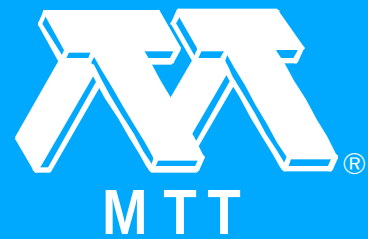


Abstracts

Design Curves for Interdigital Band-Pass Filters (Correspondence)

J.R. Pyle. "Design Curves for Interdigital Band-Pass Filters (Correspondence)." 1964 Transactions on Microwave Theory and Techniques 12.5 (Sep. 1964 [T-MTT]): 559-567.

Band-pass filters may be constructed using interdigital arrays of quarter-wave stripline resonators as shown in Fig. 1.



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Below Resonance Operation of the Strip Line Y-Circulator (Correspondence)

J. Sokolov. "Below Resonance Operation of the Strip Line Y-Circulator (Correspondence)." 1964 Transactions on Microwave Theory and Techniques 12.5 (Sep. 1964 [T-MTT]): 568-569.

Below resonance operation of a strip line Y circulator is analyzed and the limitation in choice of the internal field and of the magnetization $4\pi M/\sin\theta$ is pointed out. Bosma's design equations are reviewed, and a change in design procedure is suggested.

Click on title for a complete paper.



Abstracts

Surface Wave on a Perfectly Conducting Plane Covered with Magnetoplasma (Correspondence)

S. Adachi and Y. Mushiake. "Surface Wave on a Perfectly Conducting Plane Covered with Magnetoplasma (Correspondence)." 1964 Transactions on Microwave Theory and Techniques 12.5 (Sep. 1964 [T-MTT]): 569-570.

It has been found by Ishimaru and Seshadri that a unidirectional TEM surface wave is trapped along a perfectly conducting plane covered with transversely magnetized semi-infinite plasma.



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A Multistub Coaxial Line Tuner (Correspondence)

W.E. Little and E. Niesen. "A Multistub Coaxial Line Tuner (Correspondence)." 1964 Transactions on Microwave Theory and Techniques 12.5 (Sep. 1964 [T-MTT]): 570-571.

To date, one of the major difficulties in precision coaxial line reflectometer work has been the lack of suitable coaxial line tuners. The tuner described here was designed specifically for reflectometer work and overcomes the major problems of mechanical instability, coarse tuning adjustments, and leakage prevalent in presently available coaxial line tuners.

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Orientation of YIG Spheres for Minimum Temperature Dependence (Correspondence)

E.J. Wrobel. "Orientation of YIG Spheres for Minimum Temperature Dependence (Correspondence)." 1964 Transactions on Microwave Theory and Techniques 12.5 (Sep. 1964 [T-MTT]): 571-571.

Due to magnetocrystalline anisotropy energy, YIG spheres display a resonant frequency shift with temperature variation. By orienting the sphere along certain directions relative to the applied dc magnetic field, this frequency shift with temperature can be minimized. Clark, Brown, and Tribby have analyzed this problem, and resorted to X-ray alignment using the Laue back reflection pattern to obtain the temperature-stable orientation. They have pointed out the difficulty in maintaining the accuracy of alignment in transferring the sphere from the X-ray apparatus to the RF structure.

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



Abstracts

An Empirical Formula for the Design of Radial Line Filters (Correspondence)

M.A.R. Gunston. "An Empirical Formula for the Design of Radial Line Filters (Correspondence)." 1964 *Transactions on Microwave Theory and Techniques* 12.5 (Sep. 1964 [T-MTT]): 571-572.

The present wide interest in varactor parametric amplifiers and frequency multipliers has led to renewed interest in bandpass and band-stop filters suitable for microwave frequencies. In negative resistance amplifiers it is essential to prevent leakage of pump and idler frequencies into the signal circuit and in multipliers it is necessary to prevent outputs at unwanted higher harmonic frequencies. In many such instances simple radial-line band rejection filters are adequate, combining high reflection within the rejection band with low insertion loss at other frequencies.



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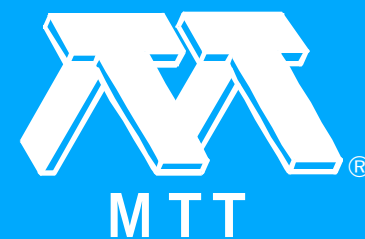


Abstracts

Electrolytic Pointing of Fine Wire (Correction)

J.W. Dozier. "Electrolytic Pointing of Fine Wire (Correction)." 1964 Transactions on Microwave Theory and Techniques 12.5 (Sep. 1964 [T-MTT]): 572-572.

In the above correspondence, the final line should have read 0.0002 inch instead of 0.002 inch.



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Abstracts

Microwave and High-Frequency Calibration Services of the National Bureau of Standards-- Part II (Correspondence)

"Microwave and High-Frequency Calibration Services of the National Bureau of Standards--Part II (Correspondence)." 1964 Transactions on Microwave Theory and Techniques 12.5 (Sep. 1964 [T-MTT]): 572-576.

Following the series of presentations on microwave and high-frequency calibration services of the National Bureau of Standards which began in the July, 1964 issue of these Transactions, the services for the measurement of attenuation and field strength are presented below. As before, following the listing of calibration services is a series of charts (Figs. 1, 2, and 3) indicating the magnitudes of quantities, the frequency range, and the over-all estimated accuracy of calibrations performed.



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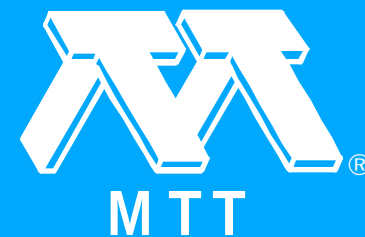


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Contributors (Sep. 1964 [T-MTT])

M.E. Brodwin, O.R. Cruzan, C.S. Durett, R.V. Garver, J.-T. Lim, O.P. McDuff, D.A. Miller, H. Mott, W.F. Pickard, F.J. Rosenbaum, S.O. Scanlan, B.M. Schiffman and S.R. Seshadri.

"Contributors (Sep. 1964 [T-MTT])." 1964 Transactions on Microwave Theory and Techniques 12.5 (Sep. 1964 [T-MTT]): 576-577.



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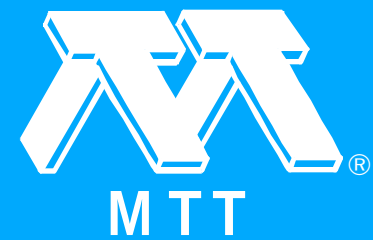
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Call for Papers - 1965 MTT Symposium (Sep. 1964 [T-MTT])

"Call for Papers - 1965 MTT Symposium (Sep. 1964 [T-MTT])." 1964 Transactions on Microwave Theory and Techniques 12.5 (Sep. 1964 [T-MTT]): 578-579.



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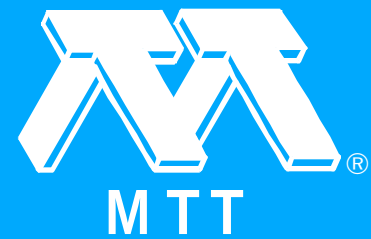
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Membership Application (Sep. 1964 [T-MTT])

"Membership Application (Sep. 1964 [T-MTT])." 1964 Transactions on Microwave Theory and Techniques 12.5 (Sep. 1964 [T-MTT]): 580-580.



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Institutional Listings (Sep. 1964 [T-MTT])

"Institutional Listings (Sep. 1964 [T-MTT])." 1964 Transactions on Microwave Theory and Techniques 12.5 (Sep. 1964 [T-MTT]): b1-b2.



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Front Cover (Nov. 1964 [T-MTT])

"Front Cover (Nov. 1964 [T-MTT])." 1964 Transactions on Microwave Theory and Techniques 12.6 (Nov. 1964 [T-MTT]): f1-f2.



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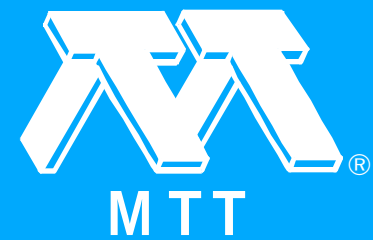
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Table of Contents (Nov. 1964 [T-MTT])

"Table of Contents (Nov. 1964 [T-MTT])." 1964 Transactions on Microwave Theory and Techniques 12.6 (Nov. 1964 [T-MTT]): 581-581.



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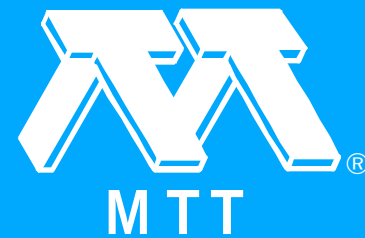


Abstracts

Message from the Editor (Nov. 1964 [T-MTT])

"Message from the Editor (Nov. 1964 [T-MTT])." 1964 Transactions on Microwave Theory and Techniques 12.6 (Nov. 1964 [T-MTT]): 582-583.

For the most part, authors of papers and correspondence items for the IEEE Transactions on Microwave Theory and Techniques need little specific information before submitting a paper and can usually determine most of the information they need by examining several late issues.



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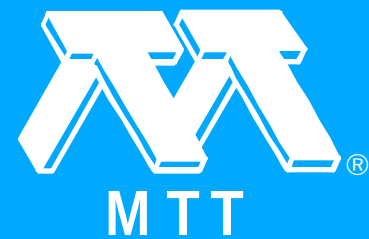
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Internal Reflections in Dielectric Prisms

R.G. Fellers and J. Taylor. "Internal Reflections in Dielectric Prisms." 1964 Transactions on Microwave Theory and Techniques 12.6 (Nov. 1964 [T-MTT]): 584-587.

A pair of closely spaced dielectric prisms used as an adjustable bidirectional coupler has been discussed by a number of investigators. In its simplest form this device permits an adjustable arbitrary distribution of power output in two directions at right angles to one another.

Reflections from the external air-dielectric interfaces change the power distribution from the theoretically computed values and result in power output in a third direction. This paper describes a theoretical calculation of the power transmission in all four directions taking into account reflections at all interfaces. Experimental data recorded at 35 Gc exhibit very good agreement with predicted results.

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



Nonreciprocal Coupling with Single-Crystal Ferrites

H. Skeie. "Nonreciprocal Coupling with Single-Crystal Ferrites." 1964 Transactions on Microwave Theory and Techniques 12.6 (Nov. 1964 [T-MTT]): 587-594.

A calculation of nonreciprocal coupling in microwave circuits with small ferrite samples tuned to ferromagnetic resonance is presented. It is shown that this coupling may be applied to the construction of simple resonant isolators, gyrators and circulators. Experimental results for the coupling in rectangular and ridge guides, applying YIG spheres, are presented. The construction of a simple X-band waveguide junction, acting as a 4-port resonant circulator, is described. Such a filter circulator, which may act as a switch or a frequency selective power divider, can be made tunable over the waveguide frequency range, with a bandwidth in the order of 10 Mc, and with values of insertion loss and isolation, which are comparable to those of conventional circulators.



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Asymmetric Coupled-Transmission-Line Magic-T

D.I. Kraker. "Asymmetric Coupled-Transmission-Line Magic-T." 1964 Transactions on Microwave Theory and Techniques 12.6 (Nov. 1964 [T-MTT]): 595-599.

A Magic-T was designed using a 3-db asymmetric coupled-transmission-line directional coupler and a schiffman phase shift network. Expressions for the coupling and phase difference of the outputs of the basic coupler were obtained. Two phase shift networks for compensating the phase variation in the coupled outputs were investigated. The Schiffman phase shift network was shown to provide the best compensation over a given bandwidth. One unit designed in strip transmission line to operate from 2 to 4 Gc showed good agreement with the theory. The maximum difference in output power was 0.4 db, and the phase deviation was less than 4°. The isolation between the input ports was greater than 25 db, while the isolation between output ports was greater than 21db throughout the entire band. Levy's design equations for a two-section asymmetric coupler with optimum coupling distribution are given for completeness.

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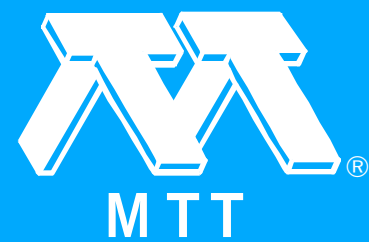
Synthesis of Filter-Limiters Using Ferrimagnetic Resonators

R.L. Comstock. "Synthesis of Filter-Limiters Using Ferrimagnetic Resonators." 1964 Transactions on Microwave Theory and Techniques 12.6 (Nov. 1964 [T-MTT]): 599-607.

A synthesis procedure is developed for microwave band-pass filters with the Chebyshev response using orthogonal circuit resonators coupled by a ferrimagnetic resonator. A stripline ferrimagnetic resonator filter is analyzed in detail. Equations and graphs are given which allow the selection of ferrimagnetic material and size of the ferrimagnetic sample necessary to achieve a desired bandwidth and insertion loss for a given pass-band response. The theoretical behavior of these circuits as microwave power limiters is discussed and it is shown that the ratio of the limiting threshold to the filter bandwidth is a constant depending only on the pass band response shape. Experimental confirmation of the design information discussed as well as some practical methods of varying the limiting threshold.

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Delay Equalization by Tapered Cutoff Waveguides

C.C.H. Tang. "Delay Equalization by Tapered Cutoff Waveguides." 1964 Transactions on Microwave Theory and Techniques 12.6 (Nov. 1964 [T-MTT]): 608-615.

When a wave packet propagates in a guided mode subject to cutoff at a definite frequency, dispersion is always present. To restore the shapes of the wave packets at the receiving end, a proper delay equalization must be applied. Waves propagating in a waveguide tapered to cutoff dimensions are reflected mostly in a region where the dimensions are at cutoff. Accordingly waves of higher frequencies will penetrate deeper into the tapered guide and thereby introduce more delay than those of lower frequencies. A profile of a tapered waveguide is obtained for the case of linear delay on the hypothetical assumption that a wave is totally reflected only at the plane of cutoff dimensions. The problem of finding a proper profile is similar in nature to the inverse scattering problem in quantum mechanics. The complex input reflection coefficient introduced by a tapered cutoff waveguide is invariably unity in its magnitude for all frequencies below cutoff and has different phases for different frequencies. Presently available theory for computing the complex reflection coefficient is valid only when its magnitude is smaller than unity. A theoretical method to calculate with accuracy the phase of such unity reflection coefficient is presented. The linking section between the standard waveguide and the tapered cutoff waveguide is designed on the basis of a high-pass filter that introduces no appreciable perturbation to the prescribed delay characteristic. The excellent agreement between the theoretical results and measured data suggests that microwave delay equalizers can be designed "on paper" with "measurement" accuracy without even going to the laboratory. Accordingly the claim can be made that any reasonable amount of delay of simple shape within certain bandwidth limits can be equalized by the present approach.

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



Abstracts

Improvement of the Wall-Current Detector (Correspondence)

F.C. de Ronde. "Improvement of the Wall-Current Detector (Correspondence)." 1964 Transactions on Microwave Theory and Techniques 12.6 (Nov. 1964 [T-MTT]): 616-616.

Since the publication by de Ronde, the construction of the wall-current detector has been modified, resulting in the following improvements.



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Multiband Cavity for High Temperature Plasma Measurements (Correspondence)

W.T. Maloney. "Multiband Cavity for High Temperature Plasma Measurements (Correspondence)." 1964 Transactions on Microwave Theory and Techniques 12.6 (Nov. 1964 [T-MTT]): 616-617.

The design of microwave cavities for investigating high temperature arc plasmas must provide for adequate cooling, vacuum sealing, high Q, minimum disturbance to gas flow and general versatility. In a typical plasma experiment (shown in Fig. 1) ionized argon gas flows through a one centimeter circular pipe formed by a stack of insulated water cooled copper disks. Ionization is maintained thermally by an electric arc burning along the pipe axis. The heat transferred to the walls may be 100 w/cm^2 and central temperatures exceed 8000°K at currents in the neighborhood of 100 a. The cavity is located in the stack so that the gas flow is along its axis.

Abstracts

Radiation Characteristics for a Magnetic Line Source in Homogeneous Electron Plasmas (Correspondence)

K.R. Cook. "Radiation Characteristics for a Magnetic Line Source in Homogeneous Electron Plasmas (Correspondence)." 1964 Transactions on Microwave Theory and Techniques 12.6 (Nov. 1964 [T-MTT]): 617-618.

The radiation characteristic of a magnetic line source in an anisotropic compressible electron plasma was discussed in a recent paper by Seshadri. In Seshadri's paper an excessive amount of effort is devoted to evaluating certain integrals occurring in the Fourier transform solutions of the single-fluid magnetohydrodynamic equations. The following discussion presents a greatly simplified method of evaluating the appropriate integrals describing the "optical" and "plasma" modes of radiation.



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Quasi-Optical Waveguide Filters (Correspondence)

J.J. Taub, H.J. Hindin and G.P. Kurpis. "Quasi-Optical Waveguide Filters (Correspondence)." 1964 Transactions on Microwave Theory and Techniques 12.6 (Nov. 1964 [T-MTT]): 618-619.

Oversize rectangular waveguide operating in the TE/sub 10 mode is useful in constructing components operating at millimeter and submillimeter wavelengths. This communication describes preliminary results on quasi-optical oversize waveguide filters. It is easier to construct filters using this technique and they have lower attenuation loss than conventional-size waveguide filters. When the waveguide is appreciably over-size (10 or more times standard-size TE/sub 10/ waveguide), a good approximation to plane wave propagation exists. This enables gratings and dielectric slabs to be used in a way that is similar to their application in optical structures, which have previously been considered as filter-like elements at millimeter and submillimeter wavelengths.



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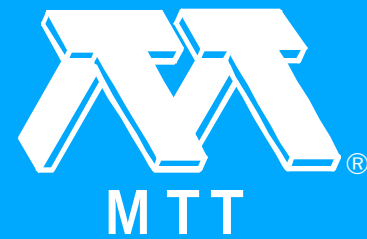


Abstracts

Total System Noise Temperature: 15°K (Correspondence)

R.C. Clauss, W. Higa, C. Stelzried and E. Wiebe. "Total System Noise Temperature: 15°K (Correspondence)." 1964 Transactions on Microwave Theory and Techniques 12.6 (Nov. 1964 [T-MTT]): 619-620.

Laboratory evaluation of an operational maser system has led to interesting results, particularly in regard to accurate noise temperature measurements.



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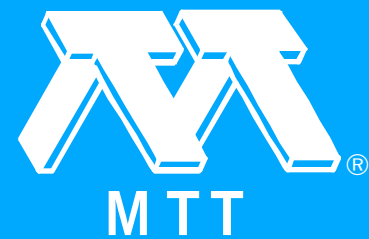
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Quick Coaxial Phaseshifter for 150 Watts (Correspondence)

H. Gerke and A. Paulin. "Quick Coaxial Phaseshifter for 150 Watts (Correspondence)." 1964 Transactions on Microwave Theory and Techniques 12.6 (Nov. 1964 [T-MTT]): 620-621.

In some RF and microwave systems it might be necessary to arrange a sudden phase jump of the RF power. For this purpose we have developed a phase shifter which switches an energy of 150 w at 500 Mc for any angle between 0 and 3600. With semiconductor diodes the energy will be switched from one path in the coaxial line to the other. The system remains matched in any case.

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Recent Linewidth Measurements with a Cross-Guide Coupler (Correspondence)

D.C. Stinson. "Recent Linewidth Measurements with a Cross-Guide Coupler (Correspondence)." 1964 Transactions on Microwave Theory and Techniques 12.6 (Nov. 1964 [T-MTT]): 621-622.

The continued interest in both narrow and broad linewidth ferromagnets for microwave applications motivates studies directed toward measuring their pertinent parameters. Two of the more important parameters are the linewidth and the effective g factor. These quantities are ordinarily measured in a resonant cavity where quite often it is necessary to use two different cavities for materials whose line widths differ by several orders of magnitude. Although the procedure for using this method is unnecessarily involved when one desires to measure only the linewidth and the g factor, the cavity technique is considered the standard.

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



Abstracts

A High Isolation/High Speed Microwave Modulator (Correspondence)

J.R. Alday. "A High Isolation/High Speed Microwave Modulator (Correspondence)." 1964 Transactions on Microwave Theory and Techniques 12.6 (Nov. 1964 [T-MTT]): 622-622.

The modulation technique shown in this communication is capable of converting a continuous wave X-band signal into nano-second carrier pulses with measured (on to off state) isolation greater than 50 db. Fig. 1 illustrates the basic block diagram of the system.



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Microwave and High-Frequency Calibration Services of the National Bureau of Standards-- Part III (Correspondence)

"Microwave and High-Frequency Calibration Services of the National Bureau of Standards--Part III (Correspondence)." 1964 Transactions on Microwave Theory and Techniques 12.6 (Nov. 1964 [T-MTT]): 623-624.

This is the third of a series of presentations on microwave and high-frequency calibration services of the National Bureau of Standards which began in the July 1964 issue of these Transactions. (See this issue for a more complete introduction.)



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Equivalence of Different Integral Equations for Confocal Resonators (Correspondence)

H. Kogelnik and S.P. Morgan. "Equivalence of Different Integral Equations for Confocal Resonators (Correspondence)." 1964 Transactions on Microwave Theory and Techniques 12.6 (Nov. 1964 [T-MTT]): 624-624.

Lotsch has proposed an integral equation for the modes of a two-dimensional confocal resonator, which he says is different from and more accurate than the integral equation used by earlier workers, such as Boyd and Gordon. Actually the two integral equations are completely equivalent. Lotsch's equation describes the field at the midplane of the resonator, and the simpler equation of Boyd and Gordon describes the field at either of the confocal mirrors.

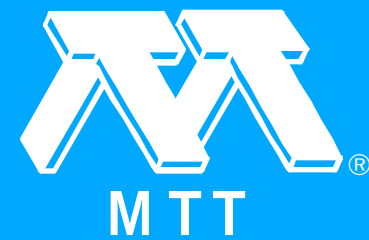
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Abstracts

Contributors (Nov. 1964 [T-MTT])

R.G. Fellers, J. Taylor, H. Skeie, D.I. Kraker, R.L. Comstock and C.C.H. Tang. "Contributors (Nov. 1964 [T-MTT])." 1964 Transactions on Microwave Theory and Techniques 12.6 (Nov. 1964 [T-MTT]): 625-625.



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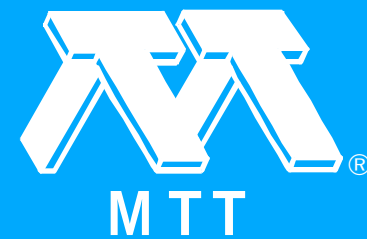
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Index, IEEE Transactions on Microwave Theory and Techniques, Volume MTT-12, 1964

*"Index, IEEE Transactions on Microwave Theory and Techniques, Volume MTT-12, 1964."
1964 Transactions on Microwave Theory and Techniques 12.6 (Nov. 1964 [T-MTT]): i-xi.*



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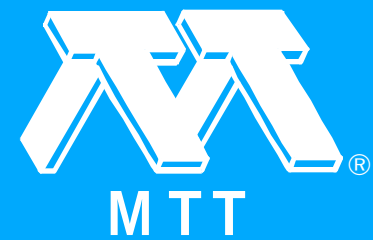
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Abstracts

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"Institutional Listings (Nov. 1964 [T-MTT])." 1964 Transactions on Microwave Theory and Techniques 12.6 (Nov. 1964 [T-MTT]): b1-b2.



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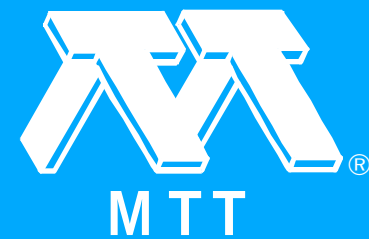
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1963 Microwave Prize, Dr. Leo Young

"1963 Microwave Prize, Dr. Leo Young." 1965 Transactions on Microwave Theory and Techniques 13.1 (Jan. 1965 [T-MTT]): 2-2.



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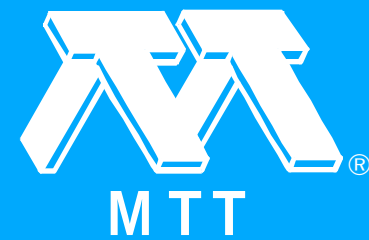
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Abstracts

1964 G-MTT International Symposium (Jan. 1965 [T-MTT])

"1964 G-MTT International Symposium (Jan. 1965 [T-MTT])." 1965 Transactions on Microwave Theory and Techniques 13.1 (Jan. 1965 [T-MTT]): 3-4.



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Application of Exact Synthesis Methods to Multichannel Filter Design (Jan. 1965 [T-MTT])

R.J. Wenzel. "Application of Exact Synthesis Methods to Multichannel Filter Design (Jan. 1965 [T-MTT])." 1965 Transactions on Microwave Theory and Techniques 13.1 (Jan. 1965 [T-MTT]): 5-15.

An exact design procedure is presented for contiguous-band multichannel filters. The procedure is theoretically valid at all frequencies for filters which employ TEM-mode (transverse-electro-magnetic-mode), quarter-wave line networks. The design of diplexing is considered in detail with multichannel filters being realized as a cascade of suitable diplexers. Microwave complementary component filters are shown to fulfill the requirement for the design of diplexing and multichannel filters with theoretically perfect match at all frequencies. A design procedure using component networks with Chebyshev characteristics is given. This allows a narrow crossover region and high isolation to be obtained for a given network complexity at the cost of a slight increase in input-port VSWR (Voltage Standing-Wave Ratio). The design procedure makes use of published tables and does not require a detailed knowledge of synthesis techniques. Experimental results for two diplexing networks, one a complementary and the other a Chebyshev pair, are given in verification of the theory presented.

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



Operation of the Ferrite Junction Circulator

C.E. Fay and R.L. Comstock. "Operation of the Ferrite Junction Circulator." 1965 Transactions on Microwave Theory and Techniques 13.1 (Jan. 1965 [T-MTT]): 15-27.

The operation of symmetrical circulators is described in terms of the counter-rotating normal modes (fields varying as $\exp n \phi$) of the ferrite-loaded circuits. The rotating modes, which are split by the applied magnetic field, form a stationary pattern which can be rotated in space to isolate one of the ports of the circulator. A detailed field theory of the strip-line Y-junction circulator operating with $n = 1$ is presented. Experiments designed to confirm the validity of the rotating normal mode description of circulator action in the Y-junction circulator also are presented; these include measurements of mode frequencies and electric field patterns. The results of the field theory are used in a design procedure for quarter-wave coupled strip-line circulators. The results of the design procedure are shown to compare adequately with experimental circulators. Higher mode operation of strip-line circulators is described. The operation of waveguide cavity circulators is shown to depend on the rotating ferrite-loaded cavity modes.



Abstracts

A DC Triggered High-Speed High-Power Microwave Spark Gap Switch (Jan. 1965 [T-MTT])

H. Farber, M. Klinger, M. Sucher and E. Malloy. "A DC Triggered High-Speed High-Power Microwave Spark Gap Switch (Jan. 1965 [T-MTT])." 1965 Transactions on Microwave Theory and Techniques 13.1 (Jan. 1965 [T-MTT]): 28-32.

Operation of a microwave spark gap switch triggered with a short high-voltage pulse is described. C-band power of 1 MW peak and 4 μ s pulse width was switched in less than 10 ns at 100 pps with less than 0.3 dB arc loss in air at atmospheric pressure. Use in a cavity resonator to give an efficient pulse compression circuit is described. Switch recovery and turn off data are given.



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Abstracts

Broadband Binary 180° Diode Phase Modulators (Jan. 1965 [T-MTT])

R.V. Garver. "Broadband Binary 180° Diode Phase Modulators (Jan. 1965 [T-MTT])." 1965 Transactions on Microwave Theory and Techniques 13.1 (Jan. 1965 [T-MTT]): 32-38.

The development of two types of broadband binary 180° diode phase modulators is disclosed. One type uses two waveguide paths with a diode switch in each arm to alternate between RF transmission paths. The phase modulation is obtained by an arrangement of E-plane and H-plane T junctions. The other type of phase modulator makes use of the reflection properties of a diode terminating a transmission line in conjunction with a 3-db coupler or circulator.



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Circulator Synthesis (Jan. 1965 [T-MTT])

J.A. Weiss. "Circulator Synthesis (Jan. 1965 [T-MTT])." 1965 Transactions on Microwave Theory and Techniques 13.1 (Jan. 1965 [T-MTT]): 38-44.

A symmetrical three-port ring network composed of reciprocal T junctions and nonreciprocal phase shifters is analyzed theoretically to determine conditions under which it exhibits perfect circulation. All physically realizable T junctions are considered. It is found that many such junctions, combined with appropriate phase shifters specified by the theory, form perfect circulators. Among these are many cases for which the internal wave amplitudes are small and which require only very small amounts of nonreciprocal phase shift. Circulators designed in accordance with this model may offer appreciable advantages in insertion loss and bandwidth, as well as in mechanical characteristics such as size and weight, and in the possibility of adapting the design for special applications such as high-power capability, high-speed switching, etc. The nature of the model and the method of calculation are summarized.



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Abstracts

A 7-Gc/s Narrow-Band Waveguide Switch Using p-i-n Junction Diodes

H.J. Peppiatt, A.V. McDaniel, Jr. and J.B. Linker, Jr.. "A 7-Gc/s Narrow-Band Waveguide Switch Using p-i-n Junction Diodes." 1965 Transactions on Microwave Theory and Techniques 13.1 (Jan. 1965 [T-MTT]): 44-47.

A narrow-band waveguide switch with power capability in excess of 8 watts has been designed in WR137 waveguide. p-i-n diodes are used in band elimination filter sections. the attenuation in the reject band is greater than 80 dB over a 10 Mc/s range, and the passband loss is less than 0.5 dB.



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A High-Power Ferroelectric Limiter (Jan. 1965 [T-MTT])

M. Cohn and A.F. Eikenberg. "A High-Power Ferroelectric Limiter (Jan. 1965 [T-MTT])." 1965 Transactions on Microwave Theory and Techniques 13.1 (Jan. 1965 [T-MTT]): 47-54.

Ferroelectric limiters capable of handling peak input power levels in excess of 25 kW with a small signal insertion loss of 0.5 dB have been built. The measured performance and a theoretical analysis have shown that excellent limiting characteristics can be obtained, and that saturation power output levels ranging from a few watts up to megawatts can be obtained with ferroelectric pellets that can be conveniently fabricated. The limited available material data indicates that ferroelectric limiters will offer their greatest advantage in the HF, VHF, and UHF bands. The theoretical analysis of the expected temperature rise within the ferroelectric pellet has shown that, by proper design, very-high-average power levels also can be handled. A recovery time of less than ten microseconds has been measured.

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E- and H-Plane Bends for High-Power Oversized Rectangular Waveguide (Jan. 1965 [T-MTT])

J.P. Quine. "E- and H-Plane Bends for High-Power Oversized Rectangular Waveguide (Jan. 1965 [T-MTT])." 1965 Transactions on Microwave Theory and Techniques 13.1 (Jan. 1965 [T-MTT]): 54-63.

A study is presented of theoretical and experimental results of E- and H-plane bends for high-power oversized rectangular waveguide having cross-section dimensions in the range between 1.5 and 2.5 free space wavelengths. It is expected that waveguides having these dimensions will be able to transmit 50 to 100 kW of average power at X-band without water cooling. The transmission of at least 5.0 MW of peak power at X-band without pressurization is also a design objective. Dimensions for bends having low-mode conversion loss were determined by numerical integration of the coupled transmission line equations. The dominant TE/sub 10//spl square/ mode and four spurious modes were considered in these calculations. The results obtained for both constant curvature and sinusoidally shaped E- and H-plane bends are presented. A compact H-plane constant curvature bend is described for which the ratio of centerline radius to waveguide width is equal to 1.48. The measured mode conversion loss to the TE/sub 20//spl square/, TE/sub 30//spl square/, and TE/sub 40//spl square/ modes for an experimental model having a width equal to 2.25 inches was less than -20 dB in the frequency range from 7.0 to 11.0 Gc/s.

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Microwave Delay Techniques Using YIG

F.A. Olson and J.R. Yaeger. "Microwave Delay Techniques Using YIG." 1965 Transactions on Microwave Theory and Techniques 13.1 (Jan. 1965 [T-MTT]): 63-69.

Recent developments in microwave delay techniques employing single-crystal yttrium iron garnet (YIG) are described. In particular, the operation of a two-port, electronically variable-delay device utilizing long-wavelength spin-wave propagation in single-crystal YIG is presented in detail. Specific advantages of this device are transmission-type operation, delay continuously variable from zero to several microseconds by means of magnetic field, and lack of critical dimensions or surface finishes. This form of delay, as well as those due to acoustic-wave and spin-wave/acoustic-wave propagation, have been observed at frequencies from 1 to 10 Gc/s. A comparison of the performances of these delay processes is made, with special attention to insertion loss, bandwidth, frequency limits, and variable-delay range.

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A Technique for Measuring Phase Modulation or Rapid Phase Changes of a Microwave Signal (Jan. 1965 [T-MTT])

W.P. Ernst. "A Technique for Measuring Phase Modulation or Rapid Phase Changes of a Microwave Signal (Jan. 1965 [T-MTT])." 1965 Transactions on Microwave Theory and Techniques 13.1 (Jan. 1965 [T-MTT]): 70-76.

The system takes advantage of the fact that a phase-modulated carrier signal will produce equivalent frequency modulation, where the change of frequency is proportional to the time rate of change of the phase variation. A microwave carrier frequency, FC , is shifted in a single sideband generator to a frequency, $FC+FM$. The upper sideband is transmitted through the phase modulating medium and then mixed with the original carrier frequency. The difference frequency FM contains the phase modulation information and, after preamplification, the signal is put through a wide-band limiter-discriminator of center frequency, FM . The discriminator output voltage will be directly proportional to the rate of phase change. To compensate for the time rate of change dependency, the discriminator output is followed by an integrating network ($E/\text{sub } 0 \sim 1/f$) which will produce an output voltage proportional to the phase change only. Calibration is accomplished by imposing a known amount of phase modulation on the sideband modulating signal FM and observing the system output signal. This measuring scheme has been built in the 70 Gc/s band and is capable of following a wide range of phase changes over microsecond periods.





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The Radiation Properties of a Parallel-Plane Waveguide in a Transversely Magnetized, Homogeneous Plasma

E.L. Johansen. "The Radiation Properties of a Parallel-Plane Waveguide in a Transversely Magnetized, Homogeneous Plasma." 1965 Transactions on Microwave Theory and Techniques 13.1 (Jan. 1965 [T-MTT]): 77-83.

The Wiener-Hopf technique is used to study the radiation from a parallel-plane waveguide embedded in a homogeneous anisotropic plasma in which the external magnetic field is perpendicular to the direction of propagation and parallel to the perfectly conducting planes of the guide. The incident field in the guide is a TEM wave, which propagates in the positive z direction. The parallel-plane guide terminates at $z = 0$, causing a reflected field in the waveguide, a radiation field, and a surface wave that is guided along the outer surface of one of the perfect conductors. Expressions are found for these field components, and the results are discussed for the different frequency ranges.

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Abstracts

The Interchange of Source and Detector in Low-Power Microwave Network Measurements

H.M. Altschuler. "The Interchange of Source and Detector in Low-Power Microwave Network Measurements." 1965 Transactions on Microwave Theory and Techniques 13.1 (Jan. 1965 [T-MTT]): 84-90.

The technique for interchanging generator and detector in the impedance measurement of microwave one-ports is a useful, known procedure often applied when low powers are indicated. The necessary and sufficient conditions for the validity of such measurements are examined critically and direct extensions of this technique to measurements of reciprocal two-ports are given. A completely separate analysis is necessary when such an interchange is made in the case of an interference bridge which is to be used for the determination of the scattering parameters of arbitrary (active or passive, and reciprocal or nonreciprocal) two-ports. This analysis, presented in detail, results in a new low-power-level version of a method of measuring arbitrary two-ports as outlined in an earlier paper. The measurement technique and the subsequent data analysis of the two versions are found to be identical, except that the two scattering parameters S_{12} and S_{21} appear in interchanged positions.



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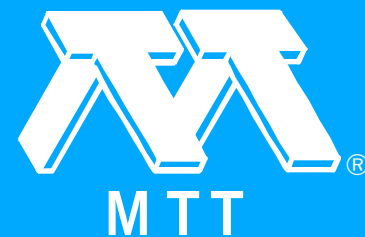


Abstracts

Split-Tee Power Divider

L.I. Parad and R.L. Moynihan. "Split-Tee Power Divider." 1965 Transactions on Microwave Theory and Techniques 13.1 (Jan. 1965 [T-MTT]): 91-95.

A new type of power divider is described which provides two in-phase isolated outputs with a constant arbitrary power division over a wide bandwidth. The derivation of the formulas from which the unit may be designed and its performance predicted are given. The bandwidth characteristics of a two-third, one-third power divider are given along with experimental verification.



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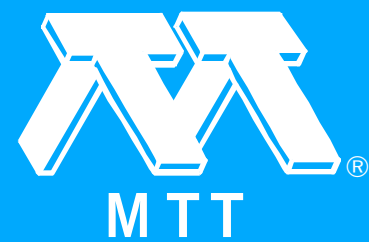
Input Conductance of a Four-Frequency Parametric Up-Converter

A. Korpel and V. Ramaswamy. "Input Conductance of a Four-Frequency Parametric Up-Converter." 1965 Transactions on Microwave Theory and Techniques 13.1 (Jan. 1965 [T-MTT]): 96-106.

The limited power gain of a parametric upper sideband up-converter may be enhanced arbitrarily by allowing additional dissipation of energy at the lower sideband. However, the input conductance of such a four-frequency device will be critically dependent upon the amount of lower sideband energy dissipated. In this paper, we shall consider a varactor diode-type four-frequency up-converter employing a single resonant circuit common to both the pump and the sidebands. The input conductance of this configuration is analyzed in terms of the relative deviation of the pump frequency from the resonance frequency of the common circuit. We show that the input conductance also is seriously affected by the presence of second harmonic capacitance variation such as may occur at high-pump levels. Numerical results have been plotted for a wide range of circuit parameters. Also presented in this paper are the experimental results of measurements performed on such an amplifier, showing good agreement with the theory.

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Characteristic Impedances of Multiconductor Strip Transmission Lines

J.W. Duncan. "Characteristic Impedances of Multiconductor Strip Transmission Lines." 1965 Transactions on Microwave Theory and Techniques 13.1 (Jan. 1965 [T-MTT]): 107-118.

The design of certain log-periodic microwave circuit elements requires a knowledge of the characteristic impedances of a system of four-coupled strip transmission lines. The system of four strip conductors between parallel ground planes is capable of supporting four different TEM modes which have different characteristic impedances. In this paper, the characteristic impedances of the four modes are determined by a variational method. The variational solution is an upper bound to the exact characteristic impedance of the line. In general, the coplanar strip conductors are located at an arbitrary (but identical) displacement from the parallel ground planes. When the separation between the broadside-coupled strips is precisely one-half the spacing between the parallel ground planes, two of the mode impedances may be determined exactly by means of conformal mapping. The variational solutions are compared to the exact solutions for this special case. Because of the "cell image" principle which holds for the problem, the mode solutions presented here also apply to various single- and two-conductor strip transmission lines with arbitrary displacements. As a result, solutions for the following strip line configurations are available from the analysis: a single strip conductor in a trough, or between parallel ground planes; two coplanar strips between ground planes; two broadside-coupled strips in a trough, or between parallel ground planes. An extensive set of curves are presented which show the characteristic impedances of the four modes as a function of the relative dimensions of the strip transmission line.

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A Ferrimagnetic Microwave Power Limiter

J. Krokstad. "A Ferrimagnetic Microwave Power Limiter." 1965 Transactions on Microwave Theory and Techniques 13.1 (Jan. 1965 [T-MTT]): 119-122.

A new method of microwave power limiting is described. In contrast to limiters previously discussed, this type limits the power reflected from a ferrite-loaded microwave cavity, the limited output power being coupled into the load by means of a hybrid or a circulator. A characteristic feature of the limiter is that the limiting level may be adjusted over a wide range by a suitable choice of the volume of the ferrite sample. Furthermore, the level may with ease be continuously varied over a wide dynamic range merely by changing the position of the ferrite sample in the cavity. Experimental results are presented.

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Abstracts

An X-Band Parametric Amplifier with Closed-Cycle Cooling (Jan. 1965 [T-MTT])

C.T. Rucker, W. Morrow and E.S. Grimes, Jr.. "An X-Band Parametric Amplifier with Closed-Cycle Cooling (Jan. 1965 [T-MTT])." 1965 Transactions on Microwave Theory and Techniques 13.1 (Jan. 1965 [T-MTT]): 123-124.

The objective in this work has been to utilize proved parametric amplifier techniques along with a relatively low cost reciprocating cryogenic cooler to achieve very low-noise parametric amplification in the X-band frequency region.



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Band-Pass Filters with Steep Skirt Selectivity (Correspondence)

E.N. Torgow and P.D. Lubell. "Band-Pass Filters with Steep Skirt Selectivity (Correspondence)." 1965 Transactions on Microwave Theory and Techniques 13.1 (Jan. 1965 [T-MTT]): 124-126.

Band-pass filters exhibiting low passband insertion loss and extremely steep rejection skirts can be realized by means of resonators having more moderate values of Q than are required by conventional techniques. The design of these filters is similar to the image parameter method in that individual filter elements, each exhibiting one portion of the desired rejection, are super-imposed to provide a composite characteristic. The principal difference is that the component building blocks used in our technique are filter elements designed to exhibit prescribed insertion loss characteristics.

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Abstracts

A New Isolator Using a Solid-State Plasma Waveguide (Correspondence)

M. Toda. "A New Isolator Using a Solid-State Plasma Waveguide (Correspondence)." 1965 Transactions on Microwave Theory and Techniques 13.1 (Jan. 1965 [T-MTT]): 126-127.

Nonreciprocal microwave circuits involving a tensor permeability were considered by Hogan in 1952 and many examples, such as isolators, circulators, modulators, switches, and phase shifters, have been developed. A gaseous plasma waveguide displays similar nonreciprocal properties, because of the plasma tensor permittivity in a magnetic field. The Faraday rotation and different losses for right-hand-polarized and oppositely-polarized waves lead to characteristics essentially similar to those of ferrites.



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Millimeter Resonance Isolator Utilizing Multilayer Ni and NiZn Ferrite Films (Correspondence)

W.L. Wade, Jr., R. Stern and T. Collins. "Millimeter Resonance Isolator Utilizing Multilayer Ni and NiZn Ferrite Films (Correspondence)." 1965 Transactions on Microwave Theory and Techniques 13.1 (Jan. 1965 [T-MTT]): 127-128.

This communication describes a significant improvement in the performance of a resonance isolator in the 35-Gc/s frequency region utilizing chemically deposited ferrite films. The performance of a millimeter resonance isolator utilizing single-layer ferrite films was reported earlier. In the device described here an improvement in the isolator performance was achieved by utilizing combinations of Ni and NiZn chemical formulations to form new multilayer ferrite films. A description of the device configuration, isolation characteristics, and modification of previous chemically deposited ferrite film techniques is included.

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Abstracts

Temperature Calibration of Microwave Thermal Noise Sources (Correspondence)

C.T. Stelzried. "Temperature Calibration of Microwave Thermal Noise Sources (Correspondence)." 1965 Transactions on Microwave Theory and Techniques 13.1 (Jan. 1965 [T-MTT]): 128-130.

The theory of microwave thermal terminations is discussed with emphasis on equivalent noise temperature calibrations.



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Graphical Procedures for Finding Matrix Elements for a Lattice Network and a Section of Transmission Line (Correspondence)

H.F. Mathis. "Graphical Procedures for Finding Matrix Elements for a Lattice Network and a Section of Transmission Line (Correspondence)." 1965 Transactions on Microwave Theory and Techniques 13.1 (Jan. 1965 [T-MTT]): 130-132.

Four-terminal networks and two-port junctions can be represented by several different well-known 2 by 2 matrices. Tables relating the elements in the various matrices have been published. Graphical procedures are presented here which may be used to determine the elements in these matrices for a lattice network and a section of transmission line, as shown in Fig. 1.

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Note on Tetrahedral Junction (Correspondence)

J. Helszajn. "Note on Tetrahedral Junction (Correspondence)." 1965 Transactions on Microwave Theory and Techniques 13.1 (Jan. 1965 [T-MTT]): 132-133.

Weiss has described a reactive waveguide switch consisting of a ferrite rod at the junction of two mutually cross-polarized rectangular waveguides, as shown in Fig. 1. When the ferrite rod is unmagnetized, the system represents a transition to cutoff waveguide. When the ferrite rod is longitudinally magnetized, the RF energy is coupled to the crossed waveguide.

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Pulse Power Capacity of Short-Slot Couplers (Correspondence)

L. Young and B.M. Schiffman. "Pulse Power Capacity of Short-Slot Couplers (Correspondence)." 1965 Transactions on Microwave Theory and Techniques 13.1 (Jan. 1965 [T-MTT]): 133-133.

A short-slot sidewall coupler and a short-slot topwall coupler were both tested at S band for their pulse power capacity. Both types of coupler were tested in the 0-dB coupler configuration, which had the practical convenience of requiring only one high-power load.

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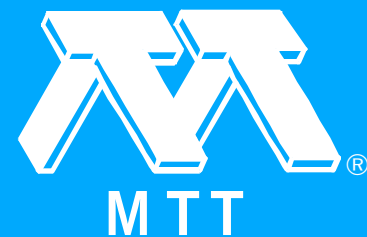


Abstracts

Accurate Measurements for Dynamic Representations of Parametric Amplifier Varactor Diodes (Correspondence)

M.M. Brady. "Accurate Measurements for Dynamic Representations of Parametric Amplifier Varactor Diodes (Correspondence)." 1965 Transactions on Microwave Theory and Techniques 13.1 (Jan. 1965 [T-MTT]): 133-135.

Varactor diode parameter representations useful for describing circuit performance are usually derived from UHF or microwave measurements. Although many measurement methods have been used to date, the two main classes appear to be measurements which result in "static" and "dynamic" diode representations.



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Abstracts

The Characteristic Impedance and Velocity Ratio of Dielectric-Supported Strip Line (Correspondence)

H.E. Green and J.R. Pyle. "The Characteristic Impedance and Velocity Ratio of Dielectric-Supported Strip Line (Correspondence)." 1965 Transactions on Microwave Theory and Techniques 13.1 (Jan. 1965 [T-MTT]): 135-137.

In its most practical form, strip line is made with a center conductor which, consists of two thin strips of copper of the desired width on each of the two faces of a printed circuit board. Without exception known to the authors, all published theoretical results for the characteristic impedances of such lines involve the neglect of the dielectric board, i.e., the configuration analyzed is that having a center conductor of two thin unsupported strips. The only data published to date in which the effect of the supporting card is included have been experimental.



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Radiation from Rectangular Waveguide with Ferrite Slabs (Correspondence)

T.M. Chien and H. Unz. "Radiation from Rectangular Waveguide with Ferrite Slabs (Correspondence)." 1965 Transactions on Microwave Theory and Techniques 13.1 (Jan. 1965 [T-MTT]): 137-138.

The problem of radiation from a rectangular waveguide completely filled with transversely magnetized ferrite has been discussed by Tyras and Held. The fundamental mode in a rectangular waveguide containing two transversely magnetized symmetrical slabs placed against the side walls has been discussed by Lax and Button, and numerous references to this subject have been made by several other authors. In the present communication we consider the radiation from the open end of a rectangular waveguide with two, ferrite slabs of different thickness placed against the side walls, magnetized by two, different static transverse magnetic fields, as shown in Fig. 1.

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Abstracts

Microwave and High-Frequency Calibration Services of the National Bureau of Standards-- Part IV (Correspondence)

"Microwave and High-Frequency Calibration Services of the National Bureau of Standards--Part IV (Correspondence)." 1965 Transactions on Microwave Theory and Techniques 13.1 (Jan. 1965 [T-MTT]): 138-139.

This is the fourth of a series of presentations on microwave and high-frequency calibration services of the National Bureau of Standards which began in the July 1964 issue of these Transactions. (See the July issue for a more complete introduction.) Included in this issue are the services for voltage, frequency stability, and cavity wavemeter calibrations. This completes the listing of presently available microwave and high-frequency calibration services of NBS. It is expected that the announcement of additional calibration services will be published in a similar manner in the Transactions as they become available. As in previous installments, following the listing of calibration services is a series of charts (Figs. 1 and 2) indicating the magnitudes of quantities, the frequency range, and the overall estimated accuracy of the calibrations performed.



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Wave Propagation in Sinusoidally Stratified Dielectric Media (Comments)

R.A. Kallas, T. Tamir, H.C. Wang and A.A. Oliner. "Wave Propagation in Sinusoidally Stratified Dielectric Media (Comments)." 1965 Transactions on Microwave Theory and Techniques 13.1 (Jan. 1965 [T-MTT]): 139-141.

Great interest has been evidenced in a recent paper by Tamir and his associates with regard to the problems involved in solving the equations which govern wave propagation in a waveguide containing an inhomogeneous dielectric media with a sinusoidal variation of the permittivity in the longitudinal direction. In this communication, an alternative approach to the solution of the equations is presented in which the vector wave equation method, as described by Hansen and Stratton, is followed. In conjunction with this approach, the Hertzian vector technique is employed in a particularly appealing and satisfying manner. The usefulness of the methodology described is more than adequately demonstrated.

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Abstracts

Wave Propagation in Sinusoidally Stratified Dielectric Media (Correction)

R.A. Tamir, H.C. Wang and A.A. Oliner. "Wave Propagation in Sinusoidally Stratified Dielectric Media (Correction)." 1965 Transactions on Microwave Theory and Techniques 13.1 (Jan. 1965 [T-MTT]): 141-141.

On pp. 331-332 the term $\kappa_{u/d}$ should be replaced by its inverse, i.e., $\pi_{u/d}$, in the numerator only of (50), (54), and (55).



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Abstracts

An Exact Method for Synthesis of Microwave Band-Stop Filters (Jan. 1965 [T-MTT] Addendum)

E.G. Cristal. "An Exact Method for Synthesis of Microwave Band-Stop Filters (Jan. 1965 [T-MTT] Addendum)." 1965 Transactions on Microwave Theory and Techniques 13.1 (Jan. 1965 [T-MTT]): 141-141.

The title of Table VII (page 380) should read: h Values for 0.01-dB Ripple Chebyshev Filters Having $h_{\text{sub } 0} /$ and $h_{\text{sub } n+1} / = 1.0$ and Various Stop-Band 0.01-dB Fractional Bandwidths w .



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Abstracts

Coupled Circular Cylindrical Rods Between Parallel Ground Planes (Correction)

E.G. Cristal. "Coupled Circular Cylindrical Rods Between Parallel Ground Planes (Correction)." 1965 Transactions on Microwave Theory and Techniques 13.1 (Jan. 1965 [T-MTT]): 141-141. Page 429, (5) should read: $C_{\text{m}} = \frac{1}{4}(C_0 - C_e)$.



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H.M. Altschuler, M. Cohn, R.L. Comstock, J.W. Duncan, A.F. Eikenberg, W.P. Ernst, H. Farber, C.E. Fay, R.V. Garver, E.L. Johansen, M. Klinger, A. Korpel, J. Krokstad, J.B. Linker, Jr., E.J. Malloy, A.V. McDaniel, Jr., R.L. Moynihan, F.A. Olson, L.I. Parad, H.J. Peppiatt, J.P. Quine, V. Ramaswamy, M. Sucher, J.A. Weiss, R.J. Wenzel and J.R. Yaeger. "Contributors (Jan. 1965 [T-MTT])." 1965 Transactions on Microwave Theory and Techniques 13.1 (Jan. 1965 [T-MTT]): 142-145.



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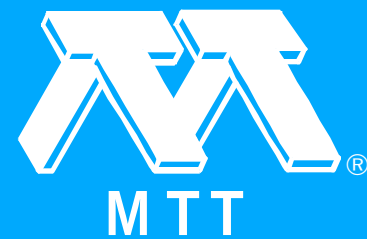
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Call for Papers - 1965 Conference on Components and Materials used in Electronics Engineering (Jan. 1965 [T-MTT])

"Call for Papers - 1965 Conference on Components and Materials used in Electronics Engineering (Jan. 1965 [T-MTT])." 1965 Transactions on Microwave Theory and Techniques 13.1 (Jan. 1965 [T-MTT]): 146-146.



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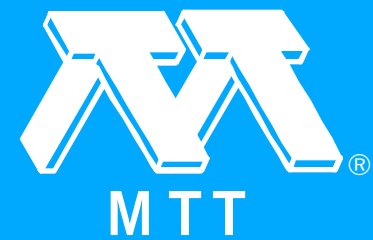
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Membership Application (Jan. 1965 [T-MTT])

"Membership Application (Jan. 1965 [T-MTT])." 1965 Transactions on Microwave Theory and Techniques 13.1 (Jan. 1965 [T-MTT]): 147-147.



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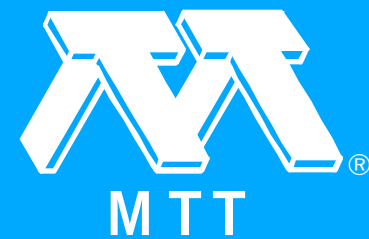
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Front Cover (Mar. 1965 [T-MTT])

"Front Cover (Mar. 1965 [T-MTT])." 1965 Transactions on Microwave Theory and Techniques 13.2 (Mar. 1965 [T-MTT]): f1-f2.



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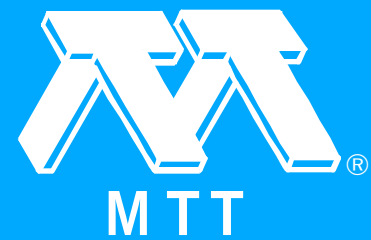
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"Table of Contents (Mar. 1965 [T-MTT])." 1965 Transactions on Microwave Theory and Techniques 13.2 (Mar. 1965 [T-MTT]): 149-149.



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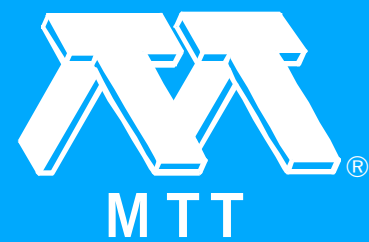
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Current-Pumped Abrupt-Junction Varactor Power-Frequency Converters

B.S. Perlman. "Current-Pumped Abrupt-Junction Varactor Power-Frequency Converters." 1965 Transactions on Microwave Theory and Techniques 13.2 (Mar. 1965 [T-MTT]): 150-161.

This paper presents equations and design curves for a noninverting frequency converter which will enable the engineer to design efficient, high-level parametric devices using abrupt-junction varactors. In addition, the excellent intermodulation characteristic and extremely wide dynamic range (in excess of 140 dB) of the parametric frequency converters enables their use immediately as low-frequency downconverters or microwave upconverters without any deterioration of other parameters, such as noise figure, in system performance. It has been shown that these abrupt-junction diode devices possess the largest known dynamic range, in addition to being relatively spurious free with respect to intermodulation products produced by the diode nonlinearity, intermodulation distortion being generated in the device due only to gain saturation. The design curves also indicate the maximum conversion efficiency possible with a given abrupt-junction diode. An inflection point for 50 per cent conversion efficiency occurs for all diodes. Any additional improvement in pump-to-sideband efficiency greater than 50 per cent gained by adjusting the diode and circuit performance, requires relatively large increases in the diode cutoff frequency and reduction in overall circuit losses. Other design curves include impedance variation with drive powers and the overall limiting output power capability for a given diode. A design example is presented to demonstrate the usefulness of the derived results and design curves. The experimental results obtained with this design have demonstrated a microwave, C band, tunable converter with almost 50 per cent conversion efficiency.



Parametric Amplifier Noise Analysis

D.G. Vice. "Parametric Amplifier Noise Analysis." 1965 Transactions on Microwave Theory and Techniques 13.2 (Mar. 1965 [T-MTT]): 162-167.

The effect of a different value of series resistance associated with the varactor in its imbedding at each of the important frequencies present in a one-port parametric amplifier is analyzed. The modified equations for effective noise temperature, amplifier gain and pump power required thus obtained are compared to experimental values measured on a 4.8 Gc/s parametric amplifier. Finally a simple and precise method for adjusting the amplifier to get close correlation between the measured varactor parameters using Kurokawa's method at signal idler, and pump frequencies and the overall amplifier performance is presented.





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Phase Equalization Problems in a Phased-Array Transmitter

S.I. Rambo and M.G. Gray. "Phase Equalization Problems in a Phased-Array Transmitter." 1965 Transactions on Microwave Theory and Techniques 13.2 (Mar. 1965 [T-MTT]): 167-171.

Current radar systems employing programmed multiple antenna feeds to orient the antenna beam electronically require large numbers of parallel channels operating simultaneously with nearly identical phase-delay characteristics. These channels include active devices such as microwave amplifiers for which phase-delay, as well as gain and power output, must be identical to accomplish high pointing accuracy and maximum power addition. When the system is required to operate over a wide frequency band, all channels must track in phase. This paper describes problems encountered in the development of a prototype transmitter requiring multiple channel phase-delay equality. A new medium power pulsed TWT is described and measurements of its electrical length are discussed. Computer programming which reduced the vast amount of phase information derived from this development is described.

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Transmission-Line Properties of Parallel Strips Separated by a Dielectric Sheet

H.A. Wheeler. "Transmission-Line Properties of Parallel Strips Separated by a Dielectric Sheet." 1965 Transactions on Microwave Theory and Techniques 13.2 (Mar. 1965 [T-MTT]): 172-185.

A transmission line is made of a symmetrical pair of strip conductors, or a single strip and a ground plane, on opposite faces of a sheet of dielectric material. There is computed, to a close approximation, the relations among the dielectric constant of the sheet, the effective dielectric constant of the sheet and the empty space, the shape ratio, and the wave resistance, for the entire range of possible values. These relations are summarized in a graphical chart covering the range of practical interest. The computation is based on conformal mapping of the dielectric boundary on coordinates such that its effect can be most closely evaluated by simple principles. All relations are approximated in terms of ordinary functions (exponential and hyperbolic). Of particular interest is the effective filling fraction of the dielectric material, which depends mainly on the shape ratio and only slightly on the dielectric constant. Explicit formulas are given for analysis or synthesis.

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Abstracts

A Broadbanded Solid-State Microwave Maser Operating at 77.4°K

E.O. Ammann. "A Broadbanded Solid-State Microwave Maser Operating at 77.4°K." 1965 Transactions on Microwave Theory and Techniques 13.2 (Mar. 1965 [T-MTT]): 186-193.

This paper considers several aspects of the problem of obtaining solid-state microwave maser action at 77.4°K. A maser cavity, designed to have a large filling factor, high unloaded Q, and tunability over a two per cent range is described. Using this cavity, a study was made of ruby as a maser material at 77.4°K. An important result of this study is the determination of the optimum Cr/sup +++/ concentration for 77.4°K maser action. A well-known broadbanding technique was applied to the maser to increase its gain-bandwidth product. Two high-Q microwave cavities spaced three-quarters wavelength apart were placed in front of the maser cavity to produce the broadbanding. The experimental results are given, and the usefulness of this technique as a method of improving maser performance is evaluated. The broadbanded maser had a midband gain of 14.5 dB and a bandwidth of 7.5 Mc/s at a signal frequency of 9.3 Gc/s. Approximately 31 watts of pump power at 23.4 Gc/s were required.



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Power Waves and the Scattering Matrix

K. Kurokawa. "Power Waves and the Scattering Matrix." 1965 Transactions on Microwave Theory and Techniques 13.2 (Mar. 1965 [T-MTT]): 194-202.

This paper discusses the physical meaning and properties of the waves defined by [Equation], [Equation] where V_i , and Z_i , are the voltage at and the current flowing into the i th port of a junction and Z_i , is the impedance of the circuit connected to the i th port. The square of the magnitude of these waves is directly related to the exchangeable power of a source and the reflected power. For this reason, in this paper, they are called the power waves. For certain applications where the power relations are of main concern, the power waves are more suitable quantities than the conventional traveling waves. The lossless and reciprocal conditions as well as the frequency characteristics of the scattering matrix are presented. Then, the formula is given for a new scattering matrix when the Z_i 's are changed. As an application, the condition under which an amplifier can be matched simultaneously at both input and output ports as well as the condition for the network to be unconditionally stable are given in terms of the scattering matrix components. Also a brief comparison is made between the traveling waves and the power waves.

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Magnetically Tunable Band-Stop Filters

G.L. Matthaei. "Magnetically Tunable Band-Stop Filters." 1965 Transactions on Microwave Theory and Techniques 13.2 (Mar. 1965 [T-MTT]): 203-212.

Techniques for the design of magnetically tunable band-stop filters using ferrimagnetic garnet resonators (such as yttrium-iron-garnet spheres) are presented. Design for prescribed response, starting from a low-pass lumped-element prototype filter is outlined. The filter structure consists of a strip line or waveguide with garnet spheres mounted at intervals of approximately a one-quarter-wavelength or three-quarters-wavelength, at the center of the tuning range. Tuning is achieved by varying a biasing magnetic field. Techniques for enhancing the coupling to the garnet-sphere resonators are discussed, and the results of four trial designs which verify the theory are presented. The band-stop filter techniques are shown to also provide a very simple means for measuring the ferrimagnetic resonance linewidth ΔH of garnet spheres.

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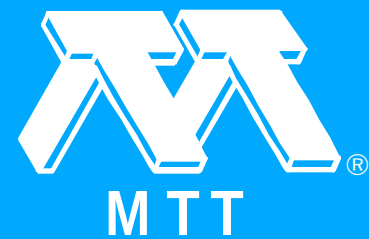
A Low-Noise and Wide-Band Esaki Diode Amplifier with a Comparatively High Negative Conductance Diode at 1.3 Gc/s

J. Hamasaki. "A Low-Noise and Wide-Band Esaki Diode Amplifier with a Comparatively High Negative Conductance Diode at 1.3 Gc/s." 1965 Transactions on Microwave Theory and Techniques 13.2 (Mar. 1965 [T-MTT]): 213-223.

This paper discusses the stability problem, output power, saturation level, and noise figure of Esaki diode amplifiers, and describes design considerations of the broadband circulator type amplifier with a large negative conductance diode. An experimental amplifier with a diode which has a negative resistance of -25 ohms is also described. The amplifier has a 3 dB bandwidth of 20 per cent, 18 dB gain, and a 3.6 dB noise figure including 0.3 dB insertion loss of the circulator. The output level for which the gain is 1 dB lower than the small signal gain is -17 dBm. These experimental results are in fair agreement with those estimated theoretically.

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An Adjustable Microwave Delay Equalizer

K. Woo. "An Adjustable Microwave Delay Equalizer." 1965 Transactions on Microwave Theory and Techniques 13.2 (Mar. 1965 [T-MTT]): 224-232.

An adjustable microwave delay equalizer is described and the feasibility of using it to provide large amounts of delay over a wide band around 11.2 Gc/s is demonstrated. The equalizer is composed of a metallic rod slanted in a circular waveguide which is fed at one end with a shunt tee connection to incoming rectangular waveguide. An experimental model 1.5 m long provides a linear delay of the order of 45 ns over the 680-Mc/s band from 10.80 to 11.48 Gc/s. The bandwidth, center frequency, and shape of delay characteristic are all adjustable. A similar model can be used for equalization at other frequencies. Theoretical estimation shows that at 6 Gc/s a total delay of 24 ns over a band of 1.2 Gc/s may be achieved with a structure 1 m long.

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High Power, p-i-n Diode Controlled, Microwave Transmission Phase Shifters

J.F. White. "High Power, p-i-n Diode Controlled, Microwave Transmission Phase Shifters." 1965 Transactions on Microwave Theory and Techniques 13.2 (Mar. 1965 [T-MTT]): 233-242.

An iterative circuit, diode, transmission phase shifter is discussed, having a canonic form that consists, of a length of transmission line symmetrically loaded at its ends by small susceptances whose values are diode controllable. The spacing of the susceptances is chosen so that their reflections are nearly mutually canceling, (about a quarter wavelength if equal magnitude, opposite sign susceptances are used). A change of electrical length of the section of 23° , in principle, is obtainable with a maximum input VSWR of 1.04. Eight section, experimental circuits yielded 180° total phase shift with less than one decibel of loss in the L and S bands and peak RF power capability to 15 kilowatts. Operation to 140 kilowatts peak power was achieved with reduced phase shift per section. The transmission phase shifter is believed to be well suited as a phase control element for beam steering of array antennas.



Abstracts

A Note on the Phase Velocity in Continuously Loaded Coaxial Cables (Correspondence)

D.B. Large. "A Note on the Phase Velocity in Continuously Loaded Coaxial Cables (Correspondence)." 1965 Transactions on Microwave Theory and Techniques 13.2 (Mar. 1965 [T-MTT]): 243-243.

The loaded coaxial cable pictured in Fig. 1 has been analyzed from a transmission line viewpoint by Prache and Raisbeck. This approach involves finding the equivalent (static) inductance L and capacitance C per unit length of line and equating the dominant-mode phase velocity to $(L C)^{-1/2}$.



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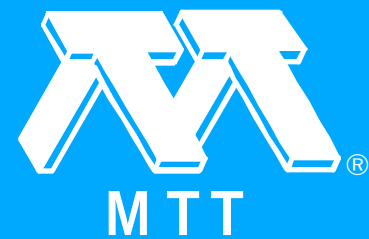
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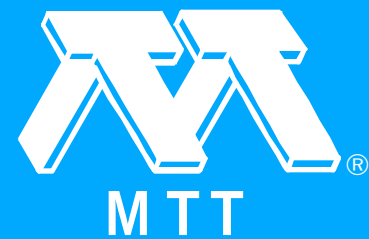
An Extension to the High Loss Region of the Solution of the Confocal Fabry-Perot Resonator Integral Equation (Correspondence)

K.E. Lonngren and J.B. Beyer. "An Extension to the High Loss Region of the Solution of the Confocal Fabry-Perot Resonator Integral Equation (Correspondence)." 1965 Transactions on Microwave Theory and Techniques 13.2 (Mar. 1965 [T-MTT]): 243-244.

Recently two papers have appeared that relate the fields in confocal Fabry-Perot resonators to oblate spheroidal coordinates. Zimmerer states ". . . the spheroidal surfaces within the resonator are surfaces of constant phase and the hyperboloids are surfaces of constant amplitude." Vainshtein shows that starting from an oblate spheroidal resonator and assuming that the propagation is directed largely along the z axis (see Fig. 1), one can determine the amplitude distribution along a resonator plate. The result he obtained agrees very well with that obtained previously by Goubau and Schwering who derived this result more directly from Maxwell's equations.

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Application of Barium Titanate Compositions to Parametric Amplification (Correspondence)

S.N. Das. "Application of Barium Titanate Compositions to Parametric Amplification (Correspondence)." 1965 Transactions on Microwave Theory and Techniques 13.2 (Mar. 1965 [T-MTT]): 245-247.

This correspondence reports results of investigations of some of the problems associated with the application of ferroelectrics to microwave parametric amplification. The design of such an amplifier requires a knowledge of the variation of the permittivity of the material as a function of the electric field at microwave frequencies. Some information on the high frequency properties can be obtained by small signal incremental permittivity measurements at microwave frequencies. The material was used in the form of a cylindrical rod as this was convenient for preparation. The relative permittivity of a ferroelectric rod, placed in the center of a rectangular waveguide, and its variation with the applied dc field can be calculated from the measured values of the normalized reactance of the rod, the formulas for which are given by Marcuvitz.

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Abstracts

A Plea for Clarity in Waveguide Designation (Correspondence)

M.M. Brady. "A Plea for Clarity in Waveguide Designation (Correspondence)." 1965 Transactions on Microwave Theory and Techniques 13.2 (Mar. 1965 [T-MTT]): 247-250.

Apparently the use of letters to designate waveguide sizes or frequency bands is deeply ingrained in the microwave field. In addition, a number of standardization systems exist such that one may find an amazing number of different numbers and letters to describe a single size of waveguide. It may be noted in passing that the situation is worse for waveguide flanges.



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Abstracts

Measurement of Dispersion Effects on Narrow RF Pulses

F.A. Russo and V.R. Schoep. "Measurement of Dispersion Effects on Narrow RF Pulses." 1965 Transactions on Microwave Theory and Techniques 13.2 (Mar. 1965 [T-MTT]): 250-251.

In an earlier issue of these Transactions, Elliott derived a formula for the degradation of RF pulses due to dispersion in waveguide. This communication describes an experiment conducted to verify his results. An RF pulse generator capable of producing one nanosecond pulse widths was developed to implement the experiment.



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Abstracts

Maximally Flat Bandwidth of Nondegenerate Parametric Amplifier with Double Tuned Signal Circuit and Single Tuned Idler Circuit (Correspondence)

W.P. Connors. "Maximally Flat Bandwidth of Nondegenerate Parametric Amplifier with Double Tuned Signal Circuit and Single Tuned Idler Circuit (Correspondence)." 1965 Transactions on Microwave Theory and Techniques 13.2 (Mar. 1965 [T-MTT]): 251-252.

The advantages of an amplifier employing a single tuned idler circuit have been discussed by DeJager. Using a single tuned idler, circuit, DeJager has calculated the maximum bandwidth obtainable with a single tuned signal circuit and also the maximum limiting flat bandwidth.



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Capacitively-Coupled Stub Filter (Correspondence)

B.M. Schiffman. "Capacitively-Coupled Stub Filter (Correspondence)." 1965 Transactions on Microwave Theory and Techniques 13.2 (Mar. 1965 [T-MTT]): 253-254.

A method of designing an easily realized narrow-band band-stop filter by modifying the exact design procedure is described herein. Although this design method is not exact, it yields a response curve that follows the desired response over a broad band. The modification consists of replacing each open-circuited high-impedance shunt stub with a short-circuited capacitively coupled stub of medium impedance, i.e., the same order of magnitude as the connecting line impedance, and slightly less than $\lambda/4$ in length, as shown in Fig. 1. The stubs are thus easily realized in coaxial line or strip-line, whereas by the exact method they would (in the case of very narrow-band filters) be difficult to realize unless coupled-line sections were used. A modified three-stub filter having ideally a five per cent stop-band width and 0.1-dB ripple in the pass-band was analyzed. The response in the frequency range 0 to $1.5f_0$ was found to deviate only a negligible amount from the exact response, while the filter was usable over a still broader range. This is clearly illustrated in Fig. 2 which shows the computed response of the three-stub exact-design filter (solid lines) and the computed response of the capacitively-coupled stub filter (dashed lines). In Fig. 2(b), the attenuation loss in the first stop band near $\omega/\omega_0 = 1$ for the exact-design case is similar to the curve for the capacitively-coupled-stub filter; therefore only a solid line is shown in that region.



Abstracts

Coupled Rods Between Ground Planes (Correspondence)

P. Vadopalas and E.G. Cristal. "Coupled Rods Between Ground Planes (Correspondence)." 1965 Transactions on Microwave Theory and Techniques 13.2 (Mar. 1965 [T-MTT]): 254-255.

In a recent paper, Cristal provided graphs of self- and mutual-capacitances (C_{self} and C_{mutual}) of parallel round conductors between two ground planes as a function of rod separation distance s/b , with rod diameter d/b as a parameter.



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Natural Resonant Frequencies of Microwave Dielectric Resonators (Correspondence)

H.Y. Yee. "Natural Resonant Frequencies of Microwave Dielectric Resonators (Correspondence)." 1965 Transactions on Microwave Theory and Techniques 13.2 (Mar. 1965 [T-MTT]): 256-256.

The application of dielectric resonators are currently of considerable interest in microwave techniques. The design of a dielectric resonator; as in the case of a metal cavity, depends on its natural resonant frequencies. Since exact solutions of dielectric resonators having shapes other than a sphere or a doughnut cannot be rigorously computed, approximate techniques must be adopted to solve the problem. Two types of resonant modes can be excited in a dielectric resonator, namely, the H mode and the E mode. The H mode is defined as the mode which has a large normal component of magnetic field at the boundary surfaces; and the E mode is the mode with no predominant normal component of magnetic field at the surfaces.

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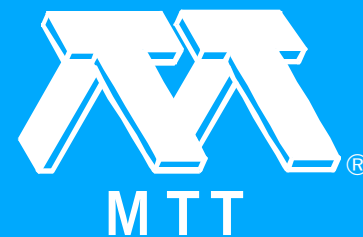


Abstracts

A Note on Varactor Frequency Tripler (Correspondence)

C.L. Chao. "A Note on Varactor Frequency Tripler (Correspondence)." 1965 Transactions on Microwave Theory and Techniques 13.2 (Mar. 1965 [T-MTT]): 256-258.

Several papers in the past ten years have considered analysis of harmonic generators with a nonlinear reactance. The most comprehensive work on the varactor multipliers is by Penfield and Rafuse, in which a detailed analysis of the frequency tripler has been made using abrupt-junction varactors. Leonard has made a detailed analysis of varactor frequency doublers to predict the power and efficiency for non-linearities ranging from graded-junction to hyperabrupt-junction varactors.



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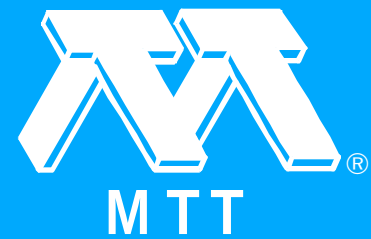


Abstracts

Intrinsic Attenuation (Correction)

R.W. Beatty. "Intrinsic Attenuation (Correction)." 1965 Transactions on Microwave Theory and Techniques 13.2 (Mar. 1965 [T-MTT]): 258-258.

In the above paper, on page 180, (4.) should have read:



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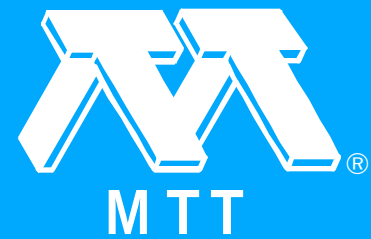


Abstracts

Electromagnetic Wave Propagation in Lossy Ferrites (Correction)

F.J. Rosenbaum. "Electromagnetic Wave Propagation in Lossy Ferrites (Correction)." 1965 Transactions on Microwave Theory and Techniques 13.2 (Mar. 1965 [T-MTT]): 258-258.

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



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Abstracts

Internal Reflection in Dielectric Prisms (Correction)

R.G. Fellers and J. Taylor. "Internal Reflection in Dielectric Prisms (Correction)." 1965 Transactions on Microwave Theory and Techniques 13.2 (Mar. 1965 [T-MTT]): 258-258.

In the above, on page 584, the membership status of the authors are incorrect. Dr. Fellers is a Fellow and Dr. Taylor is a Senior Member of IEEE:



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Contributors (Mar. 1965 [T-MTT])

E.O. Ammann, M.G. Gray, J. Hamasaki, K. Kurokawa, G.L. Matthaei, B.S. Perlman, S.I. Rambo, D.G. Vice, H.A. Wheeler, J.F. White and K. Woo. "Contributors (Mar. 1965 [T-MTT])." 1965 Transactions on Microwave Theory and Techniques 13.2 (Mar. 1965 [T-MTT]): 259-260.



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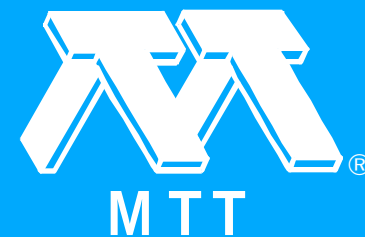
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Abstracts

1965 Physics of Quantum Electronics Conference (Announcements) (Mar. 1965 [T-MTT])

"1965 Physics of Quantum Electronics Conference (Announcements) (Mar. 1965 [T-MTT])."
1965 Transactions on Microwave Theory and Techniques 13.2 (Mar. 1965 [T-MTT]): 261-261.



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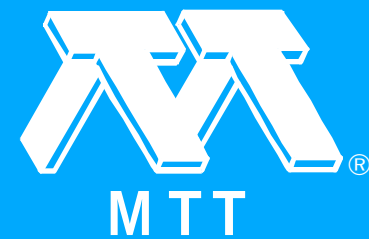
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Selected Microwave Papers (Mar. 1965 [T-MTT])

"Selected Microwave Papers (Mar. 1965 [T-MTT])." 1965 Transactions on Microwave Theory and Techniques 13.2 (Mar. 1965 [T-MTT]): 262-262.



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1965 G-MTT Symposium (Mar. 1965 [T-MTT])

"1965 G-MTT Symposium (Mar. 1965 [T-MTT])." 1965 Transactions on Microwave Theory and Techniques 13.2 (Mar. 1965 [T-MTT]): 263-266.



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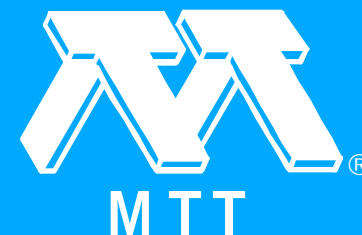
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Symposium Registration Form (Mar. 1965 [T-MTT])

"Symposium Registration Form (Mar. 1965 [T-MTT])." 1965 Transactions on Microwave Theory and Techniques 13.2 (Mar. 1965 [T-MTT]): 266-266.



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Membership Application (Mar. 1965 [T-MTT])

"Membership Application (Mar. 1965 [T-MTT])." 1965 Transactions on Microwave Theory and Techniques 13.2 (Mar. 1965 [T-MTT]): 267-267.



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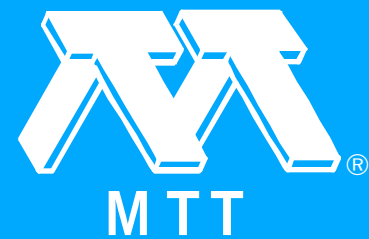
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Characteristic Impedances of Generalized Rectangular Transmission Lines

H. Guckel. "Characteristic Impedances of Generalized Rectangular Transmission Lines." 1965 Transactions on Microwave Theory and Techniques 13.3 (May 1965 [T-MTT]): 270-274.

The impedance of the generalized strip transmission line is computed by variational methods. The use of an upper bound and lower bound approximation yields an average impedance as well as a known maximum error. The one-dielectric microstrip line is treated as a limiting case. Losses are considered. Results include those problems which have been solved elsewhere by conformal mapping techniques as special cases.

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Multiplicity Line in Cascade Transmission Synthesis--Part I

H. Seidel and J. Rosen. "Multiplicity Line in Cascade Transmission Synthesis--Part I." 1965 Transactions on Microwave Theory and Techniques 13.3 (May 1965 [T-MTT]): 275-283.

The synthesis of a stepped equal-length transmission line structure to a given insertion loss function sometimes leads to a multiplicity of untrivially related solutions. The philosophy of synthesis is explored to understand this lack of uniqueness and a new statement of sufficiency and necessity of synthesis is developed based only on an insertion loss statement. The conditions are developed for nonuniqueness to occur and it is observed that these conditions are particularly prevalent in transmission line couplers. It is precisely the nonuniqueness of couplers that accounts for both the asymmetric and symmetric realizations. The symmetric coupler is generally the more difficult of the two to design and both exact and approximate methods of design are given in this case.

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Direct Synthesis of Band-Pass Transmission Line Structures

H.J. Carlin and W. Kohler. "Direct Synthesis of Band-Pass Transmission Line Structures." 1965 Transactions on Microwave Theory and Techniques 13.3 (May 1965 [T-MTT]): 283-297.

Realizable band-pass (zero of transmission, i.e., infinite loss, at dc) equiripple gain functions are constructed which permit exact physical realization of systems consisting of cascaded lines and stubs. The problem of the realization of a prescribed load resistance is solved when a dc zero of transmission is present due to a shunt short-circuiting stub. The exact limits of realizable load resistance are given for equiripple band-pass gain functions and a straight-forward method is presented to synthesize any desired value of load between the predetermined limits. The basis of the synthesis technique is the choice of location of the shunt stub in the cascaded chain.

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Transverse Magnetic Wave Propagation in Sinusoidally Stratified Dielectric Media

C. Yeh, K.F. Cafsey and Z.A. Kaprielian. "Transverse Magnetic Wave Propagation in Sinusoidally Stratified Dielectric Media." 1965 Transactions on Microwave Theory and Techniques 13.3 (May 1965 [T-MTT]): 297-302.

The problem of the propagation of TM waves in a sinusoidally stratified dielectric medium is considered. The propagation characteristics are determined from the stability diagram of the resultant Hill's equation. Numerical results show that the stability diagrams for Hill's equation and those for Mathieu's equation are quite different. Consequently, the dispersion properties of TM waves and TE waves in this stratified medium are also different. Detailed dispersion characteristics of TM waves in an infinite stratified medium and in waveguides filled longitudinally with this stratified material are obtained.

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Abstracts

An Experimental Investigation of a Two-Slot Transmission Line on Nonplanar Surfaces

R.W. Burton and R.W.P. King. "An Experimental Investigation of a Two-Slot Transmission Line on Nonplanar Surfaces." 1965 Transactions on Microwave Theory and Techniques 13.3 (May 1965 [T-MTT]): 303-306.

The two-slot transmission line, which is the dual of a two-strip line when both lines lie in a plane, is studied experimentally when the metal sheet into which it is cut is bent through angles up to 90° . It is found that the bent two-slot line is substantially the dual of a similarly bent two-strip line including a complementary reactive junction network at the bend.



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Side-Wall-Coupled, Strip-Transmission-Line Magnetically Tunable Filters Employing Ferrimagnetic YIG Resonators

P.S. Carter. "Side-Wall-Coupled, Strip-Transmission-Line Magnetically Tunable Filters Employing Ferrimagnetic YIG Resonators." 1965 Transactions on Microwave Theory and Techniques 13.3 (May 1965 [T-MTT]): 306-315.

This paper describes a new type of band-pass filter configuration for multiple-coupled-resonator magnetically tunable microwave filters. For two or more resonators, this configuration, which employs a coupling slot in the common side wall between two strip-transmission lines, results in the smallest possible air gap and, therefore, the least amount of leakage or fringing flux, and the smallest ampere-turns requirement on the bias magnet. Response curves including pass band insertion-loss, bandwidth, stop-band rejection, spurious response levels and bandwidths, VSWR, and the effect of temperature on these characteristics are presented for a two-resonator band-pass filter of the type employing YIG resonators and making use of a ferrite core electromagnet to obtain the bias field. Performance data are also given for an experimental side-wall-coupled three-resonator filter.

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General Theory and Design of Optimum Quarter-Wave TEM Filters

M.C. Horton and R.J. Wenzel. "General Theory and Design of Optimum Quarter-Wave TEM Filters." 1965 Transactions on Microwave Theory and Techniques 13.3 (May 1965 [T-MTT]): 316-327.

The exact synthesis and design of a broad class of quarter-wave TEM mode filters is presented in a three-step procedure. The theory is applicable to all microwave filter forms consisting entirely of a cascade of quarter-wave lines, quarter-wave stubs, and coupled quarter-wave lines. The exact design of many conventional filter forms that heretofore could only be designed using approximate methods is possible using the techniques and functions described. General approximating functions that give the "best" transmission response in a Butterworth or Chebyshev sense are derived. The use of a maximum number of available singularities to augment the filter skirt response leads to a minimum element filter termed "optimum multiple." An optimum multipole design insures the "best" possible response for the minimum element and all corresponding redundant element networks. The designer has the freedom of introducing sufficient redundancy to obtain a design that is practical to construct, but which still realizes the optimum response. Judicious choice of network form often results in improved performance and reduced size in comparison with many conventional filter forms. Design procedures are presented that allow the practical realization of distributed filter networks in the form of quarter-wave lines. A design example and experimental results are given to confirm the theory.

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Multiplexer Channel-Separating Units Using Interdigital and Parallel-Coupled Filters

G.L. Matthaei and E.G. Cristal. "Multiplexer Channel-Separating Units Using Interdigital and Parallel-Coupled Filters." 1965 Transactions on Microwave Theory and Techniques 13.3 (May 1965 [T-MTT]): 328-334.

Design theory is presented for strip-line multiplexer channel-separating units which have constant-resistance input impedances so that many units can be cascaded without reflection effects. Each channel unit consists of an interdigital band-pass filter and a band-stop filter which uses parallel-coupled resonators. In order to obtain the desired constant-resistance input impedance, both filters are designed from singly loaded, maximally flat, low-pass prototype filters. A trial design was worked out and constructed so as to have five per cent bandwidth for the separated channel. Excellent agreement between theory and experiment was obtained.

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Broadband Strip-Transmission Line Y-Junction Circulators

J.W. Simon. "Broadband Strip-Transmission Line Y-Junction Circulators." 1965 Transactions on Microwave Theory and Techniques 13.3 (May 1965 [T-MTT]): 335-345.

Broadband circulators have been developed which operate below resonance and cover octave bandwidths in the frequency regions 0.6-8.0 Gc. The interrelationship of voltage standing-wave ratio (VSWR) and isolation between various ports is established without imposing symmetry. The fact that building a three-port circulator is essentially a matching process is used as a basis for a successful experimental development procedure. Empirically determined criteria for broadbanding are reported with particular emphasis placed on the discussion of optimizing saturation magnetization, linewidth, strip-transmission line parameters, and magnetic biasing field. The importance of having a ferrite with low dielectric loss tangent is also discussed. The empirical data are considered in light of theoretical work done in this laboratory and in light of the papers by Bosma.

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Abstracts

Generalized Plots of Mode Patterns in a Cylindrical Dielectric Waveguide Applied to Retinal Cones

G. Biernson and D.J. Kinsley. "Generalized Plots of Mode Patterns in a Cylindrical Dielectric Waveguide Applied to Retinal Cones." 1965 Transactions on Microwave Theory and Techniques 13.3 (May 1965 [T-MTT]): 345-356.

Generalized curves are presented which describe the characteristics of the 12 lowest cutoff-frequency modes of an electromagnetic wave propagating down an infinite lossless dielectric rod, surrounded by an infinite lossless medium of lower dielectric constant. These curves were developed by a computer study particularly to analyze the optical mode patterns generated within the photosensitive portions of the cones of the retina. However, they should also be particularly useful in the study of fiber optics and dielectric microwave antennas.



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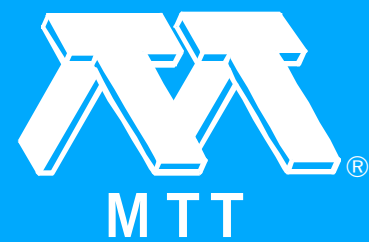
Dispersion of Very Short Microwave Pulses in Waveguide

M. Ito. "Dispersion of Very Short Microwave Pulses in Waveguide." 1965 Transactions on Microwave Theory and Techniques 13.3 (May 1965 [T-MTT]): 357-364.

A very short carrier pulse propagating in waveguide is subject to dispersion which causes distortion of both the envelope and the carrier wave of the pulse. The results of a stationary phase analysis of the problem are presented and results of experimental work at X band are described. The spectral separation property of the dispersive line which enables it to operate as an elementary spectrum analyzer are discussed and experimental evidence demonstrating this property is presented.

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The Solution of Guided Waves in Inhomogeneous Anisotropic Media by Perturbation and Variational Methods

G.J. Gabriel and M.E. Brodwin. "The Solution of Guided Waves in Inhomogeneous Anisotropic Media by Perturbation and Variational Methods." 1965 Transactions on Microwave Theory and Techniques 13.3 (May 1965 [T-MTT]): 364-370.

The Schroedinger perturbation theory is extended to the boundary value problems of guided electromagnetic waves in cylindrical structures containing inhomogeneous, anisotropic, dissipative media. A general variational principle, which reduces to existing restricted forms valid for nondissipative media, is also formulated. These approximation methods evolve in a unified manner from the eigenvalue formulation of Maxwell's equations wherein the wave numbers are the eigenvalues of a linear operator. The properties of the media are restricted only by the requirement that they be independent of the axial coordinate. Perturbation of the backward wave is considered and the condition for nonreciprocal waveguides is stated.

Modification of the perturbation method for application to gyrotropic media is outlined and it is indicated that convergence of the perturbation terms is improved in those media, such as the plasma and semiconductor, which permit a Taylor expansion of the susceptibility tensor in powers of the external field. Two specific examples, whose exact solutions are known, are included to illustrate the application.





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Microwave Frequency Translator

J.S. Jaffe and R.C. Mackey. "Microwave Frequency Translator." 1965 Transactions on Microwave Theory and Techniques 13.3 (May 1965 [T-MTT]): 371-378.

A stepped phase-shift approach, employing semiconductor switching techniques in waveguide, is used to achieve frequency translation at microwave frequencies. Stepped phase shift is employed to approximate a continuous or ideal sawtooth phase shift. It has been shown by Fourier analysis that three is the minimum number of phase steps required to achieve frequency translation with suppression of the carrier and first symmetrical sideband. A tunable device using microwave switching diodes in a single port Y junction is described. The diodes progressively switch three lengths of waveguide into the circuit establishing three phase steps. A ferrite circulator is used to create a two port device and a modulator supplies proper diode biases and switching logic. Carrier suppression of greater than 30 dB and first symmetrical sideband suppression of greater than 20 dB was observed; other sideband amplitudes are predictable. A conversion efficiency of -6 dB including the circulator loss was measured and the bandwidth for 20 dB carrier suppression varies from almost one per cent to three per cent, depending on other suppression criteria.

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Abstracts

Wide-Band Rectangular to Circular Waveguide Mode and Impedance Transformer (Correspondence)

S. Stuchly and A. Kraszewski. "Wide-Band Rectangular to Circular Waveguide Mode and Impedance Transformer (Correspondence)." 1965 Transactions on Microwave Theory and Techniques 13.3 (May 1965 [T-MTT]): 379-380.

Transformers connecting rectangular waveguides to circular waveguides are widely used in transmission systems, aerial components, ferrite devices, and measuring instruments. Conventional transitions such as linear tapers or metal and dielectric transformers provide satisfactory matching within a frequency band of a maximum of 10 or 15 per cent only.



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Abstracts

A Magnetic Loop, Diode Detector Compatible with Microwave and Beam Waveguides (Correspondence)

J.E. Degenford, J.R. Baird and E. Yamashita. "A Magnetic Loop, Diode Detector Compatible with Microwave and Beam Waveguides (Correspondence)." 1965 Transactions on Microwave Theory and Techniques 13.3 (May 1965 [T-MTT]): 380-382.

Improved detector performance is a common objective in any communication system. This is particularly true of the millimeter and submillimeter region where the available signals are weak.



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Some Experimental Results on the X-band Junction Circulator (Correspondence)

A. Kraszewski. "Some Experimental Results on the X-band Junction Circulator (Correspondence)." 1965 Transactions on Microwave Theory and Techniques 13.3 (May 1965 [T-MTT]): 382-383.

The general trend in the development of junction circulators is to provide a 20 dB isolation over the widest possible frequency band. However, in some special applications, ferrite circulators with higher isolation and low insertion loss are required for narrow bandwidth operation. An example of this is a circulator operating in connection with a parametric amplifier or maser, where the circulator insertion loss should be held small to decrease the inevitable noise.

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Abstracts

A General Proof of Floquet's Theorem (Correspondence)

M.J. Gans. "A General Proof of Floquet's Theorem (Correspondence)." 1965 Transactions on Microwave Theory and Techniques 13.3 (May 1965 [T-MTT]): 384-385.

The purpose of this correspondence is to demonstrate the form of modes which are propagating in periodic structures. Although this form has long been used through an extension of Floquet's theorem for ordinary differential equations with periodic coefficients to modes propagating in periodic electromagnetic structures, its general validity for these modes, which are determined by partial differential equations, has not been demonstrated.



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Abstracts

Field Measurements in a Small Cross Section Guide Loaded With Magnetized Ferrite (Correspondence)

M. Bujatti. "Field Measurements in a Small Cross Section Guide Loaded With Magnetized Ferrite (Correspondence)." 1965 Transactions on Microwave Theory and Techniques 13.3 (May 1965 [T-MTT]): 385-387.

By solving the Maxwell's equations for a rectangular guide partially filled with magnetized ferrite one finds that in particular conditions to be specified later for the geometry and the applied magnetic field only modes with phase velocity directed in one sense can propagate. This is the basis for the so-called thermodynamical paradox. The present work was carried out in order to experimentally investigate the microwave em. field in such a structure and compare the results with the theoretical predictions which we summarize here briefly.



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A Multiplier-Frequency Shifter Suited to Beat Frequency Generators in Microwave Repeaters (Correspondence)

G. Luzzatto. "A Multiplier-Frequency Shifter Suited to Beat Frequency Generators in Microwave Repeaters (Correspondence)." 1965 Transactions on Microwave Theory and Techniques 13.3 (May 1965 [T-MTT]): 388-388.

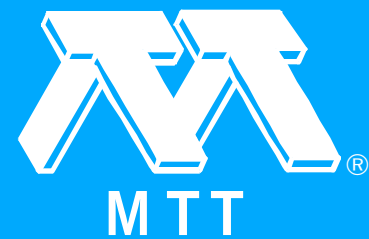
In microwave repeaters, as is well known, a single power source is used for heterodyning the coming signal down to the IF and again up to the transmission frequency, the block diagram being that of Fig. 1. The power source has the correct frequency for the transmitter mixer, and the receiver local oscillator frequency is obtained by its mixing with that of another "frequency difference" crystal controlled oscillator.



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A Four-Port Waveguide Junction Circulator and Effects of Dielectric Loading on its Performance (Correspondence)

G.S. Sidhu and O.P. Gandhi. "A Four-Port Waveguide Junction Circulator and Effects of Dielectric Loading on its Performance (Correspondence)." 1965 Transactions on Microwave Theory and Techniques 13.3 (May 1965 [T-MTT]): 388-389.

This communication describes a fourport X-band waveguide junction circulator. The effects of dielectric loading on its performance are also included. The circulator employs a right angled H-type junction of two X-band waveguides. The junction is loaded with a cylindrical post of R-4 ferrite filling the height of the waveguide. A full height teflon cylinder surrounds the ferrite post (Fig. 1). Hitherto, no four-port waveguide circulator using this ferrite-dielectric configuration has been reported in the literature. The earliest four-port waveguide junction circulator is due to Yoshida. He used a ferrite rod along with a suitable impedance element at the right place in the usual H-type four-port waveguide junction. Davis, Coleman, and Cotter have reported their investigations on four-port waveguide junction circulator in a recent publication. Their circulator also employed a central polarized ferrite post, which was half the waveguide height, on top of which was a cylindrical brass post. In another configuration they used a full height brass post surrounded by a closely fitting ferrite tube, which in turn was surrounded by a dielectric tube.





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Error of Doppler RADAR in Target Speed Determination for Traffic Control (Correspondence)

T.K. Ishii. "Error of Doppler RADAR in Target Speed Determination for Traffic Control (Correspondence)." 1965 Transactions on Microwave Theory and Techniques 13.3 (May 1965 [T-MTT]): 389-390.

The purpose of this correspondence is to show the theoretical error of Doppler radar target speed determination for traffic control due to its carrier frequency deviation. Most Doppler radars for traffic police utilize the tuning fork calibration technique immediately before monitoring the target speed. In this way, the audio-frequency part the Doppler radar is accurately calibrated. The police operator does not usually calibrate the carrier frequency before monitoring speed and no such instruction is usually given to the operator. According to the author's experience and the experience of others an error due to the carrier frequency deviation is often asserted in court. Effect of shorttime frequency fluctuation of the carrier frequency of a Doppler radar was investigated by Brady and found to be insignificant.



Abstracts

Optimum Transducer Coupling Coefficient of a Multiple Reflection Pulsed Microwave Delay Line (Correspondence)

K. Tomiyasu. "Optimum Transducer Coupling Coefficient of a Multiple Reflection Pulsed Microwave Delay Line (Correspondence)." 1965 Transactions on Microwave Theory and Techniques 13.3 (May 1965 [T-MTT]): 390-390.

Delay lines have been made which propagate pulses of sonic waves at microwave frequencies, and transducers are required to convert electromagnetic waves to sonic waves.



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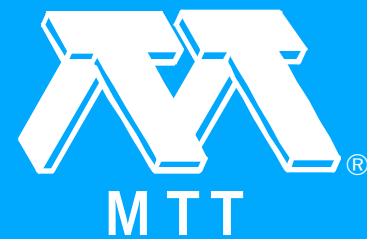
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Abstracts

Contributors (May 1965 [T-MTT])

G. Biernson, M.E. Brodwin, R.W. Burton, H.J. Carlin, P.S. Carter, K.F. Casey, Jr., E.G. Cristal, G.J. Gabriel, H. Guckel, M.C. Horton, M. Ito, J.S. Jaffe, Z.A. Kaprielian, R.W.P. King, D.J. Kinsley, W.E. Kohler, R.C. Mackey, G.L. Matthaei, J. Rosen, H. Seidel, J.W. Simon, R.J. Wenzel and C.W.H. Yeh. "Contributors (May 1965 [T-MTT])." 1965 Transactions on Microwave Theory and Techniques 13.3 (May 1965 [T-MTT]): 391-394.



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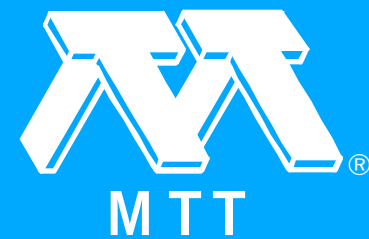
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"Selected Microwave Papers (May 1965 [T-MTT])." 1965 Transactions on Microwave Theory and Techniques 13.3 (May 1965 [T-MTT]): 394-394.



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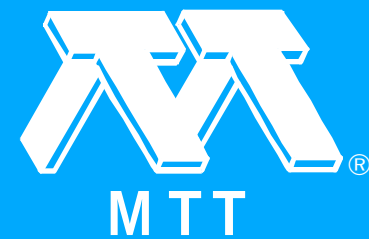
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Abstracts

Call for Papers - Symposium on the Plasma Sheath (May 1965 [T-MTT])

"Call for Papers - Symposium on the Plasma Sheath (May 1965 [T-MTT])." 1965 Transactions on Microwave Theory and Techniques 13.3 (May 1965 [T-MTT]): 395-395.



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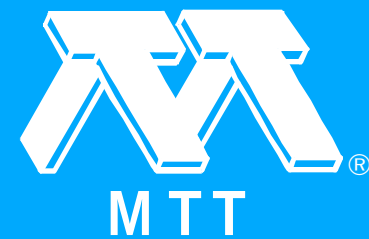
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Abstracts

Call for Papers - Issue on Frequency Stability (May 1965 [T-MTT])

"Call for Papers - Issue on Frequency Stability (May 1965 [T-MTT])." 1965 Transactions on Microwave Theory and Techniques 13.3 (May 1965 [T-MTT]): 395-395.



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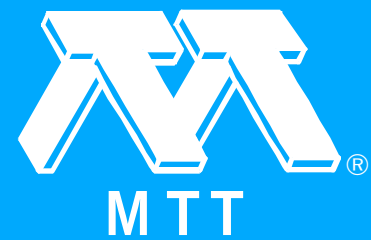
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Abstracts

Membership Application (May 1965 [T-MTT])

"Membership Application (May 1965 [T-MTT])." 1965 Transactions on Microwave Theory and Techniques 13.3 (May 1965 [T-MTT]): 396-396.



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Abstracts

Multiplicity Line in Cascade Transmission Synthesis--Part II

H. Seidel and J. Rosen. "Multiplicity Line in Cascade Transmission Synthesis--Part II." 1965 Transactions on Microwave Theory and Techniques 13.4 (Jul. 1965 [T-MTT]): 398-407.

The first portion of this paper related to an examination of the synthesis of cascade transmission line structures providing a polynomial insertion loss function phrased in terms of the cosine of an electrical length. Certain features of nonuniqueness of the synthesis were uncovered which, particularly in the case of couplers, lead to a flexibility in design. This portion of the paper includes a specific examination of couplers and concludes with some general comments on transmission line synthesis.



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Scattering by an Arbitrary Array of Parallel Wires

J.H. Richmond. "Scattering by an Arbitrary Array of Parallel Wires." 1965 Transactions on Microwave Theory and Techniques 13.4 (Jul. 1965 [T-MTT]): 408-412.

Equations are developed for the scattering pattern of an arbitrary array of parallel wires. The wires are assumed to be infinitely long, perfectly conducting, and very small in diameter in comparison with the wavelength. The incident wave is assumed to be TM with respect to the wire axis, but it may have normal or oblique incidence on the wires. The solution includes the interaction effects among all the wires. The far-field scattering patterns are presented graphically for plane arrays, circular arrays, semicircular arrays, square arrays, and other configurations. If a sufficiently great number of wires is present, it is shown that the scattering pattern approaches that of a solid conducting cylinder of the same cross-section shape as the wire-grid array.

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Electromagnetic Potentials and Field Expansions for Plasma Radiation in Waveguides

R.E. Collin. "Electromagnetic Potentials and Field Expansions for Plasma Radiation in Waveguides." 1965 Transactions on Microwave Theory and Techniques 13.4 (Jul. 1965 [T-MTT]): 413-420.

In order to calculate the radiation from plasmas placed in waveguides it is necessary to know the field produced by arbitrarily moving charged particles in a waveguide. In this paper modal expansions for the vector and scalar potentials due to arbitrarily moving charged particles in a waveguide are derived and provide the extension of the Lienard-Wiechert potentials to a waveguide environment. In addition, for a plasma filled waveguide, a modal expansion is given of the electric field directly in terms of mode coupling with the charge motion. Expressions for the spectral distribution of the radiation are given, both in general and for cyclotron radiation. Some specific results for the H_{10} mode excited in a rectangular guide by cyclotron motion are also presented.

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

D.M. Bolle and G.S. Heller. "Theoretical Considerations on the Use of Circularly Symmetric TE Modes for Digital Ferrite Phase Shifters." 1965 Transactions on Microwave Theory and Techniques 13.4 (Jul. 1965 [T-MTT]): 421-426.

The effectiveness of using magnetized ferrite toroids in circularly cylindrical guides operating in the TE/sub 01/ mode as elements of a digital phase shifter is investigated. The phase of such a device is controlled by reversing the magnetization of individual ferrite toroids. An analysis of the circularly cylindrical guide containing, coaxially, a ferrite tube is presented for circularly symmetric modes. Some results of computations to determine the optimum tube thickness, mean radius, and effect of frequency and changes in the fundamental constants of the material are included.

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Wire-Grid Waveguide Bolometers for Multimode Power Measurement

B.M. Schiffman, L. Young and R.B. Larrick. "Wire-Grid Waveguide Bolometers for Multimode Power Measurement." 1965 Transactions on Microwave Theory and Techniques 13.4 (Jul. 1965 [T-MTT]): 427-431.

A grid of many fine wires connected in parallel, which completely fills the waveguide cross section, is shown to be useful as a multimode waveguide bolometer. Two such grids with wires that are perpendicular to each other are capable of sampling the power in all modes of propagation below some upper frequency limit determined by the wire spacing. In one case the "wires" consisted of metallized glass fibers, and in a second case they consisted of Wollaston wire wrapped around supporting glass fibers. The wire-grid configuration which evolved from the thin-film bolometer of the same effective area is more stable and reproducible than the latter.

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Abstracts

On the Impulse Response of a Coupled-Mode System

C.W. Barnes. "On the Impulse Response of a Coupled-Mode System." 1965 Transactions on Microwave Theory and Techniques 13.4 (Jul. 1965 [T-MTT]): 432-435.

The impulse response is derived for a simple coupled-mode system in which two modes of propagation are passively coupled. It is found that if one mode is driven with an impulse, the response of the other mode consists of a sharply defined RF pulse, of constant maximum amplitude, whose length increases linearly with both time and distance of propagation. The energy of the coupled pulse is found to approach an equilibrium value as the time (or length) of interaction increases without limit.



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A Precise and Sensitive X-Band Reflecto"meter" Providing Automatic Full-Band Display of Reflection Coefficient

F.C. de Ronde. "A Precise and Sensitive X-Band Reflecto"meter" Providing Automatic Full-Band Display of Reflection Coefficient." 1965 Transactions on Microwave Theory and Techniques 13.4 (Jul. 1965 [T-MTT]): 435-440.

A simple waveguide system has been made for the instantaneous measurement of the magnitude of the reflection coefficient as a function of frequency for the 8.2-12.4 Gc band. Reflection coefficients in the range 1 to 0.001 can be measured on linear scales; above 0.01 the error is less than ± 3 per cent, below 0.01 it is estimated to be in the order of ± 5 per cent. By using a long line between the unknown impedance and the two wall-current detectors, which act as measuring probes, an audio-frequency voltage has been obtained which is linearly proportional to the amplitude of the unknown reflection coefficient. A third wall-current detector is used as a leveler. The principle is quite simple and can easily be applied for other frequencies or transmission lines.





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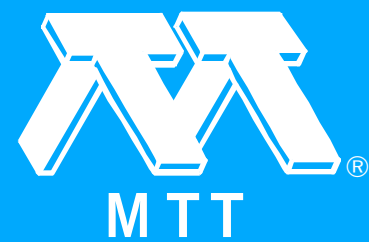
Guided Waves in Moving Media (Jul. 1965 [T-MTT])

J.R. Collier and C.T. Tai. "Guided Waves in Moving Media (Jul. 1965 [T-MTT])." 1965 Transactions on Microwave Theory and Techniques 13.4 (Jul. 1965 [T-MTT]): 441-445.

This paper contains a theoretical study of the guided waves in a moving isotropic medium. The normal modes which can exist in a circular or rectangular wave guides are found by solving the Maxwell-Minkowski Equations subject to the appropriate boundary conditions. By certain transformations of field vectors, it is possible to change the Maxwell-Minkowski Equations into familiar forms such that the method of vector potentials can be applied to derive complete expressions for the field vectors. The results demonstrate that expressions for the propagation constant and the transverse-wave impedance and admittance in stationary media are modified by terms independent of the guide geometry when the media are moving.

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Generalized Solutions for Optical Maser Amplifiers

N. Kumagai and H. Yamamoto. "Generalized Solutions for Optical Maser Amplifiers." 1965 Transactions on Microwave Theory and Techniques 13.4 (Jul. 1965 [T-MTT]): 445-451.

The optical maser amplifier is treated from the transient analysis point of view using the Laplace transform method as opposed to the conventional sinusoidal steady-state analysis that sometimes leads to inconsistent results especially for the region beyond threshold. Firstly, the wave equations are expressed in terms of laplace transforms, and then the generalized solutions for both the transmission and the reflection mode of operation are derived taking the transient terms into account. Finally, the inverse laplace transforms are obtained yielding the generalized solutions in terms of real-time functions. In order to emphasize the point of the argument and also to compare the results of the usual sinusoidal steady-state analysis, use is made of the simplest possible model of a one-dimensional system consisting of three media, air, active medium, and air. An incident coherent transverse electromagnetic wave, which falls normally on the surface of the system, is assumed. The generalized solutions derived agree, in the region below threshold, exactly with that of the sinusoidal steady-state analysis obtained previously by other investigators. However, for the region beyond critical threshold, the generalized solutions indicate that the device goes into a state of self-oscillation with oscillation frequencies that strictly coincide with those of the Fabry-Perot type resonator. Thus, the limitation of applicability of the conventional sinusoidal steady-state analysis is clarified. Some remarks are also given on the design problem of optical maser amplifiers in connection with the transient terms involved.





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Characteristics of Loaded Rectangular Waveguides

Y. Mushiake and T. Ishida. "Characteristics of Loaded Rectangular Waveguides." 1965 Transactions on Microwave Theory and Techniques 13.4 (Jul. 1965 [T-MTT]): 451-457.

Electromagnetic fields of a rectangular waveguide with an arbitrarily loaded slab are theoretically analyzed. Eigenvalues for the transmission modes are presented in the form of universal eigenvalue charts. Electric field distributions in the loaded waveguide are obtained theoretically, and they are compared with the results of measurements. Power attenuation is also discussed, and attenuation charts that give the lowest limitation for the attenuation are shown. As an example of application the attenuation characteristic of waveguide resistance attenuators are investigated, and a new interpretation is derived for the phenomena where the curves of attenuation characteristic have sharp peak points.

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Abstracts

Magnetic Waves for Microwave Time Delay-Some Observations and Results

I. Kaufman and R.F. Soohoo. "Magnetic Waves for Microwave Time Delay-Some Observations and Results." 1965 Transactions on Microwave Theory and Techniques 13.4 (Jul. 1965 [T-MTT]): 458-467.

Some topics of exchange-coupled spin waves and magnetostatic waves in narrow line width ferrimagnetic materials for electronically variable time delay of microwave signals in the microsecond realm are discussed. The excitation problem is treated by use of transmission-line analogs. A method of excitation of spin waves by microscopic geometries is suggested, and an estimate of its efficiency given. Results of experiments of magnetic wave excitation in axially magnetized YIG rods are presented. Here very strong excitation of signals with high dispersion and microsecond time delay that is a sensitive function of H_{dc} were found. These signals possess most of the characteristics predicted for Fletcher-Kittel waves. Other signals, with less dispersion and a much more slowly variable time delay, were also found.



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A Mode Chart for Accurate Design of Cylindrical Dielectric Resonators (Correspondence)

D.L. Rebsch, D.C. Webb, R.A. Moore and J.D. Cowlshaw. "A Mode Chart for Accurate Design of Cylindrical Dielectric Resonators (Correspondence)." 1965 Transactions on Microwave Theory and Techniques 13.4 (Jul. 1965 [T-MTT]): 468-469.

Awareness of dielectric resonators as useful microwave circuitry elements is indicated by a number of recent publications. Using intermediate and high dielectric constant materials of low loss, the resonators can provide a convenient means of miniaturization and field concentration. The work reported here was motivated by the need for resonators having dielectric constants of 13 to 16 to provide field concentration in ferrite crystals at 74 Gc.

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Rectangular Waveguide Flange Nomenclature (Correspondence)

M.M. Brady. "Rectangular Waveguide Flange Nomenclature (Correspondence)." 1965 Transactions on Microwave Theory and Techniques 13.4 (Jul. 1965 [T-MTT]): 469-471.

The well-known waveguide nomenclature muddle is exceeded in lack of clarity by the flange nomenclature muddle. For every rectangular waveguide size, which may have several different designations, there are several flanges available, each with its own array of designations. The flange nomenclature muddle may become a major annoyance to those users who use equipment made by different manufacturers in different countries, for manufacturers oftentimes state the flange numbers of a device without stating the waveguide size or flange nomenclature system used.

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Abstracts

Optimum Design of Helix Couplers with Shielding (Correspondence)

T. Berceli. "Optimum Design of Helix Couplers with Shielding (Correspondence)." 1965 Transactions on Microwave Theory and Techniques 13.4 (Jul. 1965 [T-MTT]): 471-472.

Helix couplers have to be shielded to insure good match to coaxial cables. In our calculations the effect of the shielding has also been taken into consideration. As a result of this, the calculated dimensions of helix couplers approximate more closely the best experimentally obtained ones.



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Dispersion of Pulsed Electromagnetic Waves in Plasma (Correspondence)

H.J. Schmitt. "Dispersion of Pulsed Electromagnetic Waves in Plasma (Correspondence)." 1965 Transactions on Microwave Theory and Techniques 13.4 (Jul. 1965 [T-MTT]): 472-473.

Observations of the dispersion of electromagnetic pulses in isotropic plasmas and gyrotropic plasmas show that the response is distorted due to the excitation of weakly damped oscillations characteristic of the natural frequencies of the plasma. For diagnostic application, signals with a smooth frequency spectrum, such as steps or short unidirectional pulses, allow a simple correlation between the observed response and the relevant plasma parameters. In radar or communications systems, however, the dispersion of sinusoidal pulses carrying information in the pulse amplitude or in the pulse duration is important. Due to the relatively high spectral intensity near the carrier frequency, a pronounced signal distortion arises if the carrier frequency is comparable to a natural oscillation frequency of the plasma.



Abstracts

Injection Locking of a Laddertron at 35 Gc/s (Correspondence)

R.G. Strauch, W.T. Smith and V.E. Derr. "Injection Locking of a Laddertron at 35 Gc/s (Correspondence)." 1965 Transactions on Microwave Theory and Techniques 13.4 (Jul. 1965 [T-MTT]): 473-474.

An OKI 34LV10 Laddertron was locked at 34830 Mc/s by injecting a controlling signal into the Laddertron cavity. The Laddertron is a single-cavity multigap oscillator that can deliver about 10 watts CW. The controlling signal was obtained from a klystron that was phase locked to a crystal oscillator harmonic. The Laddertron can be locked for CW or for pulse operation.



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Abstracts

Nonreciprocal Directional Couplers (Correspondence)

H. Berger. "Nonreciprocal Directional Couplers (Correspondence)." 1965 Transactions on Microwave Theory and Techniques 13.4 (Jul. 1965 [T-MTT]): 474-475.

This correspondence is concerned with 1) the modifications required in the standard scattering-matrix description of a directional coupler when the constraint of reciprocity is dropped, and 2) the advantages of using a nonreciprocal directional coupler (NRDC) in place of a conventional reciprocal directional coupler (DC) in a traveling-wave resonant circuit.



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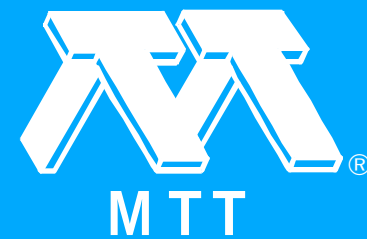


Abstracts

An Optical All-Pass Network (Correspondence)

A.D. Jacobson and T.R. O'Meara. "An Optical All-Pass Network (Correspondence)." 1965 Transactions on Microwave Theory and Techniques 13.4 (Jul. 1965 [T-MTT]): 475-477.

The problem of maintaining the correct relative phase shift between the modulation envelope components of a modulated coherent optical signal will, in all probability, eventually assume the same importance at optical frequencies that it does today at radio and microwave frequencies.



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Abstracts

A Variable Characteristic Impedance Coaxial Line (Correspondence)

J.E. Cruz and R.L. Brooke. "A Variable Characteristic Impedance Coaxial Line (Correspondence)." 1965 Transactions on Microwave Theory and Techniques 13.4 (Jul. 1965 [T-MTT]): 477-478.

The development of Time Domain Reflectometry (TDR) for UHF and microwave impedance measurements in coaxial systems has created a problem of calibrating the TDR system for accurate measurements of small reflections. A need for coaxial impedance standards has been resolved by the development of a variable impedance device which can be calibrated by the use of fixed coaxial standards.



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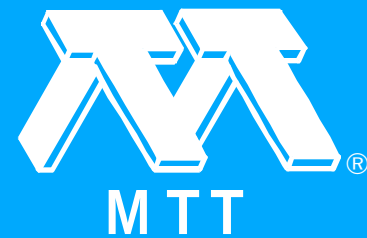
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Abstracts

Contributors (Jul. 1965 [T-MTT])

C.W. Barnes, D.M. Bolle, J.R. Collier, R.E. Collin, F.C. de Ronde, G.S. Heller, T. Ishida, I. Kaufman, N. Kumagai, R.B. Larrick, Y. Mushiake, J.H. Richmond, J. Rosen, B.M. Schiffman, H. Seidel, R.F. Soohoo, C.T. Tai, H.-I. Yamamoto and L. Young. "Contributors (Jul. 1965 [T-MTT])." 1965 Transactions on Microwave Theory and Techniques 13.4 (Jul. 1965 [T-MTT]): 479-481.



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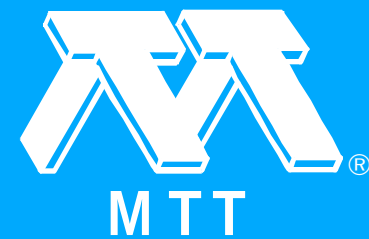
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Abstracts

Call for Papers - 1965 Boulder Millimeter Wave and Far Infrared Conference (Jul. 1965 [T-MTT])

"Call for Papers - 1965 Boulder Millimeter Wave and Far Infrared Conference (Jul. 1965 [T-MTT])." 1965 Transactions on Microwave Theory and Techniques 13.4 (Jul. 1965 [T-MTT]): 483-483.



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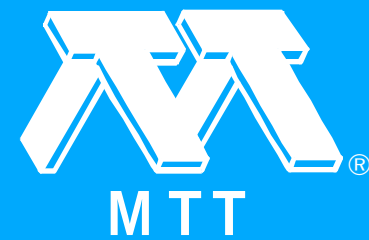
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Call for Papers - 1965 Electrical Insulation Conference (Jul. 1965 [T-MTT])

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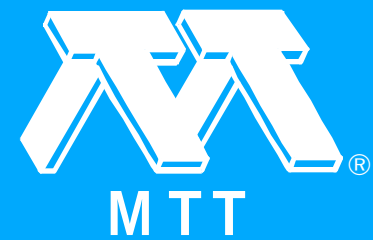
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"Membership Application (Jul. 1965 [T-MTT])." 1965 Transactions on Microwave Theory and Techniques 13.4 (Jul. 1965 [T-MTT]): 484-484.



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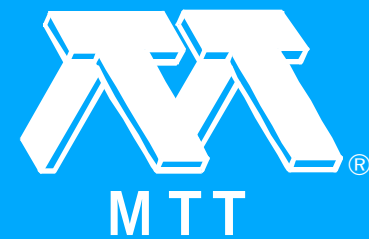
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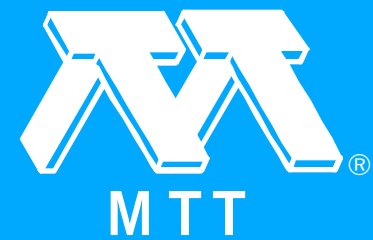
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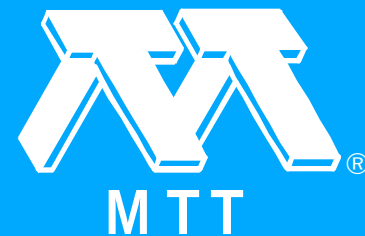


Abstracts

Microwave Filters, An Advancing Art

S.B. Cohn. "Microwave Filters, An Advancing Art." 1965 Transactions on Microwave Theory and Techniques 13.5 (Sep. 1965 [T-MTT]): 487-488.

From the beginnings of microwave engineering until today, filter design has been a persistent and fruitful field for investigation. As this issue of the Transactions shows, interest in microwave filters remains acute, and probably is greater now than ever before.



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Abstracts

Microwave Filters--1965

L. Young. "Microwave Filters--1965." 1965 Transactions on Microwave Theory and Techniques 13.5 (Sep. 1965 [T-MTT]): 489-508.

A review of recent and current work on microwave filters is presented, and an extensive bibliography of recent articles is appended. The review is largely qualitative and pictorial, rather than mathematical. Among the microwave filter topics discussed are band-pass filters with cascaded lines or cavities; band-pass and band-stop filters with stubs and parallel-line coupling; low-pass and high-pass filters; the connection between dissipation loss, group delay, and power-handling capacity; delay equalizers; diplexers; directional filters; tunable filters, especially magnetically tunable filters; dielectric-resonator filters; filter techniques applied to semiconductor devices; the connection between filters and directional couplers; filters with open walls; and filters for millimeter waves and higher frequencies.



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Band-Stop Filters For High-Power Applications

E.N. Torgow and G.E. Collins. "Band-Stop Filters For High-Power Applications." 1965 Transactions on Microwave Theory and Techniques 13.5 (Sep. 1965 [T-MTT]): 508-513.

There are several advantages to the use of band-stop filters, rather than band-pass filters, in many systems. This is shown to be particularly true when signals at high-power levels must be transmitted or rejected. A formula has been derived which expresses the external Q of each resonator in a band-stop filter in terms of the element values of the normalized low-pass prototype and the parameters of the frequency transformation. The peak power capacity of iris-coupled waveguide cavity filters and TEM filters using capacitively coupled inductive stubs is then determined in terms of the external Q of the first resonator and the dimensions of the resonator. Experimental results given for a waveguide band-stop filter show good agreement with theory.

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Abstracts

Tables of Element Values for the Distributed Low-Pass Prototype Filter

R. Levy. "Tables of Element Values for the Distributed Low-Pass Prototype Filter." 1965 Transactions on Microwave Theory and Techniques 13.5 (Sep. 1965 [T-MTT]): 514-536.

An exact general synthesis for the distributed stepped-impedance low-pass prototype filter is presented here. Tables of values of the step impedances of filters having Chebyshev equal-ripple characteristics are given for up to 21 elements over a wide range of bandwidths and ripple levels. The tables are useful for the design of short-line low-pass filters, direct-coupled cavity filters, stepped-impedance acoustic or optical filters, impedance transformers, and branched guide directional couplers, as described in the papers of L. Young.



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Synthesis of Symmetrical TEM-Mode Directional Couplers

P.P. Toullos and A.C. Todd. "Synthesis of Symmetrical TEM-Mode Directional Couplers." 1965 Transactions on Microwave Theory and Techniques 13.5 (Sep. 1965 [T-MTT]): 536-544.

Exact synthesis procedures are derived for symmetrical three-section and five-section TEM-mode directional couplers. These synthesis procedures are based on the equivalence between the theory of directional couplers and stepped quarter-wavelength filters as previously described by Levy and Young. Explicit formulas for the parameters of three-section couplers are presented. A realizable insertion-loss function is derived for the five-section coupler resulting in an equal-ripple response. Although this function has an equal-ripple characteristic, it is not expressible in terms of Chebyshev polynomials. Results obtained for the five-section coupler show considerable improvement in bandwidth over a three-section coupler. For example, a five-section coupler of -3 ± 0.5 dB has a bandwidth of 9.6:1 as compared with 5.8:1 for a three-section coupler of -3 ± 0.5 dB. A five-section coupler of -10 ± 0.5 dB was designed on this theoretical basis for the 555-4000 Mc band, and the measured shows good agreement with the theoretical coupling sponse, yielding a minimum directivity of 18.0 dB at 3.7 Gc.

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Abstracts

Theory and Tables of Optimum Symmetrical TEM-Mode Coupled-Transmission-Line Directional Couplers

E.G. Cristal and L. Young. "Theory and Tables of Optimum Symmetrical TEM-Mode Coupled-Transmission-Line Directional Couplers." 1965 Transactions on Microwave Theory and Techniques 13.5 (Sep. 1965 [T-MTT]): 544-558.

New equal-ripple polynomials were determined and applied to the synthesis of symmetrical TEM-mode coupled-transmission-line directional couplers (using exact methods). Tables of designs for symmetrical couplers of three, five, seven, and nine sections having mean couplings of -3.01, -6, -8.34, -10, and -20 dB, and having several equal-ripple tolerances in the coupling band are presented. Symmetrical maximally-flat directional-coupler designs having three, five, seven, and nine sections are also presented to complete the tables.



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Abstracts

Exact Theory of Interdigital Band-Pass Filters and Related Coupled Band-Pass Structures

R.J. Wenzel. "Exact Theory of Interdigital Band-Pass Filters and Related Coupled Band-Pass Structures." 1965 Transactions on Microwave Theory and Techniques 13.5 (Sep. 1965 [T-MTT]): 559-575.

An exact theory of interdigital line networks and related coupled structures is presented. The theory of parallel-coupled line arrays is reviewed briefly, and the derivation of exact equivalent circuits from the impedance matrix using modern network synthesis techniques is discussed. A simplified theory of equivalent coupled structures is introduced in order to avoid the lengthy analysis required when using the impedance matrix approach. Equivalent networks for the interdigital line are obtained by inspection, using a transformed capacitance matrix associated with the two-dimensional geometry of the conductors and ground planes. The techniques presented are simple to apply and allow a given transmission response to be obtained in a variety of line configurations. A practical design example and experimental results are given to illustrate the simplicity of the approach, along with general criteria for the design of practical filter networks with optimum transmission characteristics. The paper is directed toward the design of interdigital band-pass filters; however, the techniques presented can be used to analyze and design a much broader class of microwave networks. The relationship of the exact theory to existing approximate theory is discussed.



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A Rectangular-Waveguide Filter Using Trapped-Mode Resonators

B.M. Schiffman, G.L. Matthaei and L. Young. "A Rectangular-Waveguide Filter Using Trapped-Mode Resonators." 1965 Transactions on Microwave Theory and Techniques 13.5 (Sep. 1965 [T-MTT]): 575-580.

A two-resonator, narrow-band waveguide filter with a very wide stop band is described. Each resonator cavity has one side wall which is entirely open except for a bifurcating E-plane septum. Energy in most modes tends to radiate freely out of the open end of each resonator to absorbing material; however, energy in the fundamental TE/sub 101/-mode is trapped in the resonator structures to give high-Q resonances such as are typical of conventional solid-wall resonators. Thus, a primary pass band is obtained similar to that of filters using conventional cavity resonators, but the many higher-order pass bands usually found in cavity-resonator filters are largely eliminated because the higher-order-mode cavity resonances are damped out. This type of filter attenuates unwanted signals mainly by reflection. For applications where a low-input VSWR is desired in the pass band, a bifurcated section of guide backed by absorbing material is also used in the input waveguide so as to tend to absorb the input energy at frequencies above that of the pass band.

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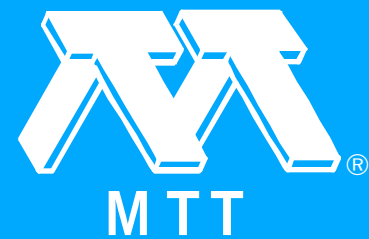
Circular TE/sub 011/Mode, Trapped-Mode Band-Pass Filters (Sep. 1965 [T-MTT])

G.L. Matthaei and D.B. Weller. "Circular TE/sub 011/Mode, Trapped-Mode Band-Pass Filters (Sep. 1965 [T-MTT])." 1965 Transactions on Microwave Theory and Techniques 13.5 (Sep. 1965 [T-MTT]): 581-589.

Band-pass filters are described which utilize a novel type of resonator which has been named a "trapped-mode resonator." This type of resonator uses a structure which is open on its sides so that energy in all but a single desired mode tends to radiate out to energy-absorbing material. However, energy in the desired resonator mode is trapped within the structure and a high-Q resonance occurs, such as is typical of conventional microwave cavity resonators. The use of resonators of this type makes possible the design of band-pass microwave filters which have a pass band similar to that of other multiresonator microwave filters, but without the many unwanted pass bands which are typical of microwave filters. The particular type of filter discussed utilizes the circular TE/sub 011/ mode. Several experimental filter structures of this type were constructed, and the results of laboratory tests are described.

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Design of Band-Stop Filters in the Presence of Dissipation

J.J. Taub and R.L. Slevin. "Design of Band-Stop Filters in the Presence of Dissipation." 1965 Transactions on Microwave Theory and Techniques 13.5 (Sep. 1965 [T-MTT]): 589-616.

The insertion loss vs. frequency characteristic of equal-element band-stop filters is derived for large as well as small degrees of dissipation, and for any number of resonators. These results are presented as curves for one through eight resonator filters. The equal-element band-stop filter, for small dissipation, is shown to have the lowest pass-band loss for a specified stop-band characteristic of all possible filters that can be represented by a low-pass prototype. Design procedures and examples are explained for waveguide and TEM band-stop filters. This includes selecting the optimum number of resonators, the resonator lengths, and the coupling reactance. Experimental results on C-band waveguide and UHF coaxial filters are presented; the results are in good agreement with the theory. This approach makes possible complete prediction of the filter response and results in lower pass-band loss than could be obtained with previously used approaches.

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YIG Filters as Envelope Limiters

R.C. Cumming and D.W. Howell. "YIG Filters as Envelope Limiters." 1965 Transactions on Microwave Theory and Techniques 13.5 (Sep. 1965 [T-MTT]): 616-621.

Envelope limiters are used in such applications as FM demodulation and power leveling. Recently, the envelope-limiting properties of yttrium-iron-garnet (YIG) filters were reported for the special cases of unmodulated and pulsed input signals. Measured data is presented hereon the response of a YIG limiter to AM carriers having modulation index of the order of 50 percent. Sinusoidal, square-wave, and low-pass noise modulating signals were used in the measurements. It was found that a YIG filter will give good envelope limiting for modulating frequencies in the submegacycle range. At these low frequencies the carrier and the side frequencies are not limited selectively. At higher modulating frequencies where the limiting is frequency selective, the YIG filter will not remove the variations. In fact, in the particular filter tested, the modulation index was increased, rather than decreased, at modulating frequencies greater than about 750 kc/s. A graph is given showing the measured factor of reduction (or increase) of modulation index, as a function of modulating frequency. The response of the limiter as a function of carrier frequency, modulating frequency, and input power is shown by oscilloscope displays produced by sweeping the carrier frequency or input power. In addition, selected photographs of output envelope waveforms are given.



Abstracts

A General Design Procedure for Quarter-Wavelength Inhomogeneous Impedance Transformers Having Approximately Equal-Ripple Performance

H.J. Riblet. "A General Design Procedure for Quarter-Wavelength Inhomogeneous Impedance Transformers Having Approximately Equal-Ripple Performance." 1965 Transactions on Microwave Theory and Techniques 13.5 (Sep. 1965 [T-MTT]): 622-629.

A general design procedure for quarter-wavelength inhomogeneous impedance transformers having approximately equal-ripple performance is presented, based on the simplifying assumptions that the relative impedance of two waveguides of slightly different widths is a constant and that $\tan \theta_i = k_i / \tan \theta_0$ in the vicinity of θ_i and $\theta_0 = 90^\circ$. The calculation of the design parameters depends on the fact that the insertion-loss function can be expressed, in closed form, in terms of the unknown parameters. When this is identified with the permissible equal-ripple function, a set of simultaneous equations in the unknown parameters results. The solution of these equations is approximated by the solution to the corresponding homogeneous transformer problem. Thus a set of simultaneous linear equations in the small differences can be obtained which provides an approximate solution to the problem. An experimental design is described and the resulting data are presented.



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Abstracts

The Scattering of a TM Surface Wave by a Perfectly Conducting Strip

E.S. Gillespie and J.J. Gustincic. "The Scattering of a TM Surface Wave by a Perfectly Conducting Strip." 1965 Transactions on Microwave Theory and Techniques 13.5 (Sep. 1965 [T-MTT]): 630-640.

The scattering of a TM surface wave by a metallic strip above a dielectric-clad ground plane is investigated both theoretically and experimentally. An expression for the Green's function which can be evaluated numerically is developed for the usual case for which the energy of the incident surface wave is "lightly trapped" by the dielectric. Using this expression, a variational formula for the reflection coefficient of the strip is developed, and the Rayleigh-Ritz technique is applied to yield approximate values for the reflection coefficient and surface currents of the strip. Numerical results are presented and compared with experimental values measured on a polystyrene-coated aluminum table. Strips measuring up to one wavelength in width positioned up to one wavelength above the dielectric are considered, and agreement between theory and experiment is found to be good. A thorough description of the experimental techniques is presented.



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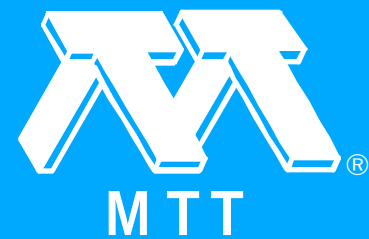
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Propagation of Electromagnetic Waves in Rectangular Guides Filled with a Semiconductor in the Presence of a Transverse Magnetic Field

M.H. Engineer and B.R. Nag. "Propagation of Electromagnetic Waves in Rectangular Guides Filled with a Semiconductor in the Presence of a Transverse Magnetic Field." 1965 Transactions on Microwave Theory and Techniques 13.5 (Sep. 1965 [T-MTT]): 641-646.

The characteristics of electromagnetic waves propagating in a semiconductor filled rectangular waveguide in the presence of a transverse magnetic field are studied. It is shown that only TE mode waves having y-independent field components (y being the direction of the steady magnetic field) and anomalous modes having all six field components can propagate. The propagation constant of waves characterized by a sinusoidal y dependence of fields is derived. Asymptotic expressions for the fields and the propagation constant are then obtained for the limiting case of a small external magnetic field and some recent experimental results are analyzed in this context.

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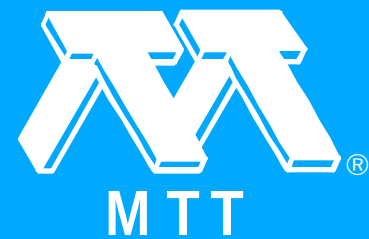


Design Considerations for Bent-Beam Waveguides

D. Marcuse. "Design Considerations for Bent-Beam Waveguides." 1965 Transactions on Microwave Theory and Techniques 13.5 (Sep. 1965 [T-MTT]): 647-651.

The description of the beam-waveguide in terms of ray optics and wave optics is combined to describe the performance of waveguides with predetermined bending radii. We require that the beam in a bend of the beam-waveguide departs from its axis no more than an amount equal to half its spot size. This requirement is sufficient to determine uniquely the spacing and focal length of the lenses. It turns out that it is advantageous to space the lenses close to four times their focal length, in order to enable the waveguide to direct a light beam around sharp bends. However, transverse random displacements of the lenses also cause the beam to depart from the axis of the guide. This departure becomes very large if the lens spacing approaches four times the focal length. A guide which is designed to negotiate sharp bends is more seriously affected by random displacements of the lenses. Further analysis of imperfections and experimental work will be required before a final design choice can be made.





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A Network Model for Transmission Lines with Gyromagnetic Coupling

C.R. Boyd, Jr.. "A Network Model for Transmission Lines with Gyromagnetic Coupling." 1965 Transactions on Microwave Theory and Techniques 13.5 (Sep. 1965 [T-MTT]): 652-662.

Reciprocal ensembles of coupled transmission lines have been studied for many years using matrix techniques. In this paper, the lossless multiconductor transmission line model is extended to permit a description of gyromagnetic coupling effects. The novel ingredient which allows such an extension is the incorporation of distributed gyrators into the elemental line-length prototype. These gyrators provide antireciprocal coupling between the ensemble conductors. The amount of coupling is expressed by a geometry-dependent factor which in effect measures a given structure relative to an ideal Faraday rotator in the same medium. The gyromagnetic coupling factor, in conjunction with the derived expressions for mode propagation factors and characteristic impedances, provides a means of interpolating between the known limits of no coupling and ideal Faraday rotation. General relations are derived for two-line systems and for symmetrical, quasi-TEM three-line systems.

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A Numerical Analysis Frequency of the Tunnel-Diode Converter

M.R. Barber. "A Numerical Analysis Frequency of the Tunnel-Diode Converter." 1965 Transactions on Microwave Theory and Techniques 13.5 (Sep. 1965 [T-MTT]): 663-670.

The theory of tunnel-diode mixer operation is briefly reviewed. It is shown how the available gain, minimum noise figure and output conductance can be expressed in terms of the bias and local oscillator voltages. A numerical analysis is then carried out for a large number of pairs of these voltages. The results show that there are two modes of low noise operation, both using approximately the same bias voltage which gives minimum noise when the diode is used as an amplifier. The minimum noise figure of one mode approaches that of the amplifier and is accompanied by very high gain, critical adjustment, and a vanishingly small local oscillator voltage. The more practical second mode on the other hand, uses a local oscillator power of about -7 dBm and gives a conversion loss lower than that obtainable from the best L-band varistor mixers, but with a slightly poorer noise figure. The analysis could be applied equally well to optimize backward diode converters using megacycle intermediate frequencies in which only the second mode occurs.



Abstracts

A General Equivalent Circuit for Coupled-Cavity Slow-Wave Structures

H.J. Curnow. "A General Equivalent Circuit for Coupled-Cavity Slow-Wave Structures." 1965 Transactions on Microwave Theory and Techniques 13.5 (Sep. 1965 [T-MTT]): 671-675.

A number of structures of the slot-coupled cavity chain type are used in high-power traveling-wave tubes. In these, different relationships between the structure pass bands and the cavity and slot resonances are found to exist. By the construction of equivalent circuits which have patterns of current flow similar to those in the real structures, this behavior is calculated and the importance of the partial nature of the coupling and the relative alignment of the slots is illustrated. It is possible to obtain from the circuits presented a qualitative understanding of the general behavior of structures of this type.



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Abstracts

The Numerical Solution of Some Important Transmission-Line Problems

H.E. Green. "The Numerical Solution of Some Important Transmission-Line Problems." 1965 Transactions on Microwave Theory and Techniques 13.5 (Sep. 1965 [T-MTT]): 676-692.

The generalized numerical solution of Laplace's equation in two dimensions is dealt with, subject to boundary conditions imposed by conducting surfaces and dielectrics which are permitted a limited amount of inhomogeneity. It is shown how this solution may be applied in the determination of the properties of TEM-mode transmission lines including the equivalent circuits of simple obstacles in these lines. The theory is illustrated with a number of examples, certain of which do not appear to have been previously treated theoretically in the literature. While certain of the examples serve mainly to show the power of the technique, others are given very detailed treatment with the production of much new design data.



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Tables of Maximally Flat Impedance-Transforming Networks of Low-Pass-Filter Form (Correspondence)

E.G. Cristal. "Tables of Maximally Flat Impedance-Transforming Networks of Low-Pass-Filter Form (Correspondence)." 1965 Transactions on Microwave Theory and Techniques 13.5 (Sep. 1965 [T-MTT]): 693-695.

In previous papers, Szentirmai and Matthaei present design theory for synthesis of lumped-element Chebyshev impedance transforming networks. In the paper of Matthaei extensive tables of element values for the impedance-transforming networks are also presented. These networks are of low-pass ladder form consisting of series inductances and shunt capacitances. They give impedance match in the Chebyshev sense between resistor terminations of arbitrary ratio (designs with resistor termination ratios from 1.5 to 50 are tabulated). The responses of these networks have moderately high attenuation at dc (the amount of attenuation depends on the termination ratio); their attenuation falls to a very low level in the impedance-matching band, and then rises monotonically and steeply above the operating band in a manner typical of low-pass filters. The impedance-transforming networks can be realized in lumped-element form for low-frequency applications, and in semi-lumped-element form (using short sections of transmission line of alternating high and low impedances) at microwave frequencies.

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Abstracts

Tables of Stub Admittances for Maximally Flat Filters Using Shorted Quarter-Wave Stubs (Correspondence)

W.W. Mumford. "Tables of Stub Admittances for Maximally Flat Filters Using Shorted Quarter-Wave Stubs (Correspondence)." 1965 *Transactions on Microwave Theory and Techniques* 13.5 (Sep. 1965 [T-MTT]): 695-696.

Consider a symmetrical filter consisting of lossless shorted quarter-wave stubs spaced a quarter wavelength apart on a uniform, lossless line. The tables given here list the normalized characteristic stub admittances k/τ necessary for a maximally flat response.



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Abstracts

A Simple Design Procedure for Small Percentage Bandwidth Round-Rod Interdigital Filters (Correspondence)

M. Dishal. "A Simple Design Procedure for Small Percentage Bandwidth Round-Rod Interdigital Filters (Correspondence)." 1965 Transactions on Microwave Theory and Techniques 13.5 (Sep. 1965 [T-MTT]): 696-698.

The continued correspondence concerning interdigital filter prompted me to submit this correspondence. The concepts and design procedures to be described have been found to be practically useful for determining the geometry of the coupled-rod structure, and because these procedures are apparently much simpler than those presently available, publication of the subject matter may be helpful to others. It will be apparent that some of this material is tutorial in nature--it is included to clarify the other information being presented.



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A New Type of Low-Pass Filter that Attenuates by Dissipation (Correspondence)

B.M. Schiffman, L. Young and G.L. Matthaei. "A New Type of Low-Pass Filter that Attenuates by Dissipation (Correspondence)." 1965 Transactions on Microwave Theory and Techniques 13.5 (Sep. 1965 [T-MTT]): 699-700.

Leaky-wall filters usually consist of a straight section of main waveguide to which are attached many narrower terminated auxiliary waveguides. These may be connected only to the broad walls or to both the broad and narrow walls. Attenuation in the stop band, above the main waveguide band, is due to absorption of power in the auxiliary waveguides. Unfortunately, the attenuation in the stop band eventually decreases as frequency increases because of the "optical beam" effect in oversize waveguide. A second fault of these structures is that there often are narrow regions of relatively low attenuation in the stop band, which are caused by multiple scattering from the periodic internal facets of the main waveguide.

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Re-Entrant Directional Coupler Using Strip Transmission Line (Correspondence)

L. Lavendol and J.J. Taub. "Re-Entrant Directional Coupler Using Strip Transmission Line (Correspondence)." 1965 Transactions on Microwave Theory and Techniques 13.5 (Sep. 1965 [T-MTT]): 700-701.

This correspondence describes a printed-circuit directional coupler design that is applicable to tight coupling (1 to 10 dB) values; it is a strip transmission line equivalent of the re-entrant coaxial coupler described by Cohn. 1 Figure 1(a) shows the cross-sectional view of Cohn's device; the printed-circuit (strip transmission line) equivalent is shown in Fig. 1 (b). The design of the coaxial version is determined by characteristic impedances Z_{01} (the impedance of a bar of width w and height $b/2$ placed within a ground plane spacing $b/1$) and Z_{02} (the impedance of the inner coaxial lines).

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Abstracts

Waffle-Iron Harmonic Suppression Filter (Correspondence)

J. Caputo and F. Bell. "Waffle-Iron Harmonic Suppression Filter (Correspondence)." 1965 Transactions on Microwave Theory and Techniques 13.5 (Sep. 1965 [T-MTT]): 701-703.

Several papers were presented dealing with the design and performance of waffle-iron filters. Essentially, waffle-iron filters are waveguide low-pass filters, with wide stop bands above their pass bands. The L-band waffle-iron filter discussed in this correspondence was originally developed at the Stanford Research Institute, Menlo Park, Calif. Subsequent reports and modifications have been presented by Young and Schiffman.



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Abstracts

Exact Design of Band-Stop Microwave Filters (Correction)

B.M. Schiffman. "Exact Design of Band-Stop Microwave Filters (Correction)." 1965 Transactions on Microwave Theory and Techniques 13.5 (Sep. 1965 [T-MTT]): 703-703.

In the above paper the authors have called the following to the attention of the Editor.



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Abstracts

The Electric Field and Wave Impedance in Spin Wave Propagation (Correspondence)

I. Kaufman and R.F. Soohoo. "The Electric Field and Wave Impedance in Spin Wave Propagation (Correspondence)." 1965 Transactions on Microwave Theory and Techniques 13.5 (Sep. 1965 [T-MTT]): 703-704.

The propagation of electromagnetic waves in magnetic materials, allowing exchange coupling, has been treated by Auld and by Soohoo. Their calculations involved the simultaneous solution of Maxwell's equations and the equation of motion the magnetization, for plane waves.



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The Synthetic Generation of Phase-Coherent Microwave Signals for Transient Behavior Measurements (Correspondence)

G.F. Ross. "The Synthetic Generation of Phase-Coherent Microwave Signals for Transient Behavior Measurements (Correspondence)." 1965 Transactions on Microwave Theory and Techniques 13.5 (Sep. 1965 [T-MTT]): 704-706.

The purpose of this correspondence is to describe a new technique for generating a microwave signal for use as a diagnostic tool in the investigation of the transient behavior of wide-band networks and dispersive media. The test signal is a periodic, phase-coherent, pulse-modulated microwave waveform which has a negligible transient build-up time. It is phase-coherent in the sense that the phase of the carrier is exactly the same at the start of each pulse. This condition is essential if the individual cycles of the response of a system to the test waveform are to be observed on a sampling oscilloscope.



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Broadbanding Microwave Diode Switches (Correspondence)

R.E. Fisher. "Broadbanding Microwave Diode Switches (Correspondence)." 1965 Transactions on Microwave Theory and Techniques 13.5 (Sep. 1965 [T-MTT]): 706-706.

In the design of microwave switching networks, it is often necessary to design for minimum VSWR and low loss over a broadband. One class of PIN diode TEM microwave switch may be successfully broad-banded by utilizing the band-pass filter designs published by Mumford and Matthaei.

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Abstracts

Organic Superconductor and Dielectric Infrared Waveguide, Resonator, and Antenna Models of Insects' Sensory Organs (Correspondence)

E.C. Okress. "Organic Superconductor and Dielectric Infrared Waveguide, Resonator, and Antenna Models of Insects' Sensory Organs (Correspondence)." 1965 Transactions on Microwave Theory and Techniques 13.5 (Sep. 1965 [T-MTT]): 706-707.

With reference to Little's recent paper, the following comments may be of value.



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Orthogonal Coupling to YIG Delay Lines (Correspondence)

E.J. Wrobel. "Orthogonal Coupling to YIG Delay Lines (Correspondence)." 1965 Transactions on Microwave Theory and Techniques 13.5 (Sep. 1965 [T-MTT]): 707-708.

Recently, many experiments have been conducted for the purpose of investigating the microwave delay properties of single-crystal YIG. Three forms of delay have been observed: fixed acoustic, variable spin-acoustic, and variable pure spin propagation. At short delays the initiating pulse makes observance of the delay pulse extremely difficult. We have conducted experiments using rod-like YIG samples and a two-port coupling arrangement similar to that employed by Olson.

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Abstracts

Synthesizing Air with a Radome Sandwich (Correspondence)

H.F. Mathis and R.F. Mathis. "Synthesizing Air with a Radome Sandwich (Correspondence)." 1965 Transactions on Microwave Theory and Techniques 13.5 (Sep. 1965 [T-MTT]): 708-708.

It is possible to design lossless radome sandwiches which have a transmission coefficient of unity and an insertion phase angle of zero. If the magnitude and phase of the electric field within the sandwich approximates that of the electric field in air, the edge diffraction of the sandwich should be small.



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Abstracts

A Variable Harmonic Phase Delay Coaxial Network (Correspondence)

R.D. Wanselow. "A Variable Harmonic Phase Delay Coaxial Network (Correspondence)." 1965 Transactions on Microwave Theory and Techniques 13.5 (Sep. 1965 [T-MTT]): 708-709.

A simple, adjustable, harmonic phase delay, equalizer network has been developed in coaxial transmission line. A harmonic equalizer network is defined as a circuit whereby the phase shift or phase delay through the device between two harmonically related or widely separated frequencies differs from an ideal dispersionless circuit. This circuit makes use of the phase shift properties of a reactive cutoff type network as the cutoff frequency is varied.



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Abstracts

A Semi-Automatic Technique for Tuning a Reflectometer (Correspondence)

M.H. Zanboorie. "A Semi-Automatic Technique for Tuning a Reflectometer (Correspondence)." 1965 Transactions on Microwave Theory and Techniques 13.5 (Sep. 1965 [T-MTT]): 709-710.

Tuned microwave reflectometers are used in single-frequency high-precision microwave measurement applications. The tuners are adjusted such that a constant detector output is achieved when the reflectometer is terminated by loads of constant reflection coefficient magnitude and variable phase. At present, the phase variation is achieved by sliding the loads inside a terminating section of uniform waveguide.



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Abstracts

A Note on Wave Propagation in Periodic Media (Correspondence)

K.F. Cafsey. "A Note on Wave Propagation in Periodic Media (Correspondence)." 1965 Transactions on Microwave Theory and Techniques 13.5 (Sep. 1965 [T-MTT]): 710-711.

The solution of problems involving wave propagation in longitudinally stratified media leads to two different equations which must be solved in order to ascertain the longitudinal dependence of the field quantities.



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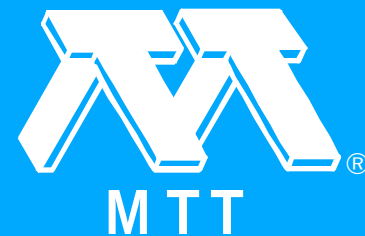


Abstracts

Note on the Measurement of Material Properties by the Strip-Line Cavity (Correspondence)

R.A. Waldron and S.P. Maxwell. "Note on the Measurement of Material Properties by the Strip-Line Cavity (Correspondence)." 1965 Transactions on Microwave Theory and Techniques 13.5 (Sep. 1965 [T-MTT]): 711-711.

It has been found that when making measurements of the properties of materials with a strip-line cavity, results are obtained which are consistently lower than expected. The error is the more serious, the higher the value of the dielectric constant or permeability, as the case may be, of the sample.



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Abstracts

On Mode Losses in Confocal Resonator and Transmission Systems (Correspondence)

J.C. Heurtley and W. Streifer. "On Mode Losses in Confocal Resonator and Transmission Systems (Correspondence)." 1965 Transactions on Microwave Theory and Techniques 13.5 (Sep. 1965 [T-MTT]): 711-712.

In a recent correspondence Lonngren and Beyer calculated the losses for a single iteration in a "beam waveguide" with circular lenses separated by twice their focal length. Since the confocal Fabry-Perot resonator with two identical circular mirrors may be studied by superimposing two guided wave beams propagating oppositely in the given system, the beam-waveguide losses allow one to determine the resonator Q.



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Ferromagnetic Resonance Linewidth and g-Factor in Ferrites from 2 to 18 Gc/s (Correspondence)

H. Brand and H.W. Fieweger. "Ferromagnetic Resonance Linewidth and g-Factor in Ferrites from 2 to 18 Gc/s (Correspondence)." 1965 Transactions on Microwave Theory and Techniques 13.5 (Sep. 1965 [T-MTT]): 712-713.

The parameters of the uniform precession in homogeneously biased ferrite spheres such as the linewidth and the g-factor are often used to characterize ferrite materials. As is well known these data are not always frequency independent. When they are measured using the standard cavity technique it is very difficult to obtain information over a broad frequency band. On the other hand, it is the actual frequency dependence that may be of interest both for microwave applications and for a theoretical understanding of the loss mechanism in ferrites.

Abstracts

International Intercomparison of Standards for Microwave Power Measurement (Correspondence)

G.F. Engen. "International Intercomparison of Standards for Microwave Power Measurement (Correspondence)." 1965 Transactions on Microwave Theory and Techniques 13.5 (Sep. 1965 [T-MTT]): 713-715.

In accordance with a resolution of Commission I of the International Scientific Radio Union (URSI), standards for microwave power measurement of Japan, the United Kingdom (England) and the United States have been intercompared. It is the purpose of this correspondence to describe the results and comment upon the significance of these intercomparisons.



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Abstracts

Wave Propagation in Sinusoidally Stratified Dielectric Media (Addendum)

R.A. Kallas. "Wave Propagation in Sinusoidally Stratified Dielectric Media (Addendum)." 1965 Transactions on Microwave Theory and Techniques 13.5 (Sep. 1965 [T-MTT]): 715-715.

In the above correspondence, acknowledgment of a prior work was inadvertently omitted. The undersigned wishes to apologize for this unintentional oversight and to acknowledge the earlier work of Professors Yeh and Kaprielian on wave propagation in a sinusoidally stratified dielectric.



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Recent Changes in High-Frequency and Microwave Calibration Services (Correspondence)

"Recent Changes in High-Frequency and Microwave Calibration Services (Correspondence)."
1965 Transactions on Microwave Theory and Techniques 13.5 (Sep. 1965 [T-MTT]): 715-716.

The following short items describe recent changes in the calibration services offered by the Radio Standards Laboratory at Boulder, Colo.



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Abstracts

Propagation in Cylindrical Waveguide Containing Inhomogeneous Dielectric (Correspondence)

R. Yamada and K. Watanabe. "Propagation in Cylindrical Waveguide Containing Inhomogeneous Dielectric (Correspondence)." 1965 Transactions on Microwave Theory and Techniques 13.5 (Sep. 1965 [T-MTT]): 716-717.

The wave equations in the cylindrical waveguide containing inhomogeneous dielectric are as follows.



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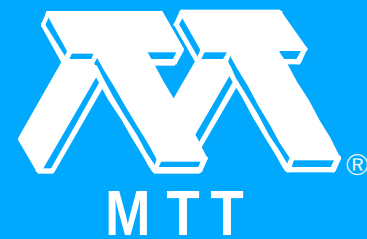
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Contributors (Sep. 1965 [T-MTT])

M.R. Barber, C.R. Boyd, Jr., G.E. Collins, E.G. Cristal, R.C. Cumming, H.J. Curnow, M.N. Engineer, E.S. Gillespie, H.E. Green, J. Gustincic, D.W. Howell, R. Levy, D. Marcuse, G.L. Matthaei, B.R. Nag, H.J. Riblet, B.M. Schiffman, R.L. Slevin, J.J. Taub, A.C. Todd, E.N. Torgow, P.P. Toulous, D.B. Weller, R.J. Wenzel and L. Young. "Contributors (Sep. 1965 [T-MTT])." 1965 Transactions on Microwave Theory and Techniques 13.5 (Sep. 1965 [T-MTT]): 718-721.



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Call for Papers - Issue of Radio Science on the Mode Theory of Wave Propagation (Sep. 1965 [T-MTT])

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"Call for Papers - 1966 National Symposium on Microwave Theory and Techniques (Sep. 1965 [T-MTT])." 1965 Transactions on Microwave Theory and Techniques 13.5 (Sep. 1965 [T-MTT]): 721-721.



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Microwave Abstracts (Sep. 1965 [T-MTT])

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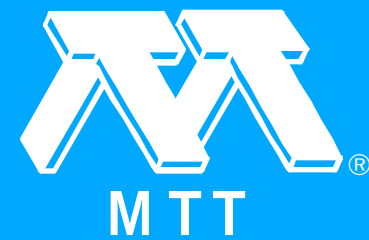
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Abstracts

Membership Application (Sep. 1965 [T-MTT])

"Membership Application (Sep. 1965 [T-MTT])." 1965 Transactions on Microwave Theory and Techniques 13.5 (Sep. 1965 [T-MTT]): 724-724.



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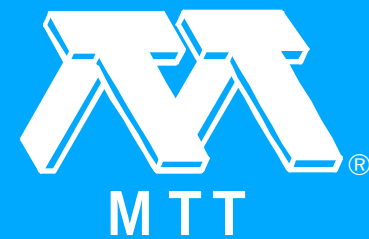
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Abstracts

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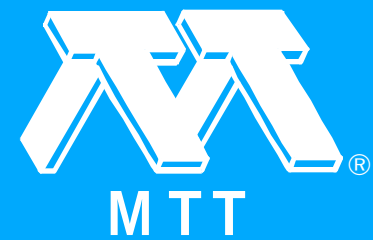
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Abstracts

Notes from the 1965 G-MTT Symposium

"Notes from the 1965 G-MTT Symposium." 1965 Transactions on Microwave Theory and Techniques 13.6 (Nov. 1965 [T-MTT]): 729-729.



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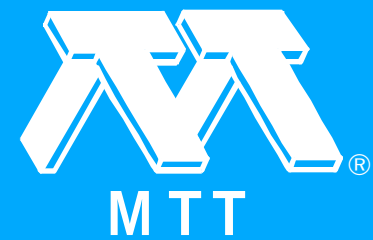
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Abstracts

1964 Microwave Prize, Seymour B. Cohn

"1964 Microwave Prize, Seymour B. Cohn." 1965 Transactions on Microwave Theory and Techniques 13.6 (Nov. 1965 [T-MTT]): 730-731.



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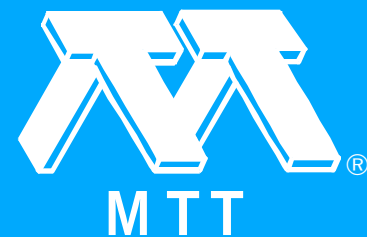


Abstracts

Space for Microwaves

D.D. King. "Space for Microwaves." 1965 Transactions on Microwave Theory and Techniques 13.6 (Nov. 1965 [T-MTT]): 732-733.

The forty-eight technical papers of the 1965 MTT Symposium provide a great fund of detailed information of the state of the microwave art. In a more general sense, the content of the program also shows unmistakable trends which we must not ignore. Before devoting our attention to the specialized presentations to follow, let us pause to consider where we are headed in microwave theory and techniques. This is our eleventh symposium, and the microwave art is now about twenty-five years old. The record of those years is something to be proud of in scientific applications, in engineering, and in business enterprise---except perhaps for some recent microprofits.



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Theory of a Thermal Gradient Gas Lens (Nov. 1965 [T-MTT])

D. Marcuse. "Theory of a Thermal Gradient Gas Lens (Nov. 1965 [T-MTT])." 1965 Transactions on Microwave Theory and Techniques 13.6 (Nov. 1965 [T-MTT]): 734-739.

The analysis of the gas lens presented in an earlier paper is extended to a more complete ray optics description. The focal length and principal surface of the gas lens have been computed. It is found that the focal length reaches a minimum as a function of flow velocity and that the two principal surfaces coincide very nearly, making the device approximately a thin lens. The gas lens is not free of distortions. The principal surface is not a plane, and the focal length measured from the principal surface depends on the distance of the ray from the lens axis. This dependence is rather weak for gas flow rates minimizing the focal length.



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Measurements on a Thermal Gradient Gas Lens (Nov. 1965 [T-MTT])

W.H. Steier. "Measurements on a Thermal Gradient Gas Lens (Nov. 1965 [T-MTT])." 1965 Transactions on Microwave Theory and Techniques 13.6 (Nov. 1965 [T-MTT]): 740-748.

If a cool gas is gently blown through a hot tube, the temperature distribution within the tube is such to make a positive optical lens which has no surfaces for scattering and reflection. These thermal gas lenses are of interest for long-distance optical transmission. In this paper the temperature distributions inside the tube and the optical properties of these lenses have been studied in detail. The temperature distributions inside a 0.250-inch ID heated tube were measured with a small thermocouple probe. The results agree with theory except for the gravity effect which displaces the coldest point below the center of the tube. The optical properties of a 0.250-inch ID 17.8 Å. The temperature profiles, paraxial focal distances, and aberration coefficients have been measured under a variety of experimental conditions.

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Modes in Radial Wave Beam Resonators (Nov. 1965 [T-MTT])

G. Goubau and F. Schwering. "Modes in Radial Wave Beam Resonators (Nov. 1965 [T-MTT])." 1965 Transactions on Microwave Theory and Techniques 13.6 (Nov. 1965 [T-MTT]): 749-755.

Resonant modes in ring shaped resonators formed by a reflector strip bent into a circle are discussed here. These modes are derived by superimposing two radially propagating wave beams, one converging toward the resonator axis, the other one diverging from this axis. The condition for resonance leads to an integral equation whose eigenfunctions describe the field distribution at the reflector strip and whose eigenvalues determine the diffraction loss due to the fraction of energy bypassing the reflector. The approximations made in deriving the radial beam mode system are equivalent to those used for the derivation of the axial beam mode system in a Fabry-Perot resonator. Within the limits of these approximations the kernel of the integral equation for a ring resonator is of the same form as the kernel of the integral equation for a parallel strip resonator. If in the radial case the reflector strip is also curved within the axial planes with a radius of curvature equal to the diameter of the reflector ring, and if the width of the reflector strip is sufficiently large, the axial field distribution of the modes is described by Gauss-Hermite functions. The Q of the ring resonator is determined by the diffraction loss and by reflection loss caused by the finite conductivity of the reflector. Formulas for the corresponding Q-values are derived. A numerical evaluation shows that in the microwave region Q-values of the order of 10^6 are feasible.





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Equalization of Waveguide Delay Distortion (Nov. 1965 [T-MTT])

E.N. Torgow. "Equalization of Waveguide Delay Distortion (Nov. 1965 [T-MTT])." 1965 Transactions on Microwave Theory and Techniques 13.6 (Nov. 1965 [T-MTT]): 756-762.

Microwave all-pass circuits, consisting of reactive networks used in conjunction with wide-band circulators or couplers, are described. An extremely useful all-pass circuit for minimizing phase distortion results when the reactive network is a linear taper extending beyond cutoff. The delay characteristics of this circuit are well suited to the correction of the dispersive characteristics of TE or TM mode waveguides. Design formulas have been derived for the parameters of the tapers and a set of design curves is presented. The use of composite tapered sections and the use of tapers in conjunction with other equalizing circuits are described. Experimental results have been obtained for the phase of the reflection factor of a linear taper. Close agreement was observed between the results predicted by theory and the experimental data. Typical examples demonstrate that the time-delay variation of a length of uniform waveguide can be substantially reduced by linearly tapered waveguide equalizers.

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Wide-Band Polarizer in Circular Waveguide Loaded with Dielectric Discs

P.J. Meier and S. Arnow. "Wide-Band Polarizer in Circular Waveguide Loaded with Dielectric Discs." 1965 Transactions on Microwave Theory and Techniques 13.6 (Nov. 1965 [T-MTT]): 763-767.

A converter between linear and circular polarization has been designed in circular waveguide by the use of periodic loading with oblong dielectric discs. The disc loading increases the single-mode (TE₁₁) bandwidth relative to that of homogeneously filled circular waveguide. Moreover, periodic loading gives the designer freedom to adjust the disc thickness and shape to meet certain requirements. With the abutting disc-loaded waveguide as a reference, the dielectric loading is increased in one plane of polarization and decreased in the orthogonal plane. In a wide-band design, this differential loading gives nearly constant 90° difference in time phase between space-quadrature component waves, the condition for circular polarization. Such a polarizer has been constructed with four oblong discs. Across a frequency bandwidth of about 15 percent, the measured phase difference is within 2° of the desired value and the SWR is within 1.5 dB.

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Abstracts

Progress in Solid-State Microwave Power Sources

F. Sterzer. "Progress in Solid-State Microwave Power Sources." 1965 Transactions on Microwave Theory and Techniques 13.6 (Nov. 1965 [T-MTT]): 768-772.

Recent progress in the following areas is reviewed: high-power UHF and microwave transistors, high-power microwave transistor-oscillator multipliers and transistor-amplifier multipliers, high-power transistor-driven harmonic-generator chains, Gunn-type oscillators, and avalanche diode oscillators.



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A Ferrimagnetically-Tuned Parametric Amplifier

K.L. Kotzebue and L.B. Fletcher. "A Ferrimagnetically-Tuned Parametric Amplifier." 1965 Transactions on Microwave Theory and Techniques 13.6 (Nov. 1965 [T-MTT]): 773-776.

A parametric amplifier can normally be tuned only over relatively restricted frequency ranges. One of the basic reasons for this tuning difficulty is that more than one frequency range is of importance for, in addition to the signal frequency, a pump frequency and one or more sum or difference frequencies must be considered. In this paper a tunable negative-resistance parametric amplifier is described which uses ferrimagnetically-tuned signal and idler circuits, together with a fixed-frequency pump source. This amplifier is unique in two respects. One is that the amplifier is electrically tuned through the use of yttrium iron garnet (YIG) resonators. Secondly, useful low-noise performance has been achieved over a tuning range of almost one octave, this amplifier thus successfully demonstrates that the technique of magnetic tuning with YIG resonators can be applied to a device as complex as a parametric amplifier in much the same manner as it has been applied in the past to microwave band-pass and band-stop filters.

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Microstrip Transmission on Semiconductor Dielectrics (Nov. 1965 [T-MTT])

T.M. Hylltin. "Microstrip Transmission on Semiconductor Dielectrics (Nov. 1965 [T-MTT])." 1965 Transactions on Microwave Theory and Techniques 13.6 (Nov. 1965 [T-MTT]): 777-781.

As a result of both a larger number of microwave functions performed by semiconductor devices and a larger number of functions required in modern systems, it has become highly desirable from both the system and the device standpoint to fabricate multiple microwave semiconductor devices on a common substrate. The use of multiple devices in a single package has system and reliability advantages, but there is also offered the possibility of improved performance of the microwave components. This results from the elimination of packaging of each individual element and the ability to place the package interface in a more advantageous position in the circuit. To effect such an improvement, an efficient means of microwave interconnection must be available. The interconnections must have not only low dissipative losses through the microwave region, but be capable of providing the impedances necessary for transformations by the various microwave functions and for circuit resonating elements. The range of impedance commonly required is of the order of 20 Ω to 80 Ω . To be compatible with semiconductor materials and processing, the choice of dielectric material was limited to film dielectrics, possibly SiO_2 , or the use of the semiconductor material itself as a dielectric. For both semi-insulating gallium arsenide and silicon of resistivity greater than 1000 $\Omega\text{-cm}$, the loss is sufficiently low to perform efficient interconnection of devices on a common substrate and is considered even suitable for other components such as directional couplers and hybrids where extremely high Q is not required.





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A Digital Latching Ferrite Strip Transmission Line Phase Shifter (Nov. 1965 [T-MTT])

L.R. Whicker and R.R. Jones. "A Digital Latching Ferrite Strip Transmission Line Phase Shifter (Nov. 1965 [T-MTT])." 1965 Transactions on Microwave Theory and Techniques 13.6 (Nov. 1965 [T-MTT]): 781-784.

This paper is concerned with the development of a new type of latching phase shifter which combines submicrosecond switching with a compact strip transmission line structure. Digital increments of nonreciprocal phase shift are obtained by "latching" or switching the magnetization of appropriate square loop garnet or ferrite materials from one remanent state to another. The following data have been obtained for a four-bit, C-band model utilizing yttrium iron garnet ($4\pi M/\text{sub } 8/ = 1600 \text{ G}$): Center Frequency - 5.45 Gc/s Phase Deviation - $\leq \pm 3$ percent over an 8 percent frequency band Insertion Loss - $< 0.9 \text{ db}$ VSWR - < 1.50 Switching Time - $< 0.3\mu\text{s}$ with a 130 V, 13 amp pulse Switching Energy - $< 200 \mu\text{J}$ for 180° bit Length - < 6 inches.

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A High Power Phase Shifter for Phased-Array Systems

W.P. Clark. "A High Power Phase Shifter for Phased-Array Systems." 1965 Transactions on Microwave Theory and Techniques 13.6 (Nov. 1965 [T-MTT]): 785-788.

The design of a small, lightweight, high peak and average power phase shifter is discussed. To achieve the high peak power handling, a small crystal grain technique was employed that resulted in a 14 to 1 power handling improvement. To achieve the high average power handling, a temperature compensated garnet was used along with a novel direct dielectric liquid cooling technique. The structure used to implement the cooling causes dielectric loading of the garnet material which enhances the microwave performance of the device. The results have provided a device capable of 360° of continuous reciprocal phase shift while operating at signal levels of 115-kW peak, and 600-watts average power.



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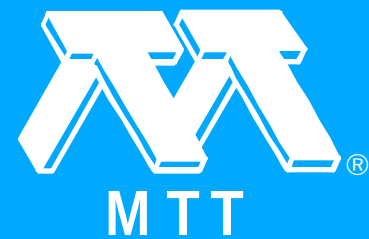
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A Ferroelectric Microwave Switch (Nov. 1965 [T-MTT])

J.W. Amoss, M.R. Donaldson, L.J. Lavedan, A.L. Stanford and J.E. Pippin. "A Ferroelectric Microwave Switch (Nov. 1965 [T-MTT])." 1965 Transactions on Microwave Theory and Techniques 13.6 (Nov. 1965 [T-MTT]): 789-793.

The rapid variation of an admittance shunting a transmission line is a well-known technique for switching microwave power. The application of a switching voltage to a ferroelectric material provides a convenient means for rapidly varying an admittance between significantly different states. A multistub transmission-reflection-type switch actuated by a switching voltage of 1000 volts has been studied. The operation of the switch depends upon the ability of a ferroelectric variable capacitor to change its capacitance upon application of a switching voltage. A change in capacitance represented by a ratio of two to one results in substantial change in the input admittance of the prototype network shunting the transmission line. The prototype network is a shunt stub and is spaced nominally at $\lambda/4$ intervals along the transmission line to form a multistub switch. Each shunt stub includes a ferroelectric variable capacitance which employs lead strontium titanate ($\text{Pb}/\text{sub } 0.315/\text{Sr}/\text{sub } 0.685/\text{TiO}/\text{sub } 3/$) as the ferroelectric material. Both theoretical and experimental curves of isolation and insertion loss vs. frequency are given for two- and three-stub versions of the switch. For switching voltages of the order of 1000 volts, ferroelectric switches with an isolation of 40 dB, an insertion loss less than 1.0 dB, and a bandwidth of 10 percent are feasible.



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Computation of Impedance and Attenuation of TEM-Lines by Finite Difference Methods

M.V. Schneider. "Computation of Impedance and Attenuation of TEM-Lines by Finite Difference Methods." 1965 Transactions on Microwave Theory and Techniques 13.6 (Nov. 1965 [T-MTT]): 793-800.

The characteristic impedance and the attenuation of transmission lines supporting TEM modes can be computed by using finite difference methods for solving the Laplace equation for the domain defined by the inner and the outer conductor. The difference equations can be solved by machine computation and the impedance and the attenuation is obtained by integrating the field gradients and the squares of field gradients over both boundaries. The case of a shielded strip transmission line is treated as a numerical example. A computation time of approximately 0.015 hour on the IBM 7094 is required for achieving an accuracy of 0.5 percent for the impedance and 2 percent for the attenuation. The finite difference method is also used for lines which are partially filled with dielectric material and it is concluded that low attenuations are obtained by placing the dielectric material in such a way that high field regions are avoided.

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The Arc Loss of Multimegawatt Gas Discharge Duplexers (Nov. 1965 [T-MTT])

C.S. Ward, F.A. Jellison, N.J. Brown and L. Gould. "The Arc Loss of Multimegawatt Gas Discharge Duplexers (Nov. 1965 [T-MTT])." 1965 Transactions on Microwave Theory and Techniques 13.6 (Nov. 1965 [T-MTT]): 801-805.

The arc loss of a multimegawatt gas discharge switch is analyzed in the approximation that discharge skin depth is small compared to the discharge container dimensions. Experimental agreement with the results of this analysis is found in several respects: 1) arc loss varies linearly with iris height; 2) arc loss varies inversely with the one fourth root of average peak power; 3) calculated ratios of shunt to series arc loss agree with experimental loss measurements on gas filled TR and ATR duplexer windows. These results have been of particular value in predicting both the loss and power handling capability of extremely high power balanced TR and ATR duplexers from tests on simple shunt mounted discharge windows. It is shown that, for the same iris height, series windows are superior in power handling capability to shunt windows, with the result that a balanced ATR duplexer has two to four times the power handling capability of a balanced pre-TR duplexer.

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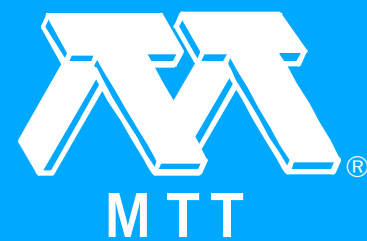


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The Automatic Phasing System for the Stanford Two-Mile Linear Electron Accelerator (Nov. 1965 [T-MTT])

C.B. Williams, A.R. Wilmunder, J. Dobson, H.A. Hogg, M.J. Lee and G.A. Loew. "The Automatic Phasing System for the Stanford Two-Mile Linear Electron Accelerator (Nov. 1965 [T-MTT])." 1965 Transactions on Microwave Theory and Techniques 13.6 (Nov. 1965 [T-MTT]): 806-814.

This paper describes the system for automatically phasing 240 high-power klystrons that drive the Stanford two-mile linear electron accelerator. After a brief discussion of the requirements of a phasing system for such a long machine and a review of some alternative methods which were initially considered, the principle of "Beam-Induction" phasing is described. Advantages of the "Beam-Induction" technique are listed, and the problem of obtaining phase error information from accelerator signals varying over a 54-dB power range is considered. It is shown that the problem may be solved by the use of coaxial thermionic diodes, which have nearly linear detection characteristics. The concept of phase-wobbling is introduced. It is shown that this idea may be used to design an ac servo system, avoiding problems with dc amplifier stability. Phase wobbling is also seen to remove phasing errors due to imperfect matching of the diode pair. The installation and operation of the automatic phasing system in a typical sector of the machine is briefly described. In conclusion, some results of preliminary tests on the first two sectors (660 feet) of the machine are presented.



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Abstracts

Stability and Gain Prediction of Microwave Tunnel-Diode Reflection Amplifiers

J.W. Bandler. "Stability and Gain Prediction of Microwave Tunnel-Diode Reflection Amplifiers." 1965 Transactions on Microwave Theory and Techniques 13.6 (Nov. 1965 [T-MTT]): 814-819.

The Nyquist approach to stability is used in a form suitable for representation on a chart having conventional Smith chart scales. It is shown how the gain and stability of negative conductance reflection amplifiers of the tunnel-diode type can be simultaneously predicted on this chart. The technique described is particularly useful in the practical design of these amplifiers embedded in networks having complicated functions of frequency, as it involves predominantly graphical computations. A procedure is outlined for constructing immittance curves for the tunnel-diode, viewed either as a series or as a parallel circuit. An example of a 3-Gc/s amplifier operating in a rectangular waveguide is given.



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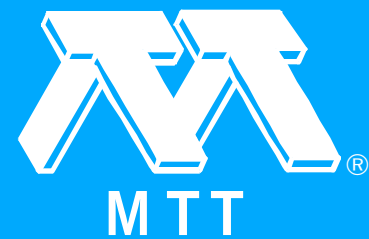
A Large Signal Analysis Leading to Intermodulation Distortion Prediction in Abrupt Junction Varactor Upconverters

S.M. Perlow and B.S. Perlman. "A Large Signal Analysis Leading to Intermodulation Distortion Prediction in Abrupt Junction Varactor Upconverters." 1965 Transactions on Microwave Theory and Techniques 13.6 (Nov. 1965 [T-MTT]): 820-827.

Even though the abrupt junction varactor parametric upconverter is a "square-law" device, it exhibits gain saturation. This nonlinearity of the transfer characteristic is responsible for the nonlinear distortion present at the output of the device. Of the several methods used to measure nonlinear distortion, the two tone test has been widely used. It is the accepted test method of both SMPTE and CCIR. This paper discusses the relationship between the nonlinear distortion measured by the two tone test and the nonlinear gain characteristic. It shows that if one is known the other is uniquely determined. The analysis is broken into two parts. The first is a large signal analysis of the "square-law" parametric frequency converter. The results show that the gain is a function of the input signal level. It is this nonlinear relationship that is responsible for gain saturation. The second part is a study of the series representation of this nonlinear equation with respect to the terms containing the intermodulation frequencies. The final result is an equation which predicts the amplitude of the intermodulation distortion at any of the intermodulation frequencies. The analysis presented is closely related to the circuit and diode parameters and therefore not only predicts the amount of intermodulation distortion but also shows how it may be reduced. Experimental verification of the theory is also included.

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The Effect of Parasitic Elements on Reflection Type Tunnel Diode Amplifier Performance

J.O. Scanlan and J.T. Lim. "The Effect of Parasitic Elements on Reflection Type Tunnel Diode Amplifier Performance." 1965 Transactions on Microwave Theory and Techniques 13.6 (Nov. 1965 [T-MTT]): 827-836.

The effect of the tunnel diode series inductance and stray capacitance on the gain and bandwidth of broadband reflection type amplifiers is considered. General stability criteria imposed by these reactance are given together with realizability conditions for ideal (flat gain), Butterworth and Chebyshev responses. The main effect of the parasitic elements is to restrict the range of gain and bandwidth which may be achieved for a given number of elements in the matching network. The minimum gain is restricted together with both the maximum and minimum bandwidths. Comprehensive sets of curves are given which enable a rapid design of either Butterworth or Chebyshev response to be accomplished, and a procedure is given for conversion of the low-pass prototype network to band-pass form in the presence of the parasitic reactances. The frequency transformation is used to obtain an upper limit on the center frequency of the band-pass amplifier imposed by the parasitic. The use of the design data is illustrated by numerical examples.

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Locking of Magnetrons by an Injected RF Signal

H.L. Thal and R.G. Lock. "Locking of Magnetrons by an Injected RF Signal." 1965 Transactions on Microwave Theory and Techniques 13.6 (Nov. 1965 [T-MTT]): 836-846.

An equivalent circuit is given which quantitatively predicts the performance of magnetron oscillators when they are frequency locked by an injected RF signal. A method is presented for the reciprocal coupling of magnetrons to a traveling wave without reflection. The theory is supported by experimental results which include: 1) a single-tube locked oscillator with nonreciprocal (circulator) coupling, 2) a three-tube locked oscillator array with reciprocal coupling, 3) a two-tube oscillator with reciprocal coupling. The feasibility of various locked oscillator and self-oscillating arrays, including the effect of mismatched loads, is discussed.

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Abstracts

Uniform Waveguides with Arbitrary Cross-Section Considered by the Point-Matching Method

H.Y. Yee and N.F. Audeh. "Uniform Waveguides with Arbitrary Cross-Section Considered by the Point-Matching Method." 1965 Transactions on Microwave Theory and Techniques 13.6 (Nov. 1965 [T-MTT]): 847-851.

The point-matching method applies to the problem of wave propagation in many uniform waveguides of very general cross-sections. The boundary conditions are satisfied at a finite number of points on the guide wall only. This method applies when the contour of the cross section of the guide is a closed curve, the function of which is single-valued. The validity of the point-matching method is demonstrated qualitatively. Examples show that accurate values of cutoff wave numbers can be achieved easily.



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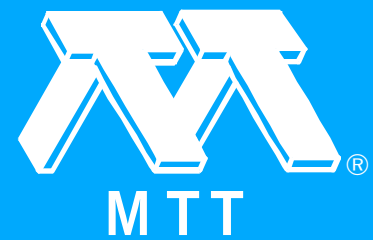
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Lumped Element Y Circulator

Y. Konishi. "Lumped Element Y Circulator." 1965 Transactions on Microwave Theory and Techniques 13.6 (Nov. 1965 [T-MTT]): 852-864.

A lumped element Y circulator using ferrite, having a mesh mechanism in place of the center conductor of an ordinary Y strip line circulator, is proposed. A theory is developed relating to bandwidth, insertion loss, and temperature dependence of the reactive energy and the tensor permeability of ferrite, and the bandwidth enlargement is discussed on the basis of the equivalent network. The size of the circulator is approximately 1~2 cm in diameter for VHF and UHF bands and the characteristics are, for example, about 50 percent bandwidth for 20-dB isolation, 2-dB insertion loss at 600-Mc/s center frequency. It is also shown that the insertion loss has its minimum value at a definite bandwidth and, as a practical example, a circulator is described with 0.25 dB of insertion loss and 6.5 percent bandwidth at 700 Mc/s.

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Abstracts

Large Signal Operation of Microwave Transistors (Correspondence)

B.T. Vincent. "Large Signal Operation of Microwave Transistors (Correspondence)." 1965 Transactions on Microwave Theory and Techniques 13.6 (Nov. 1965 [T-MTT]): 865-866.

Transistor amplifiers designed for small signal operation and near optimum noise figure in the microwave region have been reported by numerous workers. As the transistors operate under small signal conditions, conventional characterization in terms of Y or other parameters may be used for circuit design. Accurate measurement of the parameters is somewhat more difficult than at lower frequencies; nevertheless, in principle and practice, the same techniques employed at lower frequencies to measure transistor parameters can be utilized in the microwave region.



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A Four-Bit Latching Ferrite Switch (Nov. 1965 [T-MTT]) (Correspondence)

D.H. Landry and W.C. Passaro. "A Four-Bit Latching Ferrite Switch (Nov. 1965 [T-MTT]) (Correspondence)." 1965 Transactions on Microwave Theory and Techniques 13.6 (Nov. 1965 [T-MTT]): 866-867.

Latching ferrites are rapidly advancing a new era of solid-state devices. These new devices require neither external magnets nor continuous drive current, and, in many applications, are far superior to those which utilize conventional biasing techniques. The resultant economy of weight and power supply requirements suggests the possibility of uses in a variety of microwave components such as circulators, switches, isolators, and digital phase shifters. Their fast-switching lightweight characteristics make them particularly suited to phased array and other systems.



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Abstracts

A High Power X-Band Limiter (Correspondence)

E. Wantuch and M. King. "A High Power X-Band Limiter (Correspondence)." 1965 Transactions on Microwave Theory and Techniques 13.6 (Nov. 1965 [T-MTT]): 868-869.

The narrow ferromagnetic linewidth exhibited by single crystal yttrium iron garnet forms the basis for several novel microwave devices. These may be divided into two main categories, namely, magnetically tunable filters and microwave limiters. Single crystal YIG spheres may be associated with additional microwave resonators to enhance one of these desired characteristics and to suppress the other.



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Prediction and Measurement of Oscillator Frequency Modulation under Random Vibration (Correspondence)

J.R. Ashley and C.B. Searles. "Prediction and Measurement of Oscillator Frequency Modulation under Random Vibration (Correspondence)." 1965 Transactions on Microwave Theory and Techniques 13.6 (Nov. 1965 [T-MTT]): 869-870.

Electronic equipment used in jet aircraft or in a missile environment must operate under broadband random mechanical and acoustic vibration. Individual component performance is tested by subjecting the operating component to band limited random noise vibration rather than to sinusoidal vibration. The analysis of component performance, particularly the problem of pinpointing the source of spurious responses resulting from such random vibration testing is often not available.

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Relative to Microwave Power Engineering (Correspondence)

E. Okress. "Relative to Microwave Power Engineering (Correspondence)." 1965 Transactions on Microwave Theory and Techniques 13.6 (Nov. 1965 [T-MTT]): 870-871.

Recent erroneous reporting of a facet of the proceedings of a microwave power engineering symposium has left the impression that microwave CW power transmission is limited, without qualification, by heating of the waveguide before the electric breakdown limit is reached. Consequently, a partial purpose of this correspondence is to show that microwave CW power transmission via re-entrant waveguide need not be limited by heat dissipation in the waveguide nor by electric breakdown even beyond the equivalent CW power capacity of high voltage (i.e., 132 to 750 kV) classical (i.e., 60 c/s) transmission lines. On the contrary, the feasibility of microwave power transmission is dependent on resolving the following.

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Varactor Measurements and Equivalent Circuits (Correspondence)

N. Houlding. "Varactor Measurements and Equivalent Circuits (Correspondence)." 1965 Transactions on Microwave Theory and Techniques 13.6 (Nov. 1965 [T-MTT]): 872-873.

There have been two reports of the use of series resonance for evaluation of varactors, and another on the impedance locus of coaxially mounted varactors. There can be considerable error in the assumption of a simple resonance, and, since the author has heard of alarming variations in varactor resistance, which may be a consequence of measurement errors, it seems important to draw attention to the pitfalls.

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Abstracts

Submillimeter Wave Harmonic Mixing (Correspondence)

R.G. Strauch, R.A. Miesch and R.E. Cupp. "Submillimeter Wave Harmonic Mixing (Correspondence)." 1965 Transactions on Microwave Theory and Techniques 13.6 (Nov. 1965 [T-MTT]): 873-873.

The difference frequency between harmonics of millimeter wave oscillators has been observed at submillimeter wavelengths using a crossed-waveguide harmonic generator as a harmonic mixer.



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Magnetostriction Effects in Remanence Phase Shifters (Correspondence)

E. Stern and D.H. Temme. "Magnetostriction Effects in Remanence Phase Shifters (Correspondence)." 1965 Transactions on Microwave Theory and Techniques 13.6 (Nov. 1965 [T-MTT]): 873-874.

One type of remanence phase shifter consists of a microwave ferrite toroid located in a waveguide. Close mechanical fit between ferrite and waveguide is desirable to eliminate reflection spikes, and to provide an adequate thermal path. Such structures typically develop mechanical pressure on the ferrite, and this pressure may vary with temperature, due to the unequal expansion of the waveguide and ferrite with temperature.

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Comparison of Two Low-Loss Semiconductor Switches (Correspondence)

D.L. Rebsch, H.J. Peppiatt, A.V. McDaniel, Jr. and J.B. Linker, Jr.. "Comparison of Two Low-Loss Semiconductor Switches (Correspondence)." 1965 Transactions on Microwave Theory and Techniques 13.6 (Nov. 1965 [T-MTT]): 874-875.

The semiconductor waveguide switch discussed in these Transactions in 1965 is similar to a switch reported in 1961, and yet the authors of the recent paper were not aware of earlier work, approaching their project from a different point of view. The earlier switch offers advantages over the latter, with switching specifications (isolation, insertion loss, power limitations, bandwidth, etc.) that are strikingly similar.

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



Abstracts

Acceptable Mode Types for Inhomogeneous Media (Correspondence)

A. Wexler and D.A. Holmes. "Acceptable Mode Types for Inhomogeneous Media (Correspondence)." 1965 Transactions on Microwave Theory and Techniques 13.6 (Nov. 1965 [T-MTT]): 875-878.

This correspondence is prompted by Holmes's paper in which he presented a study of the use of the WKB approximation for the solution of the wave equations in a rectangular waveguide inhomogeneously and continuously loaded across the broad dimension. I would like to point out the form of the acceptable mode types in such a waveguide.



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Measurement of Cutoff Frequencies (Correspondence)

N.F. Audeh and H.Y. Yee. "Measurement of Cutoff Frequencies (Correspondence)." 1965 Transactions on Microwave Theory and Techniques 13.6 (Nov. 1965 [T-MTT]): 878-879.

Measurements of guide wavelengths and cutoff frequencies are often of interest in experimental investigations of waveguides with general cross sections. When necessary measuring equipment is not available, the phase constant measurement described by Altschuler provides a simple method of determining the cutoff frequency, which is readily obtainable from the phase constant of the waveguide. However, if a more accurate determination is required, the preceding method may not be adequate. A more accurate and convenient method for determining cutoff frequencies is presented here.

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Characteristics of Transient Parametric Amplification of Elastic Waves in YIG (Correspondence)

R.A. Sparks and E.L. Higgins. "Characteristics of Transient Parametric Amplification of Elastic Waves in YIG (Correspondence)." 1965 Transactions on Microwave Theory and Techniques 13.6 (Nov. 1965 [T-MTT]): 879-880.

The observation of a transient mode of quasi-degenerate parametric amplification of elastic waves in YIG was reported in an earlier letter along with other modes of operation. The purpose of this correspondence is to describe further experiments that have been conducted in order to characterize in greater detail the very high gain, transient amplification process in the microwave frequency range.

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



Abstracts

Linear Tuning of a Microwave Cavity (Correspondence)

M.J. Vetter. "Linear Tuning of a Microwave Cavity (Correspondence)." 1965 Transactions on Microwave Theory and Techniques 13.6 (Nov. 1965 [T-MTT]): 880-880.

The usual tuning devices used with microwave cavities have pronounced non-linear (frequency vs. probe position) characteristics because of their operation in non-uniform fields. The arrangement described here encloses a small tuning probe with a dielectric sleeve of such shape as to improve the uniformity of the field around the probe and consequently the linearity of tuning over a useful range of operation.



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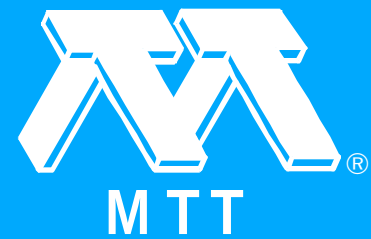


Abstracts

Experimental Results in Groove Guide (Correspondence)

J.M. Ruddy. "Experimental Results in Groove Guide (Correspondence)." 1965 Transactions on Microwave Theory and Techniques 13.6 (Nov. 1965 [T-MTT]): 880-881.

This correspondence is concerned with the following developments in low-loss groove guide.



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Abstracts

Field Equations in Cylindrical Coordinates for Gyroelectric Media with Sources (Correspondence)

R.K. Likuski. "Field Equations in Cylindrical Coordinates for Gyroelectric Media with Sources (Correspondence)." 1965 Transactions on Microwave Theory and Techniques 13.6 (Nov. 1965 [T-MTT]): 881-882.

For a gyroelectric medium characterized by a tensorial relative permittivity of the form Maxwell's equations may be written where both electric and magnetic currents, designated by subscripts e and m, respectively, have been included.



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On the Superheterodyne Method of Microwave Noise Measurements (Correspondence)

M. Kloza. "On the Superheterodyne Method of Microwave Noise Measurements (Correspondence)." 1965 Transactions on Microwave Theory and Techniques 13.6 (Nov. 1965 [T-MTT]): 882-883.

One of the frequently used methods in microwave oscillator noise measurements is the superheterodyne method. This correspondence is not intended to describe this method in detail, but to call attention to the possibility of pointing out one measurement error. Every one who is interested in microwave oscillator measurements can find fundamental information given in [1].

Abstracts

ADI Auxiliary Publications Program (Correspondence)

R.W. Zimmerer. "ADI Auxiliary Publications Program (Correspondence)." 1965 Transactions on Microwave Theory and Techniques 13.6 (Nov. 1965 [T-MTT]): 883-884.

On many occasions a manuscript submitted for publication must be condensed or otherwise abridged to reduce the number of pages it will require in the final published form. This is a natural result of the competition among authors for the limited space available within the journals of their choice. While the author may be aggrieved at the cutting of his masterpiece, the readers may often be annoyed at the resulting limited discussion of difficult points. Another situation where this policy is awkward is in the presentation of tables for design (filter design for example). To be useful to a designer the tables must be complete and to the proper number of places. If the theory is presented with only sample calculations or a portion of the table printed, a great deal of utility is lost. Yet this detailed information may be useful to such a small proportion of the profession that the editor cannot justify committing all the pages needed to make it useful to anyone at the expense of other equally meritorious manuscripts.



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Calibration of Coaxial Bolometer Units (Correspondence)

"Calibration of Coaxial Bolometer Units (Correspondence)." 1965 Transactions on Microwave Theory and Techniques 13.6 (Nov. 1965 [T-MTT]): 884-884.

The Radio Standards Laboratory of the Institute for Basic Standards (National Bureau of Standards, U. S. Department of Commerce) announces that services are now available for the measurement of calibration factor of nominal 50-ohm coaxial bolometer units and coaxial bolometer-coupler units. These devices have proved useful in the accurate measurement of CW RF power in coaxial systems over a range of 1 mW to 10 watts. At present the service is offered for bolometer units at two frequencies only, 100 MHz and 1 GHz; for bolometer-coupler units the service is offered at 30, 100, 200, 300, 400, 500 MHz, and 1 GHz. Plans call for extension of the frequency range to at least 10 GHz and for essentially continuous frequency coverage.

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Discrepancies in Dielectric Waveguide Mode Cutoff Conditions (Correspondence)

P. Diamant, S.P. Schlesinger, G. Biernson and D.J. Kinsley. "Discrepancies in Dielectric Waveguide Mode Cutoff Conditions (Correspondence)." 1965 Transactions on Microwave Theory and Techniques 13.6 (Nov. 1965 [T-MTT]): 884-885.

The rederivation of the characteristics of modes of propagation along a dielectric rod by Biernson and Kinsley kindled renewed interest in work we published in 1960 on the same topic. Whereas our interest in the dielectric rod waveguide was as a surface wave transmitting structure at microwave frequencies, Biernson and Kinsley analyze this configuration mainly as a model of retinal cones, sensitive to optical frequencies. Since the electromagnetic field equations are, of course, identical in both regimes, a direct comparison is possible.

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Abstracts

Contributors (Nov. 1965 [T-MTT])

J.W. Amoss, S. Arnow, N.F. Audeh, J.W. Bandler, N.J. Brown, W.P. Clark, J. Dobson, M.R. Donaldson, L.B. Fletcher, G. Goubau, L. Gould, H.A. Hogg, T.M. Hylltin, F. Jellison, R.R. Jones, Y. Konishi, K.L. Kotzebue, L.J. Lavedan, M.J. Lee, J.-T. Lim, R.G. Lock, G.A. Loew, D. Marcuse, P.J. Meier, B.S. Perlman, S.M. Perlow, J.E. Pippin, S.O. Scanlan, M.V. Schneider, F.K. Schwering, A.L. Stanford, W.H. Steier, F. Sterzer, H.L. Thal, Jr., E.N. Torgow, C.S. Ward, L.R. Whicker, C.B. Williams, A.R. Wilmunder and H.Y. Yee. "Contributors (Nov. 1965 [T-MTT])." 1965 Transactions on Microwave Theory and Techniques 13.6 (Nov. 1965 [T-MTT]): 886-891.



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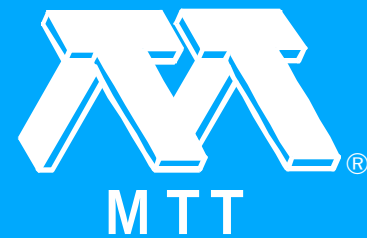
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Abstracts

Call for Papers - Conference on Precision Electromagnetic Measurements (Nov. 1965 [T-MTT])

"Call for Papers - Conference on Precision Electromagnetic Measurements (Nov. 1965 [T-MTT])." 1965 Transactions on Microwave Theory and Techniques 13.6 (Nov. 1965 [T-MTT]): 894-894.



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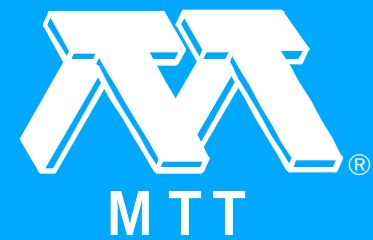
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Membership Application (Nov. 1965 [T-MTT])

"Membership Application (Nov. 1965 [T-MTT])." 1965 Transactions on Microwave Theory and Techniques 13.6 (Nov. 1965 [T-MTT]): 895-895.



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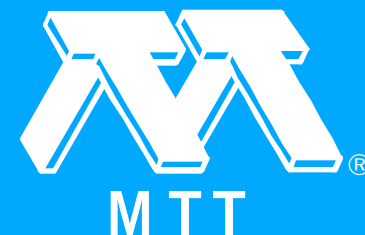
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Index, IEEE Transactions on Microwave Theory and Techniques, Volume MTT-13, 1965

*"Index, IEEE Transactions on Microwave Theory and Techniques, Volume MTT-13, 1965."
1965 Transactions on Microwave Theory and Techniques 13.6 (Nov. 1965 [T-MTT]): i-xiv.*



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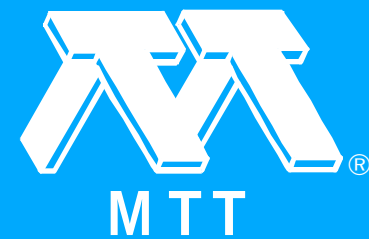
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Abstracts

Design of Microwave Dielectric Resonators

J.C. Sethares and S.J. Naumann. "Design of Microwave Dielectric Resonators." 1966 Transactions on Microwave Theory and Techniques 14.1 (Jan. 1966 [T-MTT]): 2-7.

The resonant frequencies for the fundamental modes in circular cylindrical and rectangular parallelepiped high dielectric resonators have been calculated by computer for a range of values of physical dimensions and relative dielectric constant. The frequency range extends from zero to 50 kMc/s, the relative dielectric constant from 50 to 1800, and physical dimensions from zero to 500 mils. Results are presented in graphical form with frequency plotted vs. resonator length for parametric values of relative dielectric constant and cross-sectional dimensions. A brief review of earlier work with high dielectric resonators is included. Expressions for the resonant frequency and fundamental mode field configurations are given.



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Impedances of Offset Parallel-Coupled Strip Transmission Lines

J.P. Shelton, Jr.. "Impedances of Offset Parallel-Coupled Strip Transmission Lines." 1966 Transactions on Microwave Theory and Techniques 14.1 (Jan. 1966 [T-MTT]): 7-15.

An offset parallel-coupled strip configuration is described, in which the mechanical parameters are strip width, strip offset, and ratio of strip spacing to ground-plane spacing. The electrical parameters are dielectric constant, characteristic impedance, even and odd mode impedance. The configuration is analyzed by conformal mapping techniques. Explicit design equations are derived in which the mechanical parameters are expressed in terms of the electrical parameters. Illustrative results are presented, and the limitations on coupling strength, characteristic impedance, and strip configuration are discussed.

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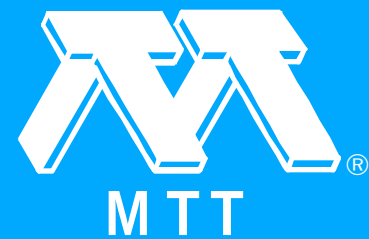
Theoretical Analysis of Twin-Slab Phase Shifters in Rectangular Waveguide (Jan. 1966 [T-MTT])

E. Schlomann. "Theoretical Analysis of Twin-Slab Phase Shifters in Rectangular Waveguide (Jan. 1966 [T-MTT])." 1966 Transactions on Microwave Theory and Techniques 14.1 (Jan. 1966 [T-MTT]): 15-23.

The differential phase shift and the losses to be expected in phase shifters using two oppositely magnetized ferrite slabs located symmetrically in a rectangular waveguide have been calculated for various locations and thicknesses of the ferrite slabs. For small thicknesses of the ferrite slabs, the differential phase shift increases rapidly with increasing thickness reaching a maximum when the thickness is approximately 1/10 of the free space wavelength. The calculated insertion loss of a 360-degree phase shifter decreases with increasing slab thickness for small thickness, reaching a minimum when the thickness is approximately 1/25 of the free space wavelength. The minimum insertion loss calculated with the assumption that the imaginary part of the diagonal component of the permeability tensor is 0.01 and that dielectric loss can be neglected is approximately 0.85 dB. The peak power handling capability has also been analyzed. It can conveniently be summarized in terms of a high-power figure of merit. For reasonably high values of this figure of merit, a peak power capability of the order of 100 kW is anticipated.

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Phase-Shift Characteristics of Helical Phase Shifters

R. Seckelmann. "Phase-Shift Characteristics of Helical Phase Shifters." 1966 Transactions on Microwave Theory and Techniques 14.1 (Jan. 1966 [T-MTT]): 24-28.

The phase shifters considered consist of a helix surrounded by or surrounding a ferrite toroid. The ferrites work at their maximum remanent magnetization. It is shown that the helix surrounding a ferrite allows at any combination of frequency and helix diameter a larger differential phase shift than the helix surrounded by a ferrite does; and that in the latter helix the phase shift is easily disturbed by the TE/sub 11/ mode. It is furthermore shown that the $3\lambda/4$ per turn helix offers a larger fractional bandwidth than the $\lambda/4$ per turn helix does unless one uses ferrites with very low saturation magnetization. The theoretical results are supplemented by experimental data.

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Abstracts

Some Fundamental Design Principles for the Development of Precision Coaxial Standards and Components

T.E. MacKenzie and A.E. Sanderson. "Some Fundamental Design Principles for the Development of Precision Coaxial Standards and Components." 1966 Transactions on Microwave Theory and Techniques 14.1 (Jan. 1966 [T-MTT]): 29-39.

Significant advances in the performance of precision coaxial standards and components have resulted from rigid adherence to three basic design principles: 1) incremental constancy of characteristic impedance, 2) coplanar compensation of discontinuities, and 3) control of mechanical tolerance sensitivity. The advances include dielectric supports with extremely small interface discontinuities, contacting members that are insensitive to mechanical tolerances, calculable airline impedance standards of very high absolute accuracy, nearly reflectionless terminations based on a cylindrical metal-film resistor, and adaptors between line sizes based on smooth (rather than stepped) diametral transitions. Extensions of the design principles have resulted in the introduction of closely controlled reflections provided by a novel impedance-matching tuner, broadband calibrated mismatches, and resistance-standard terminations that retain their nominal dc values to very high frequencies.



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A Resonator Technique for Studying Dispersion in Longitudinally Magnetized Plasma Guides (Correspondence)

R.K. Likuski, P.D. Coleman and J.J. Stafford. "A Resonator Technique for Studying Dispersion in Longitudinally Magnetized Plasma Guides (Correspondence)." 1966 Transactions on Microwave Theory and Techniques 14.1 (Jan. 1966 [T-MTT]): 40-41.

A resonator technique has been developed for experimentally studying the dispersion characteristics of the angular symmetric modes with one and two radial variations in a circular, longitudinally magnetized plasma column. The resonator was made to resonate for both modes by varying the magnetic field, thus making an independent measurement of plasma density unnecessary for verifying theoretical calculations. A detailed cutaway cross-sectional drawing of one of the resonators is shown in Fig. 1. The plasma was formed by pulsing the cathodes negative with a 2-kilovolt pulse of 5 microseconds duration applied at a repetition rate of 60 cycles per second. The plasma thus formed decayed completely between successive pulses. A CW probing microwave signal was applied to one end of the resonator and the resonance was detected in the decaying plasma either by monitoring a sharp decrease in the reflected power or an increase in the transmitted power when the plasma density decayed to a value that caused the column to resonate. The oscilloscope traces of reflected power shown in Fig. 2 (a) and (b), in which time increases from right to left, are illustrative examples of the resonances obtained in such a resonator for modes with one and two radial variations, respectively. The second dip corresponds to a resonance; the one near the beginning of the trace, which is independent of magnetic field, has not been fully explained.



Abstracts

A Parallel-Strip Point-Contact Diode Mount for Video Detection of Millimeter Waves (Correspondence)

M.A. Gerdine and F.S. Barnes. "A Parallel-Strip Point-Contact Diode Mount for Video Detection of Millimeter Waves (Correspondence)." 1966 Transactions on Microwave Theory and Techniques 14.1 (Jan. 1966 [T-MTT]): 41-42.

This correspondence presents measurements of the performance of an experimental parallel-strip transmission line mount for point-contact diodes (see Fig. 1). These results are an extension of work reported previously. The mount has been used with tunnel-diode, back diode, and ordinary diode detectors at wavelengths of 3.3, 2.1, and 0.84 mm. The sensitivities of the diodes in the new mount compare favorably with reported results for in-line waveguide diodes. As the signal wavelength decreases, the fabrication of waveguide diode mounts becomes increasingly difficult; therefore, the parallel-strip mount does effect some construction and experimental advantages over such waveguide structures. A detailed description of the parallel-strip mount is given in Gerdine and Barnes.



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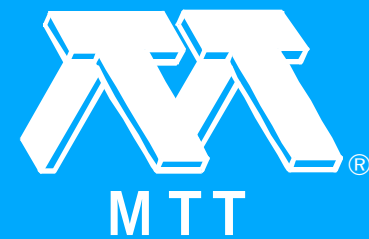


Abstracts

A 150 Mc/s Circulator (Correspondence)

B. Maher, D. Mitchell and A. Reeves. "A 150 Mc/s Circulator (Correspondence)." 1966 Transactions on Microwave Theory and Techniques 14.1 (Jan. 1966 [T-MTT]): 42-43.

The below-resonance operation of strip-line circulators at lower frequencies is not of interest as the low magnetic loss region is quite narrow on the magnetic field axis.



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Frequency Doublers Using Varactors Exhibiting "Punch-Through" Capacitance-Voltage Behavior (Correspondence)

C.L. Chao. "Frequency Doublers Using Varactors Exhibiting "Punch-Through" Capacitance-Voltage Behavior (Correspondence)." 1966 Transactions on Microwave Theory and Techniques 14.1 (Jan. 1966 [T-MTT]): 43-45.

Recently, a number of authors have given the analysis of the overdrive doubler for abrupt-junction, graded-junction, and stepwise-junction varactor doublers. All previous work has stimulated considerable interest in the prediction of power and efficiency of frequency doublers lusing varactors exhibiting a general nonlinearity. This discussion is concerned with the detailed analysis of the "punch-through" behavior varactor doubler to determine the conditions of optimum input and output resistances, maximum conversion efficiency, and power. The results will generally be determined by numerical techniques because of the algebraic complexity of the solutions. The analysis in this discussion asumes the varactor to be imbedded in a lossless tuned circuit.

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Abstracts

A Digital Current Controlled Latching Ferrite Phase Shifter (Correspondence)

L.R. Whicker and R.R. Jones. "A Digital Current Controlled Latching Ferrite Phase Shifter (Correspondence)." 1966 Transactions on Microwave Theory and Techniques 14.1 (Jan. 1966 [T-MTT]): 45-46.

With increased interest being placed on phased array antenna systems, much effort is being extended to improve the component phase shifters. The recent development of digital "latching ferrite" devices has been of considerable significance. Such phase shifters, for example, have reduced switching speeds to microsecond or submicrosecond intervals and have no need for bulky switching coils. This correspondence is concerned with the design of a new latching device which obtains digital increments of phase shift by using material properties exhibited in a single element geometry.



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General Three-Resonator Filters in Waveguide (Correspondence)

R.M. Kurzrok. "General Three-Resonator Filters in Waveguide (Correspondence)." 1966 Transactions on Microwave Theory and Techniques 14.1 (Jan. 1966 [T-MTT]): 46-47.

General three-resonator filters are capable of providing both band-pass and band-reject behavior. This type of filter network has been briefly considered as a generalized triple-tuned circuit. The potential advantages of general three- and four-resonator filters have been more recently discussed by Johnson, who considers dissipationless filters using inductive couplings. Johnson has presented experimental data on a lumped-circuit element general filter at 20 Mc/s, and has suggested some techniques for microwave implementation of general filters. In this correspondence, the performance capabilities of dissipative general three-resonator filters in waveguide will be discussed.

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Abstracts

Peak-Pulse Power Calibrations Initiated (Correspondence)

"Peak-Pulse Power Calibrations Initiated (Correspondence)." 1966 Transactions on Microwave Theory and Techniques 14.1 (Jan. 1966 [T-MTT]): 47-48.

The Radio Standards Laboratory at Boulder, Colorado, has inaugurated a new service for the calibration of coaxial RF peak-pulse power meters. This service is available for a frequency band of 950 to 1200 MHz and a peak-power range of 1 mW to 3 kW. Calibrations are performed at pulse widths of 2 to 10 μ s and repetition rates of 100 to 1600 pps, with a maximum duty cycle of 0.0033 due to generator limitations.



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Abstracts

On the Impedance of a Finite Slot (Correspondence)

M.A. Plonus. "On the Impedance of a Finite Slot (Correspondence)." 1966 Transactions on Microwave Theory and Techniques 14.1 (Jan. 1966 [T-MTT]): 48-49.

It is well known that in boundary value problems which involve slots or apertures the analysis becomes easier when the assumption of infinitesimally narrow slots can be made. Doing so however, will usually result in divergent expressions for slot impedance and current across the slot. One ordinarily gets around this by stating that, since in a real or physical problem the slot width must be finite, the impedance of such slot can be obtained by summing the first few terms of the infinitesimal slot series and throwing away the divergent part.



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Abstracts

Propagation of the Quasi-TEM Mode in Ferrite-Filled Coaxial Line (Correspondence)

M.M. Weiner, M.E. Brodwin and D. Miller. "Propagation of the Quasi-TEM Mode in Ferrite-Filled Coaxial Line (Correspondence)." 1966 Transactions on Microwave Theory and Techniques 14.1 (Jan. 1966 [T-MTT]): 49-50.

Brodwin and Miller, in discussing the propagation of the quasi-TEM mode in ferrite-filled coaxial line, were apparently unaware of an earlier comprehensive treatment of the subject. For purpose of comparison, the notations in this correspondence correspond to those used by Brodwin and Miller.



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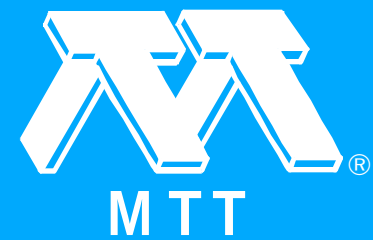
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Abstracts

Contributors (Jan. 1966 [T-MTT])

T.E. MacKenzie, S.J. Naumann, A.E. Sanderson, E. Schlomann, R. Seckelmann, J.C. Sethares and J.P. Shelton, Jr.. "Contributors (Jan. 1966 [T-MTT])." 1966 Transactions on Microwave Theory and Techniques 14.1 (Jan. 1966 [T-MTT]): 51-51.



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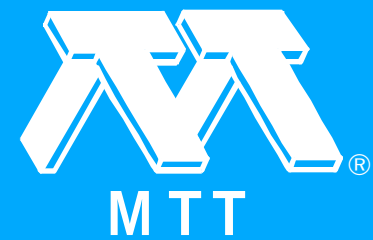
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Microwave Abstracts (Jan. 1966 [T-MTT])

"Microwave Abstracts (Jan. 1966 [T-MTT])." 1966 Transactions on Microwave Theory and Techniques 14.1 (Jan. 1966 [T-MTT]): 52-52.



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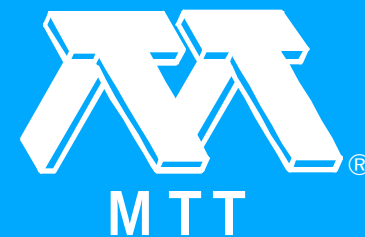
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Abstracts

1966 AIAA Plasmadynamics Conference (Announcements) (Jan. 1966 [T-MTT])

"1966 AIAA Plasmadynamics Conference (Announcements) (Jan. 1966 [T-MTT])." 1966 Transactions on Microwave Theory and Techniques 14.1 (Jan. 1966 [T-MTT]): 53-54.



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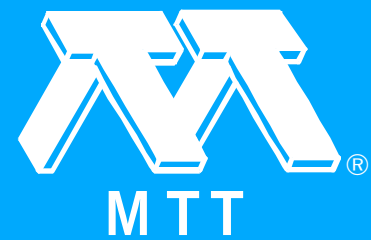
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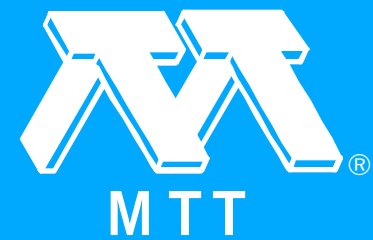
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Abstracts

The Packaged and Mounted Diode as a Microwave Circuit

W.J. Getsinger. "The Packaged and Mounted Diode as a Microwave Circuit." 1966 Transactions on Microwave Theory and Techniques 14.2 (Feb. 1966 [T-MTT]): 58-69.

Suitable definitions of the elements in the equivalent circuit of a packaged diode yield a lumped-element circuit with an impedance at its terminals which is the same as the total radial-line impedance of the packaged diode with the outer surface of the diode taken as the terminal surface. Consideration of the packaged diode as a radial-line structure permits an analytical justification for the incorporation of the diode circuit with the circuits of waveguide, coaxial-line, and strip-line diode mounts. As a result, the lumped-element equivalent circuit of a packaged diode can be directly related to the microwave equivalent circuit of the diode and the mount together. Diode element values, which were obtained from low-frequency measurements, have been used in conjunction with the theoretically determined circuits of mounted diodes to predict resonant frequencies at X-band of waveguide, coaxial-line, and stripline mounts holding packaged diodes. Similarly, antiresonant frequencies of greater than 20 Gc/s have been predicted for diodes in a radial cavity. The validity of all these predictions has been verified by measurement.



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A Nonresonant Perturbation Theory

C.W. Steele. "A Nonresonant Perturbation Theory." 1966 Transactions on Microwave Theory and Techniques 14.2 (Feb. 1966 [T-MTT]): 70-74.

This paper presents a theory for a nonresonant perturbation technique for the measurement of electric and magnetic field strengths within a device. Most presently employed perturbation field strength measurements require the use of a resonance technique. In the technique discussed here, reflection coefficient measurements are made at the same frequency with, and without, a perturbing object placed at the point at which the field strength is to be measured. By these data, and by the equations derived and presented in this paper, the desired field strength can be calculated. The technique can be used for cavities that are too lossy to support resonance, and is suitable for cavities for which the resonant field configuration differs from the field configuration to be measured. In addition, this technique has the advantage that it permits the measurement of the phase, as well as the amplitude of the field.

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Abstracts

Low-Pass and High-Pass Filters Consisting of Multilayer Dielectric Stacks

L. Young and E.G. Cristal. "Low-Pass and High-Pass Filters Consisting of Multilayer Dielectric Stacks." 1966 Transactions on Microwave Theory and Techniques 14.2 (Feb. 1966 [T-MTT]): 75-80.

Dielectric layers of alternating low and high dielectric constant are useful as filters in the millimeter wave, infrared, and optical regions, spanning a spectrum of about five decades. Transmission line theory can be applied, with refractive index replacing admittance. The electrical or optical thicknesses of the layers are generally integral multiples of the thinnest layer, but the reflection in the pass band can be appreciably reduced by small adjustments in the layer thicknesses. The theory is based on the concept of Herpin equivalent index, which is the optical counterpart of image admittance used by electrical engineers. The theory is reviewed and design data is presented.



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Network Representation for Lossless Symmetrical Discontinuities in a Multimode Waveguide

C.-L. Ren. "Network Representation for Lossless Symmetrical Discontinuities in a Multimode Waveguide." 1966 Transactions on Microwave Theory and Techniques 14.2 (Feb. 1966 [T-MTT]): 81-85.

It is shown that a symmetrical, lossless 2N-port may be represented by an equivalent circuit, a 2N-port lattice network, which is a 2N-port generalization of the known two-port symmetrical lattice. The approach employed here in finding the equivalent circuits is based on the fact that any symmetrical 2N-port may be decomposed into two general N-port networks, each of which represents the open-circuit or short-circuit bisected structures.

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Perturbation Theorems for Waveguide Junctions, with Applications (Feb. 1966 [T-MTT])

D.M. Kerns and W.T. Grandy, Jr.. "Perturbation Theorems for Waveguide Junctions, with Applications (Feb. 1966 [T-MTT])." 1966 Transactions on Microwave Theory and Techniques 14.2 (Feb. 1966 [T-MTT]): 85-92.

Perturbation theorems are derived in the context of a theory of waveguide junctions. These theorems express changes in impedance or admittance matrix elements, due to changes in a waveguide junction, in terms of integrals over products of perturbed and unperturbed basis fields associated with the junction and with its adjoint. Media involved are required only to be linear. Concepts of first-order perturbation theory are discussed briefly, and the term "correct to the lowest order" is precisely defined. The need of explicit theorems telling when one may expect results actually correct to the lowest order is noted. Two problems are solved approximately by the perturbation approach: i) reflection at the junction of rectangular waveguide with filleted waveguide of the same main dimensions; and 2) the effect of finite conductivity of both obstacle and waveguide wall for half-round inductive obstacles in rectangular waveguide.

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Abstracts

Three Microwave Calibration Services Extended: Noise Sources, Attenuation, Reflection Coefficient (Correspondence)

"Three Microwave Calibration Services Extended: Noise Sources, Attenuation, Reflection Coefficient (Correspondence)." 1966 Transactions on Microwave Theory and Techniques 14.2 (Feb. 1966 [T-MTT]): 93-93.

The Radio Standards Laboratory of the NBS Institute for Basic Standards, Boulder, Colo., has announced three changes in the microwave calibration services it offers: 1) Calibration of noise sources has been extended to WR62 waveguides. 2) Calibration of coaxial attenuators and couplers has been pushed beyond the former ceiling of 12 GHz up to 18 GHz. 3) Measurements of reflection coefficient magnitude are now also available for WR137 waveguides.



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Determination of Equivalent Network Parameters for a Lossless Two-Port Junction (Correspondence)

P.J. Freyheit and C.D. Lustig. "Determination of Equivalent Network Parameters for a Lossless Two-Port Junction (Correspondence)." 1966 Transactions on Microwave Theory and Techniques 14.2 (Feb. 1966 [T-MTT]): 93-93.

We wish to point out a graphical method for determining the parameters of a lossless two-port network, which we have found useful when the number of available data points is small. This situation may arise when the output line is not easily terminated by an adjustable short circuit, which is the case, for example, for a radial waveguide.

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Abstracts

On High-Frequency Stability of Tunnel Diode Amplifiers (Correspondence)

*H. Plutchok. "On High-Frequency Stability of Tunnel Diode Amplifiers (Correspondence)."
1966 Transactions on Microwave Theory and Techniques 14.2 (Feb. 1966 [T-MTT]): 93-94.*

It is well recognized that in a shunt tuned tunnel diode amplifier, where the tunnel diode is parallel resonated by an inductance at band center, stability at high frequencies requires that diode series resonant frequency be greater than its cutoff frequency.



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Abstracts

X to K Band Broadband Varactor Frequency Doubler (Correspondence)

G. Kurpis and J. Taub. "X to K Band Broadband Varactor Frequency Doubler (Correspondence)." 1966 Transactions on Microwave Theory and Techniques 14.2 (Feb. 1966 [T-MTT]): 94-94.

This correspondence describes a broad-band X to K band varactor frequency doubler. Instantaneous bandwidths of 12 percent at 20 percent efficiency or 19 percent at 2 percent efficiency were obtained. Typical bandwidths of varactor multipliers at these frequencies had been reported at about one percent. Broadband varactor frequency multipliers with C-band or lower output frequencies, designed in coaxial or strip transmission line circuits, had been reported by C. L. Cuccia and by R. J. Wenzel.



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Abstracts

Permeability of Toroids in Latching Ferrite Devices (Correspondence)

L.E. Davis. "Permeability of Toroids in Latching Ferrite Devices (Correspondence)." 1966 Transactions on Microwave Theory and Techniques 14.2 (Feb. 1966 [T-MTT]): 95-97.

This correspondence presents the results of computations of relative permeability of some typical toroids used in digital phase shifters. The graphs enable the properties of materials with comparatively narrow and broad line widths to be compared, and the effects of toroid shape to be seen. From these results, the suitability of a material and a toroid shape for a particular application maybe assessed.



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Slope Parameter and Q of Radial Resonators (Correspondence)

I.V. Lindell. "Slope Parameter and Q of Radial Resonators (Correspondence)." 1966 Transactions on Microwave Theory and Techniques 14.2 (Feb. 1966 [T-MTT]): 97-98.

A radial resonator, Fig. 1, has proved useful, e.g., in filter constructions of coaxial parametric amplifiers. As a band rejection filter in a coaxial line, the radial resonator lies in antiresonance. Thus, it opens up the outer conductor efficiently, and power at this frequency band is reflected back. For filter design purposes, it maybe useful to know what are the slope parameter and the Q of the resonator, In the following, a formula for the characteristic impedance of the equivalent uniform TEM short-circuited $\lambda/4$ -resonator is derived, whose slope factor is the same as that of the radial antiresonant line. In design work, the radial line can be replaced by this $\lambda/4$ -line around the center frequency. A formula for the Q of the resonator is also derived.



A Novel Strip-Line Circulator (Correspondence)

M.D. Bonfeld, D.F. Linn and M. Omori. "A Novel Strip-Line Circulator (Correspondence)." 1966 Transactions on Microwave Theory and Techniques 14.2 (Feb. 1966 [T-MTT]): 98-99.

A circulator with strip-line inputs has been developed which incorporates a single disk of yttrium aluminum iron garnet (YAIG) on one side of the center conductor and a large, metallic short circuit on the other side. The short circuit can be the magnet necessary to bias the garnet to the optimum field for broadband circulation. The basic design is shown in Fig. 1. The center conductor junction is round with alumina loaded quarter-wave transformer coupling to the 50-ohm input lines. Compared to a standard circulator with two YAIG disks operating in the same frequency range, the center conductor diameter is somewhat larger and the transformers of lower impedance. The metallic disk is smaller than the center conductor diameter and is one of the factors which determine the resonant frequency of the junction. The performance of a typical unit is plotted in Fig. 2. This isolation characteristic is double humped and ranges from 30 to 40 dB across a 13.7 percent frequency band. The insertion loss is 0.2 dB across the same band.

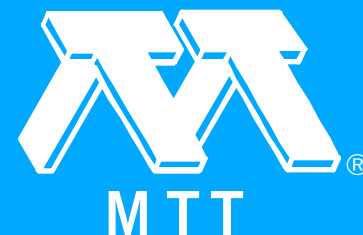


Abstracts

On Nonresonant Perturbation Measurements (Correspondence)

K.B. Mallory and R.H. Miller. "On Nonresonant Perturbation Measurements (Correspondence)." 1966 Transactions on Microwave Theory and Techniques 14.2 (Feb. 1966 [T-MTT]): 99-100.

A perturbation measurement technique has been developed at Stanford University which determines the phase and field strength at a point inside a microwave structure by measuring the reflection produced at the input Port by a perturbing bead. The theoretical basis for the measurement is presented in this issue by C. Steele. Some applications and experimental considerations of the technique are presented here.



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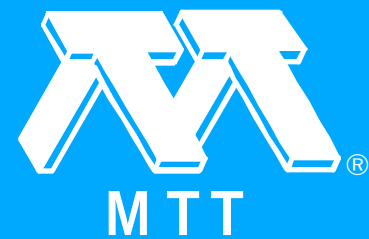
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Improved Response of Pyroelectric Millimeter Wave Detectors (Correspondence)

J.R. Alday, G.E. Everett and D.J. White. "Improved Response of Pyroelectric Millimeter Wave Detectors (Correspondence)." 1966 Transactions on Microwave Theory and Techniques 14.2 (Feb. 1966 [T-MTT]): 100-100.

Pyroelectric materials such as triglycine sulfate (TGS) and barium titanate have been investigated for possible use as millimeter and submillimeter wave detectors. The primary limitation of pyroelectric detectors appears to be its response time since its sensitivity is suitable for many applications, e.g., microwatt range at submillimeter wavelengths. The best reported response time thus far is on the order of 30 microseconds for TGS at room temperature.

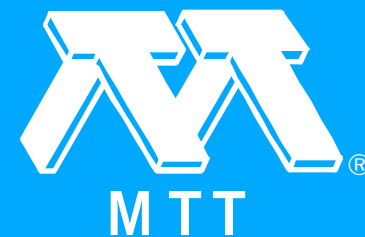
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Abstracts

Contributors (Feb. 1966 [T-MTT])

E.G. Cristal, W.J. Getsinger, W.T. Grandy, Jr., D.M. Kerns, C.-L. Ren, C.W. Steele and L. Young. "Contributors (Feb. 1966 [T-MTT])." 1966 Transactions on Microwave Theory and Techniques 14.2 (Feb. 1966 [T-MTT]): 101-101.



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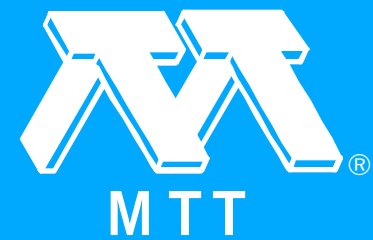
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Microwave Abstracts (Feb. 1966 [T-MTT])

"Microwave Abstracts (Feb. 1966 [T-MTT])." 1966 Transactions on Microwave Theory and Techniques 14.2 (Feb. 1966 [T-MTT]): 102-102.



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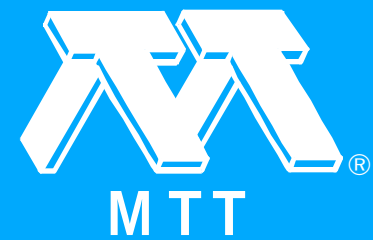
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Membership Application (Feb. 1966 [T-MTT])

"Membership Application (Feb. 1966 [T-MTT])." 1966 Transactions on Microwave Theory and Techniques 14.2 (Feb. 1966 [T-MTT]): 103-103.



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"Information for Authors (Feb. 1966 [T-MTT])." 1966 Transactions on Microwave Theory and Techniques 14.2 (Feb. 1966 [T-MTT]): 104-104.



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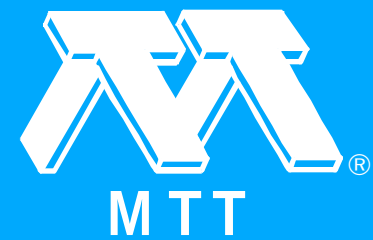
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Abstracts

Table of Contents (Mar. 1966 [T-MTT])

"Table of Contents (Mar. 1966 [T-MTT])." 1966 Transactions on Microwave Theory and Techniques 14.3 (Mar. 1966 [T-MTT]): 105-105.



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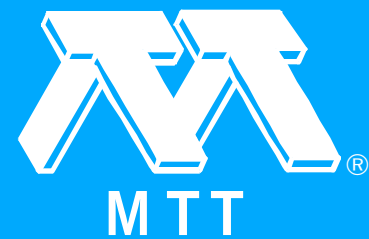
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Polarization Transformation in Twisted Anisotropic Media

R.E. Van Doeren. "Polarization Transformation in Twisted Anisotropic Media." 1966 Transactions on Microwave Theory and Techniques 14.3 (Mar. 1966 [T-MTT]): 106-111.

Polarization transformation of plane waves propagating in twisted anisotropic media is studied theoretically and numerically. It is shown that rotation of linear polarization is effected by such a medium when the anisotropy is of the order of 2 to 1 and twist rates commensurate with the relative value of the dielectric constants of the medium are used (less than $15^\circ/\lambda/\sin \theta$ for low dielectric constants and up to $90^\circ/\lambda/\sin \theta$ for dielectrics in the vicinity of 1000).

Click on title for a complete paper.



The Compensated Balun

G. Oltman. "The Compensated Balun." 1966 Transactions on Microwave Theory and Techniques 14.3 (Mar. 1966 [T-MTT]): 112-119.

The compensated balun, first described by Marchand and later reinvented by Roberts, is found to have much broader band-widths than realized by either author. This balun is analyzed here and the parameters which determine its bandwidths are discussed. Curves are presented which allow the design of a balun having any bandwidth. The practical considerations which preclude realization of infinite bandwidths are pointed out. Since the balun is one-quarter wavelength long at center frequency, the balun can be less than one-twentieth wavelength at its lowest operating frequency. Because impedance transformation is generally required with balanced-to-unbalanced line transformation, two techniques including impedance transformation are discussed. The reactance slope of the compensated balun is controllable, which allows the balun to directly compensate for the reactance slope of some loads. An example of the compensation of a dipole antenna over a 17-percent bandwidth is discussed. Finally, experimental verification of the balun theory is presented, along with an application to an S-band impedance-transforming compensated balun.





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Characteristics of Dielectrically Loaded Ladder Lines for Traveling-Wave Masers and Other Applications

G.I. Haddad. "Characteristics of Dielectrically Loaded Ladder Lines for Traveling-Wave Masers and Other Applications." 1966 Transactions on Microwave Theory and Techniques 14.3 (Mar. 1966 [T-MTT]): 120-129.

The characteristics of ladder lines are investigated in detail and the effects of the various dimensions of the ladder line and the enclosing structure on the omega-Beta characteristic are presented. The effects of a dielectric material placed at different positions in the structure on the characteristics are also examined in detail. Dielectric materials selected for investigation have relative dielectric constants of 9, 100, and 256, characteristic of ruby and rutile, which have been shown to be good maser materials. It is shown that a nonpropagating easitron circuit may be made to propagate by loading it with a dielectric material, in which case the ridge in a Karp-type slow-wave structure may be eliminated. This results in a simple traveling-wave maser structure. The input impedance to the ladder-line structure and the structure ohmic loss have been evaluated and are presented in the figures. This information is useful in designing transducers to couple the power into and out of the structure, and gives an estimate of the expected ohmic loss in the structure.

Click on title for a complete paper.



Abstracts

The Matrix Formulation of Scattering Problems

J. Van Bladel. "The Matrix Formulation of Scattering Problems." 1966 Transactions on Microwave Theory and Techniques 14.3 (Mar. 1966 [T-MTT]): 130-135.

Two regions in space are coupled through an opening in a perfectly conducting surface. By using a complete set of eigenvectors in the opening, each region can be represented by an equivalent Norton circuit involving a short-circuit current (a vector) and a generator admittance (a matrix). The particular case of a cavity at resonance is investigated. Application to a cavity terminated in a waveguide is considered, and the transformation of the equivalent circuit resulting from the shift of the terminal plane is analyzed. After solving the example of a slotted waveguide, a possible set of eigenvectors for an arbitrary opening is proposed.



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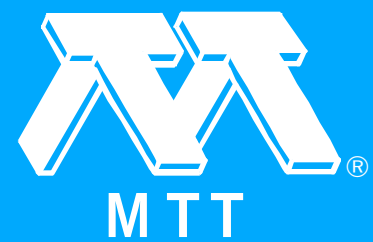
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Guided Waves Propagating Along the Magnetostatic Field at a Plane Boundary of a Semi-Infinite Magnetoionic Medium

G.H. Owyang and S.R. Seshadri. "Guided Waves Propagating Along the Magnetostatic Field at a Plane Boundary of a Semi-Infinite Magnetoionic Medium." 1966 Transactions on Microwave Theory and Techniques 14.3 (Mar. 1966 [T-MTT]): 136-144.

The characteristics of the surface waves supported by a plane boundary of a semi-infinite region of gyrotropic plasma are investigated for the case in which the direction of the magnetostatic field is parallel to both the interface and the propagation direction. Two cases are considered, one for which the plasma is terminated by a perfectly conducting screen, and the other for which it is terminated by a semi-infinite region of free space. Surface waves are found to be propagated for all frequencies below both the plasma and the gyromagnetic frequency in the first case, and below both the plasma and $1/\sqrt{\epsilon} \text{ rad/sec}$ times the upper hybrid resonant frequency in the second case. The characteristics of the surface waves are discussed, and numerical results of the phase velocity and the propagation coefficient of the surface waves along the interface, as well as their attenuation rates normal to the interface, are given.

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



Abstracts

Some Results for Thin-Iris Loaded Periodic Waveguides

D. Rosenberg and D.J.R. Stock. "Some Results for Thin-Iris Loaded Periodic Waveguides." 1966 Transactions on Microwave Theory and Techniques 14.3 (Mar. 1966 [T-MTT]): 145-153.

The planar waveguide holding planar obstacles is a prototype structure--its fields correspond to some sets of lowest modes in circular and coaxial line waveguides that use coaxial iris loading and in inductive iris loaded rectangular guides. An analysis of a periodically thin-iris loaded planar waveguide is offered, the procedure for which can also be applied to the other waveguides mentioned. A particular example for small iris separation is considered. Among the results of this study are adjustments to some formulas of Brillouin so as to allow consideration of large phase shifts per cell of periodic guide. The procedure, which can be recommended as a formula deriving technique, can find use with such other planar obstacles as the thick periodic iris, the interdigitally placed irises, or the single iris in a multimode guide. Some consideration is given to interdigital loading.



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Amplitude and Phase Modulators in Rectangular Waveguides for 5 to 7 Gc/s (Correspondence)

F. Reggia. "Amplitude and Phase Modulators in Rectangular Waveguides for 5 to 7 Gc/s (Correspondence)." 1966 Transactions on Microwave Theory and Techniques 14.3 (Mar. 1966 [T-MTT]): 154-157.

While investigating the electrical and magnetic properties of ferromagnetic materials, Reggia and Spencer discovered that it was possible to obtain very large reciprocal phase shifts with a longitudinally magnetized ferrite rod, centrally located in a standard rectangular waveguide. Since that time, many investigators have continued to study (both theoretically and experimentally) the properties of this phase modulator and have since been able to design and fabricate a number of different versions of the original model. Also during this time, continued investigations at Harry Diamond Laboratories, Washington, D. C., of the RF field distribution inside these magnetized ferrite rods have led to the discovery of a new type of amplitude modulator (or absorption modulator) with electrical characteristics particularly desirable in a microwave switch. This absorption modulator-switch has a geometrical configuration very similar to that of the reciprocal phase modulator. In fact, the same waveguide and solenoid assembly is often used today for both the phase modulator- and the amplitude modulator-switch.

Click on title for a complete paper.



Abstracts

Suggested Name "Nanowave Region" for the E-M Spectrum Between 10 Micrometers to 10 Millimeters Wavelength (Correspondence)

R.W. Zimmerer. "Suggested Name "Nanowave Region" for the E-M Spectrum Between 10 Micrometers to 10 Millimeters Wavelength (Correspondence)." 1966 Transactions on Microwave Theory and Techniques 14.3 (Mar. 1966 [T-MTT]): 157-158.

With the growing activity making use of that portion of the electromagnetic spectrum which lies between the visible and microwave, I would like to enter a plea. for an improvement in nomenclature before too many more grotesque synonyms become generally accepted. This is a highly controversial subject, I grant, but one which should be given the dignity of serious discussion by the people who are inventing the jargon.



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Transverse Resonance Solution of Uniform Trapezoidal Waveguides (Correspondence)

S.T. Uptain and N.F. Audeh. "Transverse Resonance Solution of Uniform Trapezoidal Waveguides (Correspondence)." 1966 Transactions on Microwave Theory and Techniques 14.3 (Mar. 1966 [T-MTT]): 158-158.

Waveguides of nonconventional cross sections are of interest, and several approximate techniques are being developed. Yashkin approximated the complicated cross section of waveguides by a cluster of rectangles. For example, the lateral sides of a uniform isosceles trapezoidal waveguide were approximated by three steps, as shown in Fig. 1, thus forming five rectangular guides. The solution of the wave equation was sought by matching the five separate solutions at the boundaries of the adjacent rectangular guides. This led to a system of transcendental equations, which is often laborious to solve. Yashkin's theoretical calculations are verified experimentally as shown in Table I.

Abstracts

Design of Lossless Junction, Given One Row in its Scattering Matrix (Correspondence)

H.F. Mathis. "Design of Lossless Junction, Given One Row in its Scattering Matrix (Correspondence)." 1966 Transactions on Microwave Theory and Techniques 14.3 (Mar. 1966 [T-MTT]): 159-159.

It is desirable occasionally to find a lossless n-port junction which has a scattering matrix with a specified row. In some cases, it may be sufficient to know that such a junction exists. An example of how such a junction might be used is given later.



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Abstracts

A Method of Calculating the Attenuation Constants of the Unwanted Modes in Mode Filters Using Resistive Sheets (Correspondence)

S. Shimada. "A Method of Calculating the Attenuation Constants of the Unwanted Modes in Mode Filters Using Resistive Sheets (Correspondence)." 1966 Transactions on Microwave Theory and Techniques 14.3 (Mar. 1966 [T-MTT]): 159-161.

Mode filters, which are one of the most important components in overmoded waveguides, give no attenuation to the main mode and large attenuations to some unwanted modes. This correspondence deals with mode filters using resistive sheets.



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Calibration of Coaxial Bolometer Mounts (Correspondence)

"Calibration of Coaxial Bolometer Mounts (Correspondence)." 1966 Transactions on Microwave Theory and Techniques 14.3 (Mar. 1966 [T-MTT]): 161-161.

The Radio Standards Laboratory announces that an additional service is now available for the measurement of the calibration factor of nominal 50-ohm coaxial bolometer units. The new service provides for calibration at 3 GHz, in addition to the frequencies of 100 MHz and 1 GHz that have been available for a number of months. Measurements are made of the 1- and 10-milliwatt power levels only, with no provision at present for the calibration of bolometer-coupler units.

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Rectangular Waveguide Short Circuit with Cylindrical Slugs (Correspondence)

M. Rzepecka and S. Stuchly. "Rectangular Waveguide Short Circuit with Cylindrical Slugs (Correspondence)." 1966 Transactions on Microwave Theory and Techniques 14.3 (Mar. 1966 [T-MTT]): 161-162.

The design of precision waveguide choke shorts imposes many problems, especially as concerns millimeter wave devices. A guide consisting of a rectangular waveguide with a cylindrical rod placed along its axis may help to solve the problem. Such arrangements are used in coaxial-to-strip line adapters. Adequate electric characteristics can be achieved in very simple mechanical designs of shorts comprising cylindrical sections of low and high impedance. To design such a short it is necessary to know, however, the wavelength in the rectangular waveguide comprising a cylindrical rod--a problem which still appears to be unsolved.

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



Abstracts

An Experimental X-band Electron-Cyclotron-Resonance Plasma Accelerator (Correspondence)

D.B. Miller. "An Experimental X-band Electron-Cyclotron-Resonance Plasma Accelerator (Correspondence)." 1966 Transactions on Microwave Theory and Techniques 14.3 (Mar. 1966 [T-MTT]): 162-164.

The electron-cyclotron-resonance plasma accelerator represents a new and potentially important application of microwave power. Uses in space propulsion engines and thermonuclear energy generators are currently under investigation. In this type of accelerator, the plasma is generated and accelerated to high velocities by RF power. The high-frequency nature of the electrical energy allows efficient, electrodeless coupling to the plasma. Conduction and control of the power is also relatively easy. Finally, for the space application, a combined communication and propulsion system can reduce total system weight and complexity.



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Abstracts

Organic Superconductor and Dielectric Infrared Waveguide, Resonator, and Antenna Models of Insects' Sensory Organs (Correction)

E.C. Okress. "Organic Superconductor and Dielectric Infrared Waveguide, Resonator, and Antenna Models of Insects' Sensory Organs (Correction)." 1966 Transactions on Microwave Theory and Techniques 14.3 (Mar. 1966 [T-MTT]): 164-164.

1) Reference [6] in the text (page 707) should read [8].



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Abstracts

Microwave Band-Stop Filters with Narrow Stop Bands (Correspondence)

L. Young. "Microwave Band-Stop Filters with Narrow Stop Bands (Correspondence)." 1966 Transactions on Microwave Theory and Techniques 14.3 (Mar. 1966 [T-MTT]): 164-164.

Equation (17) on page 419 should have read.



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Acceptable Mode Types for Inhomogeneous Media (Correction)

A. Wexler. "Acceptable Mode Types for Inhomogeneous Media (Correction)." 1966 *Transactions on Microwave Theory and Techniques* 14.3 (Mar. 1966 [T-MTT]): 164-164.

Maxwell's equations, (1) and (2), should have been $\nabla \times \bar{E} = -j\omega\mu\bar{H}$ and $\nabla \times \bar{H} = j\omega\epsilon\bar{E}$.

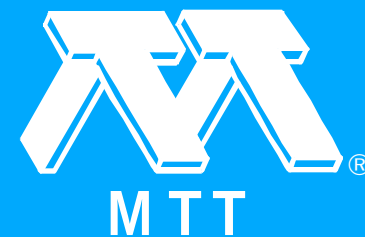
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Abstracts

Contributors (Mar. 1966 [T-MTT])

G.I. Haddad, G. Oltman, G.H. Owyang, D. Rosenberg, S.R. Seshadri, D.J.R. Stock, J.G. Van Bladel and R.E. Van Doeren. "Contributors (Mar. 1966 [T-MTT])." 1966 Transactions on Microwave Theory and Techniques 14.3 (Mar. 1966 [T-MTT]): 165-166.



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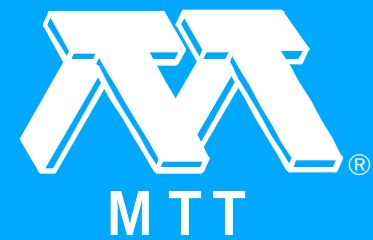
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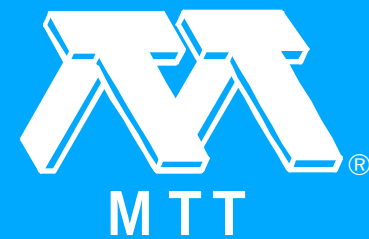
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Abstracts

Message from the Outgoing Editor (Apr. 1966 [T-MTT])

R.W. Beatty. "Message from the Outgoing Editor (Apr. 1966 [T-MTT])." 1966 Transactions on Microwave Theory and Techniques 14.4 (Apr. 1966 [T-MTT]): 170-171.

Because of the normal time required in publication processes, I am writing this message in January for the April Issue. At this moment, our new editor, S. Okwit, is about to take office, although by the time you read this, he will probably have been functioning as editor for four months.



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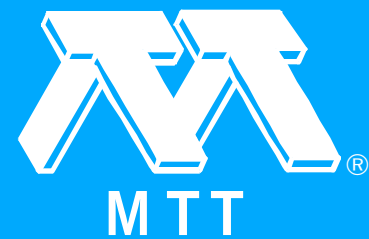
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A Sensitive Method for Measuring Complex Permittivity with a Microwave Resonator

G. Roussy and M. Felden. "A Sensitive Method for Measuring Complex Permittivity with a Microwave Resonator." 1966 Transactions on Microwave Theory and Techniques 14.4 (Apr. 1966 [T-MTT]): 171-175.

The proposed method was carried out to make easier dielectric studies em powders under controlled pressure when the frequency varies. A TE/sub 01n/-mode resonator is needed. The substance under test is contained in a tube of quartz, placed along the axis of a cylindrical cavity. The mathematical formulation for the complex permittivity is given in rigorously accounting for the presence of the tube. Typical diticulties are discussed, and experimental results given. The absolute precision of the measurement can be compared with that of the classicrd method (± 2 percent for epsilon' and ± 10 percent for epsilon"). The greatest error arises from an insufficiently precise determination of the geometrical and electrical characteristics of the quartz tube. This error is systematic, and thus it is possible to demonstrate the very small permittivity variations (± 0.3 percent for epsilon' and ± 5 percent for epsilon").

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Abstracts

The Cutoff Wavelength of the TE/sub 10/ Mode in Ridged Rectangular Waveguide of any Aspect Ratio

J.R. Pyle. "The Cutoff Wavelength of the TE/sub 10/ Mode in Ridged Rectangular Waveguide of any Aspect Ratio." 1966 Transactions on Microwave Theory and Techniques 14.4 (Apr. 1966 [T-MTT]): 175-183.

Design curves for ridged rectangular waveguides of the usual aspect ratio of 0.45 were published by Hopfer following earlier work carried out by Cohn and Marcuvitz. This paper has been written to extend the design data to ridged rectangular waveguides of any aspect ratio. An analysis of the error introduced by proximity effects has shown these to be of the order of a few percent.



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Abstracts

The Modified Series Model for an Abrupt-Junction Varactor Frequency Doubler

B.J. Levin. "The Modified Series Model for an Abrupt-Junction Varactor Frequency Doubler." 1966 Transactions on Microwave Theory and Techniques 14.4 (Apr. 1966 [T-MTT]): 184-188.

The theoretical performance of an abrupt-junction high-quality epitaxial varactor diode used as a harmonic frequency doubler is considered. The modified series model for the device, consisting of a nonlinear elastance (reciprocal of capacitance) and a nonlinear resistance, is presented. A comparison is made between the performance limits derived for the modified series model and similar results based on the conventional series model. In addition to dissipating some power, the charge-variable series resistance contributes to the frequency conversion of the device.



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Analysis of Coupling Loops in Waveguide and Application to the Design of a Diode Switch

W.C. Jakes, Jr.. "Analysis of Coupling Loops in Waveguide and Application to the Design of a Diode Switch." 1966 Transactions on Microwave Theory and Techniques 14.4 (Apr. 1966 [T-MTT]): 189-200.

A voltage-controlled switch using PIN diodes loop-coupled to a section of WR975 waveguide is described. Total switching loss of over 40 dB could be obtained at 960 Mc/s. The switch was operated at rates up to 60 c/s for use in the satellite-tracking radar system at Crawford Hill, N.J. The 3-dB bandwidth of the complete switch was 0.7 Mc/s. The forward switch loss was low enough to permit transmission of 10 kW of 960-Mc/s power with a 50 percent duty cycle without excessive heating of the diodes. Theoretical analysis of the complete waveguide switch involved determination of the coupling of individual loops to the dominant and higher-order waveguide modes. A reciprocity theorem was used to calculate the appropriate mode coupling coefficients. These were then related to the insertion loss by means of an equivalent circuit for the complete switch. A number of experiments confirmed the theory.

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An Equivalent Circuit for the "Centipede" Waveguide

T.M. Reeder. "An Equivalent Circuit for the "Centipede" Waveguide." 1966 Transactions on Microwave Theory and Techniques 14.4 (Apr. 1966 [T-MTT]): 200-205.

An equivalent circuit is presented for the "centipede" coupled-cavity waveguide. The "centipede" waveguide, which is typical of the class of slow-wave structures suitable for use in a wide-band high-power traveling-wave tube, has two pass bands which may interact strongly with a small-diameter electron beam. The equivalent circuit is able to represent both of these pass bands. A detailed comparison with an S-band "centipede" waveguide shows that the equivalent circuit can represent the dispersion, interaction, and loss characteristics of the waveguide within a few percent.

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Abstracts

Electromagnetic Potentials and Field Expansions for Plasma Radiation in Waveguides (Correction)

R.E. Collin. "Electromagnetic Potentials and Field Expansions for Plasma Radiation in Waveguides (Correction)." 1966 Transactions on Microwave Theory and Techniques 14.4 (Apr. 1966 [T-MTT]): 205-205.

R.E. Collins, author of the paper, "Electromagnetic Potentials and Field Expansions for Plasma Radiation in Waveguides," which appeared on pages 413-420 of the July, 1965, issue, submits the following.



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Abstracts

Wide-Band Polarizer in Circular Waveguide Loaded with Dielectric Discs (Correction)

P.J. Meier and S. Arnow. "Wide-Band Polarizer in Circular Waveguide Loaded with Dielectric Discs (Correction)." 1966 Transactions on Microwave Theory and Techniques 14.4 (Apr. 1966 [T-MTT]): 205-205.

P. J. Meier and S. Arnow, authors of the paper, "Wide-Band Polarizer in Circular Waveguide Loaded with Dielectric Discs," which appeared on pages 763-767 of the November, 1965, issue, wish to note the following.



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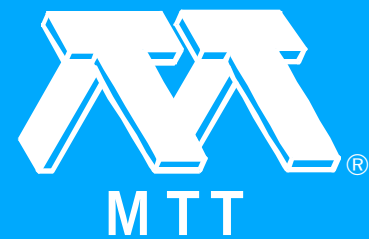
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Fast Sweep Measurements of Relaxation Times in Superconducting Cavities (Correspondence)

H.J. Schmitt and H. Zimmer. "Fast Sweep Measurements of Relaxation Times in Superconducting Cavities (Correspondence)." 1966 Transactions on Microwave Theory and Techniques 14.4 (Apr. 1966 [T-MTT]): 206-207.

Conventional equilibrium methods used to determine the quality of cavity resonators become quite inaccurate if cavities with a high Q , especially superconducting cavities with $Q \sim 10^6$ or more, are to be measured. A static measurement of the cavity impedance requires an extremely small frequency drift, and swept frequency methods require a very slow variation of the frequency because of the long energy relaxation times involved. If random frequency fluctuations due to generator noise are comparable to the bandwidth of the cavity $\Delta\omega/R$, measurements of half-power widths become inaccurate.

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Re-Entrant Directional Couplers having Direct Coupled Center Conductors (Correspondence)

E.G. Cristal. "Re-Entrant Directional Couplers having Direct Coupled Center Conductors (Correspondence)." 1966 Transactions on Microwave Theory and Techniques 14.4 (Apr. 1966 [T-MTT]): 207-208.

The re-entrant coaxial coupler and its strip transmission line equivalent are shown in Figs. 1 and 2, respectively. In both configurations, no direct coupling between center conductors exist. The purpose of this communication is to point out that if direct coupling between center conductors is permitted, the required value of Z_{01} is reduced (see Figs. 1 and 2), thus often permitting easier realization of the coupler than would otherwise be the case.

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On Incidental Dissipation in High-Pass and Band-Stop Filters (Correspondence)

R.C. Smythe. "On Incidental Dissipation in High-Pass and Band-Stop Filters (Correspondence)." 1966 Transactions on Microwave Theory and Techniques 14.4 (Apr. 1966 [T-MTT]): 208-209.

For narrow-band microwave band-stop filters, Young, et al. have obtained valuable expressions for the effects of incidental dissipation. The purpose of this correspondence is to remark that for the uniformly dissipative (i.e., equal Q) case, the response of the lossy low-pass prototype (and hence, the response of the lossy band-stop filter) may be obtained from the lossless response by means of the frequency transformation.

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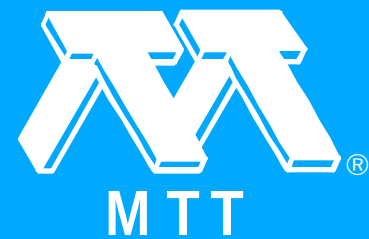
Multisection Microwave Phase-Shift Network (Correspondence)

B.M. Schiffman. "Multisection Microwave Phase-Shift Network (Correspondence)." 1966 Transactions on Microwave Theory and Techniques 14.4 (Apr. 1966 [T-MTT]): 209-209.

correspondence extends the analysis of a phase-shift network consisting of a cascade of pairs of coupled transmissions lines together at their far ends (see 1), to any value of n, Such cascaded all-pass networks, also known as microwave C-sections, recently been analyzed by Steenart and Zysman and Matsumoto Cristal has solved the problem of analysis and exact synthesis of cascaded C-sections. Matrix methods are generally used and Richards' theorem is employed, restricting the various coupled sections to have equal lengths. In this analysis, the various sections may have unequal lengths.

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Dual Reflex Klystron Cavity-Beam Interaction (Correspondence)

J.J. Hamilton. "Dual Reflex Klystron Cavity-Beam Interaction (Correspondence)." 1966 Transactions on Microwave Theory and Techniques 14.4 (Apr. 1966 [T-MTT]): 209-210.

While the occurrence of spurious resonances, or the detection of harmonic content, is not uncommon in reflex oscillators, the particular case wherein the tube performs reflex klystron functions at two different frequencies has not been reported heretofore. This phenomenon was observed in the course of a search for spurious output signals conducted on Raytheon QKK754 CW communication klystrons. X-band output was detected from these tubes using the RF equipment shown in Fig. 1.

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An Exact Analysis of Varactor Frequency Multipliers (Correspondence)

C.C.H. Tang. "An Exact Analysis of Varactor Frequency Multipliers (Correspondence)." 1966 Transactions on Microwave Theory and Techniques 14.4 (Apr. 1966 [T-MTT]): 210-212.

A novel yet simple approach to the exact analysis of an abrupt-junction frequency doubler is presented, utilizing the fact that the voltage is proportional to the square of the charge. Penfield and Rafuse were the first to consider the problem in an exact analysis. By imposing certain constraints they obtained useful design information with the aid of a large-scale computer. Through different constraints, the present analysis also offers an exact analysis, but the solution is expressed in a closed form. The series model of incremental elastance $S(t)$ and resistance R/s is shown in the circuit of Fig. 1.



Abstracts

Optimum Pitch of Traveling-Wave Masers (Correspondence)

E. Kollberg. "Optimum Pitch of Traveling-Wave Masers (Correspondence)." 1966 Transactions on Microwave Theory and Techniques 14.4 (Apr. 1966 [T-MTT]): 212-213.

The purpose of this correspondence is to show theoretically that there exists an optimum pitch (p in Fig. 1), which gives maximum net gain for traveling-wave masers (TWM), utilizing transverse strip slow wave structures (e.g., comb-structures, Karp-structures, and meander lines).



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Measurement of Microwave Power in WR137 Waveguide (5.85-8.20 GHz) (Correspondence)

"Measurement of Microwave Power in WR137 Waveguide (5.85-8.20 GHz) (Correspondence)." 1966 Transactions on Microwave Theory and Techniques 14.4 (Apr. 1966 [T-MTT]): 213-213.

The Radio Standards Laboratory of the NBS Institute for Basic Standards (U.S. Department of Commerce), Boulder, Colo., announces a calibration service in WR137 waveguide for the measurement of effective efficiency, efficiency, and calibration factor of bolometer units, and of calibration factor of bolometer-coupler units. The measurement of efficiency of a bolometer unit is made available for the first time by the Radio Standards Laboratory, but for the present is limited to WR137 waveguide.

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Abstracts

Contributors (Apr. 1966 [T-MTT])

M. Felden, W.C. Jakes, Jr., B.J. Levin, J.R. Pyle, T.M. Reeder and G. Roussy. "Contributors (Apr. 1966 [T-MTT])." 1966 Transactions on Microwave Theory and Techniques 14.4 (Apr. 1966 [T-MTT]): 214-214.



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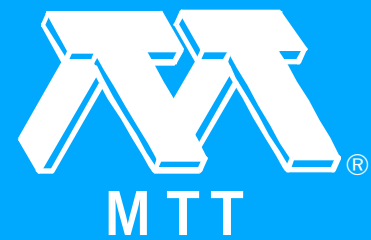
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Abstracts

Membership Application (Apr. 1966 [T-MTT])

"Membership Application (Apr. 1966 [T-MTT])." 1966 Transactions on Microwave Theory and Techniques 14.4 (Apr. 1966 [T-MTT]): 218-218.



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Abstracts

A Dual-Mode Beam Waveguide Resonator and Frequency Stabilizer at Millimeter-Wave Frequencies

J.W. Mink and E.H. Scheibe. "A Dual-Mode Beam Waveguide Resonator and Frequency Stabilizer at Millimeter-Wave Frequencies." 1966 Transactions on Microwave Theory and Techniques 14.5 (May 1966 [T-MTT]): 222-228.

By applying perturbation theory to one of the higher modes that may exist in the beam waveguide resonator (also known as the focused Fabry-Perot interferometer), it can be shown that the degeneracy of the mode system can be reduced, resulting in two mode systems with slightly different resonant frequencies. Using this result, a dual-mode frequency discriminator was constructed and used as a reference element for stabilizing the frequency of microwave sources. The stability of a 34-GHz stabilized source was better than 1 part in 5×10^{-7} short term and better than 1 Part in 1.5×10^{-6} long term. The frequency sensitivity of this dual-mode resonator to changes in the properties of the dielectric medium between the end plates was utilized to determine the dielectric constant of gases at 34 GHz with an accuracy of a few parts in 10^{-7} .



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Abstracts

Some Characteristics of Alternating Gradient Optical Transmission Lines

W.H. Steier. "Some Characteristics of Alternating Gradient Optical Transmission Lines." 1966 Transactions on Microwave Theory and Techniques 14.5 (May 1966 [T-MTT]): 228-233.

The effect of adding a negative lens between each pair of positive lenses of an optical transmission line is calculated. The negative lens reduces the ability of the transmission line to control the direction of the light beam. The changes in dominant mode spot size, allowed bending radius, critical bend periodicity, and sensitivity to random lateral lens displacements are computed for all ranges of lens spacings and focal lengths which are stable.



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Mode Conversion in Tapered Waveguides At and Near Cutoff

C.C.H. Tang. "Mode Conversion in Tapered Waveguides At and Near Cutoff." 1966 Transactions on Microwave Theory and Techniques 14.5 (May 1966 [T-MTT]): 233-239.

The coupling coefficient between the TE/sub 11/ mode and the TM/sub 11/ mode in tapered circular waveguides is derived, and at cutoff frequency it tends to approach an infinity of the order of $O/\sup -1/4/$. It is surprising to discover that the corresponding coupling coefficient between the TE/sub 10/ mode and the TM/sub 12/ mode in tapered rectangular waveguides approaches instead a zero of the order of $O/\sup 1/4/$ at cutoff frequency. Accordingly, for the modes concerned, the choice of using circular or square waveguides as tapers for transition at and near cutoff frequency is significant in reducing mode conversion level. At and near cutoff frequency a "synthesized" square taper is better in that it is shorter than a "synthesized" circular taper for the same mode conversion levels. On the other hand, for frequencies far away from cutoff the choice is insignificant. Design procedures for "synthesized" waveguide tapers at and near cutoff are presented, and the results of measurements are in agreement with the theoretical calculations.

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Computation of the Performance of the Abrupt Junction Varactor Doubler

A.I. Grayzel. "Computation of the Performance of the Abrupt Junction Varactor Doubler." 1966 Transactions on Microwave Theory and Techniques 14.5 (May 1966 [T-MTT]): 239-242.

A computational procedure is given for the solution of the large signal abrupt junction varactor doubler as the input frequency is varied, given the available power of the source and the source and load impedances. The basic equations are presented in a convenient form. The steps in the procedure are then outlined, and an example is given to demonstrate their use.

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A Flow Graph Analysis of 3- and 4-Port Junction Circulators

S. Hagelin. "A Flow Graph Analysis of 3- and 4-Port Junction Circulators." 1966 Transactions on Microwave Theory and Techniques 14.5 (May 1966 [T-MTT]): 243-249.

A simple theoretical model of a lossless nonideal junction circulator is described. The model consists of a matched lossless n -port junction with a lossless two-port connected to each arm. The basic thought behind it is to separate the reflecting properties of the circulator from the other ones. For the case $n=3$, unsymmetrical as well as symmetrical junctions are treated. For a symmetrical three-port, the justification of the model has also been experimentally verified. In the case $n=4$, a symmetrical junction is treated. Flow graphs are used for visualizing the scattering matrices of combined networks and for calculating the coefficients of them.

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Abstracts

Impedances of Offset Parallel-Coupled Strip Transmission Lines (Correction)

J.P. Shelton, Jr.. "Impedances of Offset Parallel-Coupled Strip Transmission Lines (Correction)." 1966 Transactions on Microwave Theory and Techniques 14.5 (May 1966 [T-MTT]): 249-249.

J. Paul Shelton, Jr., author of the paper "Impedances of Offset Parallel-Coupled Strip Transmission Lines," which appeared in these Transactions, vol. MTT-14, no. 1, January 1966, pp. 7-14, is indebted to Steven March for his careful reading of the paper and pointing out the following.



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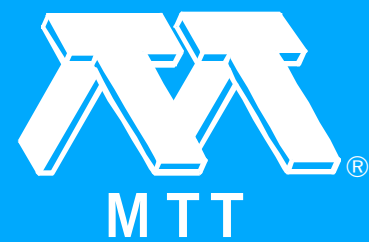
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The Resonant Frequency of Interdigital Filter Elements (May 1966 [T-MTT])

B.F. Nicholson. "The Resonant Frequency of Interdigital Filter Elements (May 1966 [T-MTT])." 1966 Transactions on Microwave Theory and Techniques 14.5 (May 1966 [T-MTT]): 250-251.

The purpose of this correspondence is to describe a method of predicting the center frequencies of band-pass interdigital filters. The individual filter elements consist of approximately quarter-wavelength fingers between parallel ground-planes, the fingers being short-circuited at one end and a finite distance from another short-circuit plane at the open end. At present the accepted technique appears to be to separate the short-circuit planes by a quarter-wavelength at the design center frequency and to fore-shorten the fingers by an arbitrary amount, based upon the designer's experience. This procedure is rather inexact and tends to shift the center frequency of the filter by an amount which is often unacceptably large, particularly in the case of very narrow-band designs. As an example, the ten percent bandwidth filter of Crystal suffered a shift, when measured, of 3.8 percent from the design center frequency. Therefore, it is apparent that the center frequencies of filters with bandwidths less than three percent could easily be shifted beyond the desired band edges, and although the filter can be tuned by adjusting either the length of the finger or the capacitive gap at the open-circuited end, this method is not always desirable. Tuning mechanisms are not suitable when the filter is for a high power application or when dissipation losses or manufacturing costs must be minimized.

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Abstracts

Application of the Point-Matching Method in Waveguide Problems (Correspondence)

P.A. Laura. "Application of the Point-Matching Method in Waveguide Problems (Correspondence)." 1966 Transactions on Microwave Theory and Techniques 14.5 (May 1966 [T-MTT]): 251-251.

The determination of cutoff frequencies of waveguides with arbitrary cross section by the point-matching technique was recently studied by Yee and Audeh.



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Resonances of a Cylindrical Cavity in a Lossy Compressible Plasma (Correspondence)

R. Burman. "Resonances of a Cylindrical Cavity in a Lossy Compressible Plasma (Correspondence)." 1966 Transactions on Microwave Theory and Techniques 14.5 (May 1966 [T-MTT]): 251-252.

Wait has derived equations describing the resonances of a cylindrical cavity in an isotropic, lossy compressible plasma. The purpose of this communication is to consider low-frequency resonances when the effects of losses and compressibility are small.

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Abstracts

Attenuation Constants of Waveguides with General Cross Sections (Correspondence)

H.Y. Yee and N.F. Audeh. "Attenuation Constants of Waveguides with General Cross Sections (Correspondence)." 1966 Transactions on Microwave Theory and Techniques 14.5 (May 1966 [T-MTT]): 252-253.

The cutoff frequencies and the field configurations of waveguides with general cross section can be calculated approximately by the point-matching method, provided that the method is applicable. With the field configurations of the ideal waveguide (with perfectly conducting guide walls) known, it is expected that the attenuation constant due to the finite conductivity of the guide walls may be estimated numerically.



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Abstracts

On Transverse Electromagnetic Wave Propagation in a Cylindrically Stratified Magnetoplasma (Correspondence)

R. Burman. "On Transverse Electromagnetic Wave Propagation in a Cylindrically Stratified Magnetoplasma (Correspondence)." 1966 Transactions on Microwave Theory and Techniques 14.5 (May 1966 [T-MTT]): 253-254.

This communication is concerned with a second-order ordinary differential equation arising in the theory of electromagnetic waves in a cylindrically stratified, axially magnetized plasma. The equation describes transverse propagation when the wave's magnetic field has only an axial component.



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Measurement of Microwave Power in WR112 Waveguide (7.05 to 10.0 GHz) (Correspondence)

"Measurement of Microwave Power in WR112 Waveguide (7.05 to 10.0 GHz) (Correspondence)." 1966 Transactions on Microwave Theory and Techniques 14.5 (May 1966 [T-MTT]): 254-254.

The Radio Standards Laboratory of the NBS Institute for Basic Standards (U.S. Department of Commerce), Boulder, Colo., announces a calibration service for the measurement of effective efficiency and calibration factor of bolometer units and bolometer-coupler units in WR112 waveguide. Although calibrations can be performed within the useful range of the waveguide, some degree of economy to the customer results if calibrations are performed at the selected frequencies of 7.75, 8.50, and 900 GHz.



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Abstracts

Contributors (May 1966 [T-MTT])

A.I. Grayzel, S.I. Hagelin, J.W. Mink, E.H. Scheibe, W.H. Steier and C.C.H. Tang.

"Contributors (May 1966 [T-MTT])." 1966 Transactions on Microwave Theory and Techniques 14.5 (May 1966 [T-MTT]): 255-255.



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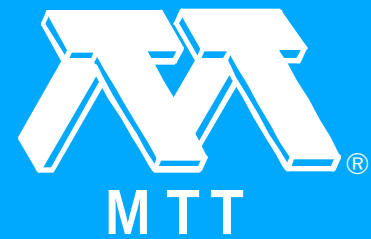
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Membership Application (May 1966 [T-MTT])

"Membership Application (May 1966 [T-MTT])." 1966 Transactions on Microwave Theory and Techniques 14.5 (May 1966 [T-MTT]): 256-256.



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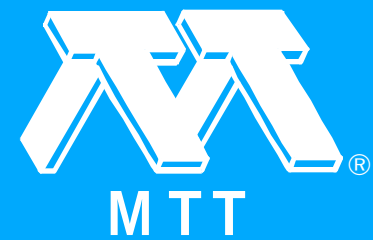
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Perturbation Analysis of Rectangular Waveguide Containing Transversely Magnetized Semiconductor

G.J. Gabriel and M.E. Brodwin. "Perturbation Analysis of Rectangular Waveguide Containing Transversely Magnetized Semiconductor." 1966 Transactions on Microwave Theory and Techniques 14.6 (Jun. 1966 [T-MTT]): 258-264.

The boundary value problem of rectangular waveguide, filled with transversely magnetized semiconductor or plasma, is solved by a perturbation method reported earlier. The solution by first-order theory is compared to the results of an experiment in which surface currents in the guide wall due to perturbed and unperturbed TE/sub 1,0/ wave in N-type Silicon are sampled and segregated. Theoretical and experimental results are in excellent agreement.

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Log-Periodic Transmission Line Circuits--Part I: One-Port Circuits

R.H. DuHamel and M.E. Armstrong. "Log-Periodic Transmission Line Circuits--Part I: One-Port Circuits." 1966 Transactions on Microwave Theory and Techniques 14.6 (Jun. 1966 [T-MTT]): 264-274.

A theoretical study of one-port log-periodic circuits consisting of a transmission line shunt loaded with open-circuit transmission lines is reported. The objective was to determine the conditions under which the phase of the input reflection coefficient varies linearly with the logarithm of the frequency. Precise definitions and general analytical techniques for log-periodic circuits are given. Results of extensive numerical calculations are presented to illustrate the dependence of the input reflection coefficient on the various design parameters. It was found that phase deviations from linear on the order of one degree are quite easily achieved.

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Abstracts

On the Wave Propagation and Mode Conversion in a Helically Corrugated Multimode Circular Waveguide

C.C.H. Tang. "On the Wave Propagation and Mode Conversion in a Helically Corrugated Multimode Circular Waveguide." 1966 Transactions on Microwave Theory and Techniques 14.6 (Jun. 1966 [T-MTT]): 275-284.

For specific forms of excitations, the normal modes and mode coefficients of a lossless helically corrugated circular multimode waveguide are determined from the appropriate boundary conditions. Because of the multiplicity of the roots of the characteristic dispersion equation obtained, care must be exercised in the evaluation of the equation and in the interpretation of the omega-beta diagram. For the TE/sub 11/ mode excitation, it is shown that increasing either the depth or the width of the corrugation enhances the conversion into the TM/sub 11/ mode, whereas increasing the pitch reduces the TM/sub 11/ mode conversion. Mode conversion always increases with increasing frequency. The theoretical results are in agreement with the results of measurement.



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Analysis and Exact Synthesis of Cascaded Commensurate Transmission-Line C-Section All-Pass Networks

E.G. Cristal. "Analysis and Exact Synthesis of Cascaded Commensurate Transmission-Line C-Section All-Pass Networks." 1966 Transactions on Microwave Theory and Techniques 14.6 (Jun. 1966 [T-MTT]): 285-291.

An analysis of cascaded commensurate transmission-line C-section all-pass networks is presented. The analytical form of the transmission coefficient is found to have a very simple form, intimately related to the reflection coefficient of the stepped-impedance transformer prototype of the cascaded C-section. The phase function of cascaded commensurate transmission-line C-sections is investigated and found to be the arctangent of a reactance function in $\tan \theta$. Last, general, exact synthesis procedures for designing cascaded commensurate transmission-line C-section all-pass networks to have prescribed phase characteristics are presented, and two design examples are given. One of the examples is the exact design of a 3-section Schiffman 90° phase shifter, which has not been previously reported in the literature.



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Distinctions Between Gyroelectric and Gyromagnetic Media in Rectangular Waveguide (Correspondence)

G.J. Gabriel and M.E. Brodwin. "Distinctions Between Gyroelectric and Gyromagnetic Media in Rectangular Waveguide (Correspondence)." 1966 Transactions on Microwave Theory and Techniques 14.6 (Jun. 1966 [T-MTT]): 292-293.

Gas plasmas and ferrites become anisotropic when placed in a magnetostatic field. Waveguides containing these media may be termed, respectively, as gyroelectric and gyromagnetic. In this correspondence we compare these waveguides when the magnetostatic field is transverse to the direction of wave propagation. In particular, we discuss the difference in the TE/sub 0,n/ modes of rectangular waveguides. Although the partial differential equations for the longitudinal fields in the two waveguides are duals, the essential difference lies in the boundary conditions. The result is that in gyroelectric waveguides the general solution, in exact or approximate form, for the higher order modes is necessary. This result is unlike that for the gyromagnetic case in which the restricted TE/sub 0,n/ solutions are adequate for analysis of practical problems.

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Abstracts

A High Directivity, Broadband Coaxial Coupler (Correspondence)

P.A. Hudson. "A High Directivity, Broadband Coaxial Coupler (Correspondence)." 1966 Transactions on Microwave Theory and Techniques 14.6 (Jun. 1966 [T-MTT]): 293-294.

Directional couplers having the proper impedance and directivity characteristics are useful devices for reflectometry measurements and for the intercomparison of RF power meters. In the latter application, stable, sensitive power detectors are connected to the appropriate coupler sidearms to allow monitoring of both the incident and reflected powers in the primary line.



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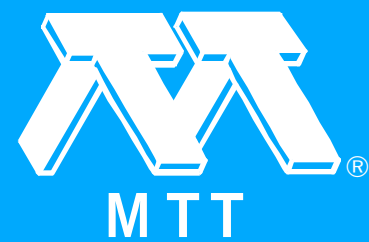
General Four-Resonator Filters at Microwave Frequencies (Correspondence)

R.M. Kurzrok. "General Four-Resonator Filters at Microwave Frequencies (Correspondence)." 1966 Transactions on Microwave Theory and Techniques 14.6 (Jun. 1966 [T-MTT]): 295-296.

General four-resonator filters are capable of providing both band-pass and band-reject behavior. The potential advantages of general three and four-resonator filters have been discussed by Johnson, who considers dissipationless filters using inductive couplings. Johnson has presented experimental data on a lumped-circuit-element general filter at 20 Mc/s, and has suggested some techniques for microwave implementation of general filters. Kurzrok has analyzed dissipative general three-resonator filters, and applied this theory to the development of a general three-resonator filter in X-band rectangular waveguide.

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Band-Pass Spurline Resonators (Correspondence)

E.G. Cristal. "Band-Pass Spurline Resonators (Correspondence)." 1966 Transactions on Microwave Theory and Techniques 14.6 (Jun. 1966 [T-MTT]): 296-297.

The spurline resonator, a term coined by Schiffman to denote the particular type of transmission-line resonator shown in Fig. 1, is sometimes useful in the design and construction of transmission-line band-stop filters. Its open-wire-line equivalent (see Fig. 1) shows that it is naturally applicable to band-stop (or low-pass) transmission-line filters. A similar structure, which might be denoted a "band-pass spurline resonator" (to distinguish it from the band-stop type of spurline resonator), is shown in Fig. 2. Note that the main difference in the physical configuration of Fig. 2 from that of Fig. 1 is the grounding of the spurline. The main differences in the open-wire-line equivalent circuit is that the shunt stub is short-circuited at its end rather than open-circuited, and a transformer is required at Port 2. The band-pass spurline resonator may provide for alternative realizations of band-pass filters that have, either totally or in part, open-wire-line equivalent circuits of short-circuited shunt stubs alternating with commensurate length transmission lines. Examples are the parallel-coupled-resonator band-pass filter and the direct-coupled-stub band-pass filter. The transformer may, perhaps, be utilized to beneficially alter the impedance level within the filter. It is expected that the band-pass spurline resonator configuration will be most useful in filters of moderate bandwidth.

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Two Nomograms for Coupled-Line Sections for Band-Stop Filters (Correspondence)

B.M. Schiffman. "Two Nomograms for Coupled-Line Sections for Band-Stop Filters (Correspondence)." 1966 Transactions on Microwave Theory and Techniques 14.6 (Jun. 1966 [T-MTT]): 297-299.

A common form of microwave band-stop filter consists of open-circuit shunt stubs separated by lengths of transmission line, all one quarter wave long at band center. Two equivalent but more compact types derivable from the former are the spurline and the parallel-coupled resonator form of band-stop filter. Since the process of designing a filter starting with the prototype and ending with practical physical dimensions can be time consuming and tedious, two nomograms are here presented to speed one step of that process, viz., conversion of the stub type filter into one containing either spurline or coupled-resonator sections (or both).

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Abstracts

Contributors (Jun. 1966 [T-MTT])

*M.E. Armstrong, M.E. Brodwin, R.H. DuHamel, E.G. Cristal, G.J. Gabriel and C.C.H. Tang.
"Contributors (Jun. 1966 [T-MTT])." 1966 Transactions on Microwave Theory and Techniques
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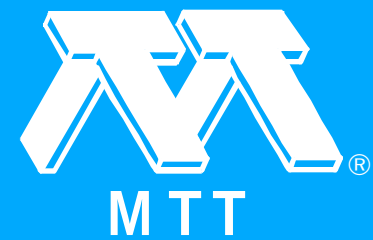
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"Microwave Abstracts (Jun. 1966 [T-MTT])." 1966 Transactions on Microwave Theory and Techniques 14.6 (Jun. 1966 [T-MTT]): 302-302.



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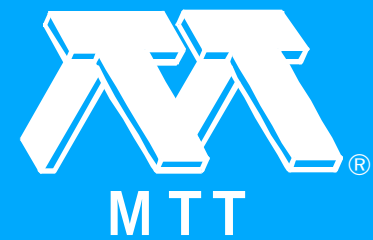
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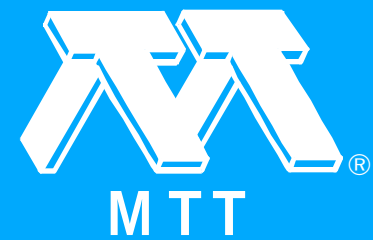
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Characteristics of Waveguides with a Semiconductor Side Wall

R.D. Larrabee. "Characteristics of Waveguides with a Semiconductor Side Wall." 1966 Transactions on Microwave Theory and Techniques 14.7 (Jul. 1966 [T-MTT]): 306-310.

The attenuation, guide wavelength, and characteristic impedance of rectangular waveguides with one high conductivity semiconductor side wall have been derived for the case of propagating TE/sub NO/ modes. These properties can be interpreted in terms of the penetration of the microwave electric field into the semiconductor material by an amount of the same order as, but generally unequal to, the classical skin depth. These theoretical results are evaluated for the special case of an indium antimonide side wall in RG 138/U waveguide operating at 110 Gc/s. The calculated attenuation lengths and guide wavelengths for this case are of such magnitude that they can be measured with reasonable accuracy, thus illustrating the value of this technique for the measurement of the electrical properties of semiconductor materials at the higher microwave frequencies.

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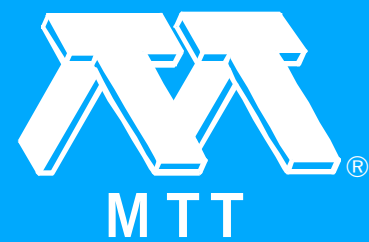
A Technique for Measuring Individual Modes Propagating in Overmoded Waveguide

D.S. Levinson and I. Rubinstein. "A Technique for Measuring Individual Modes Propagating in Overmoded Waveguide." 1966 Transactions on Microwave Theory and Techniques 14.7 (Jul. 1966 [T-MTT]): 310-322.

A practical measurement technique for determining the relative amplitude and phase of the individual modes propagating in overmoded waveguide is described. A phase-sensitive detector is used to measure the output of fixed probes placed around a single transverse plane in a section of enlarged waveguide. The detected output is directly proportional to the modal components, and data reduction is performed manually. The use of oversize waveguide provides increased accuracy and permits total multimode power measurements in conjunction with mode analysis. The technique can be used for mode measurements up to the fourth harmonic in standard rectangular waveguide. Experiments described in the paper use a single frequency source. However, signal sources with spurious content can be evaluated using appropriate tunable RF band-pass filters.

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Synthesis of Negative Resistance Reflection Amplifiers, Employing Band-Limited Circulators

H.C. Okean. "Synthesis of Negative Resistance Reflection Amplifiers, Employing Band-Limited Circulators." 1966 Transactions on Microwave Theory and Techniques 14.7 (Jul. 1966 [T-MTT]): 323-337.

This paper presents a theory for single-stage circulator-coupled negative resistance reflection amplifiers based on proposed realistic circuit models for frequency-dependent band-limited circulators and broadband negative resistance devices such as the tunnel diode. In particular, gain bandwidth limitations are derived which are imposed by both the inherent resonance associated with the nonreciprocal circulator junction and the reactive parasitic associated with the active device. These limitations are generally more restrictive than past results which assumed a "perfect" frequency-independent circulator and took into account only the device parasitic. In addition, a synthesis procedure is presented for realization of an absolutely stable amplifier with a prescribed n th-order Butterworth or Chebyscheff approximation to an ideally flat band-pass power gain characteristic. The approach employed is based upon the theory of reflection coefficient equalization between two reactively constrained resistances representing the pass band circulator and device immittance models. In addition, a band rejection out-of-band stabilizing network is absorbed in the pass band equalizer in accordance with an over-all synthesis procedure. Finally, the theory is verified by the construction and testing of an L-band tunnel diode amplifier having third-order maximally flat power gain centered at 1.46 Gc/s and with half-power bandwidths (430 Mc/s and 355 Mc/s at 10 dB and 16dB midband gain) within six percent of those predicted by theory.





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Coupled-Transmission-Line Directional Couplers with Coupled Lines of Unequal Characteristic Impedances (Jul. 1966 [T-MTT])

E. G. Cristal. "Coupled-Transmission-Line Directional Couplers with Coupled Lines of Unequal Characteristic Impedances (Jul. 1966 [T-MTT])." 1966 Transactions on Microwave Theory and Techniques 14.7 (Jul. 1966 [T-MTT]): 337-346.

A new class of coupled-transmission-line directional couplers, called "nonsymmetrical directional couplers," is described. Unlike conventional directional couplers, nonsymmetrical directional couplers use coupled lines of unequal characteristic impedances. The principal difference between the performance of nonsymmetrical directional couplers and that of conventional designs is the impedance level of the coupled waves, which may be changed to higher or lower impedance levels than that of the incident wave. These directional couplers may be designed to have infinite directivity and to be matched at all frequencies, or they may be designed to have infinite directivity at all frequencies and a specified maximum VSWR. Coupling relationships and design equations for both cases are presented, and the relative properties of both cases are discussed. The theoretical limitation on the maximum coupling and the maximum impedance transformation that can be obtained simultaneously are derived. Techniques for broadbanding by cascading additional sections of coupled lines are described. Experimental results of a trial --10-dB coupler with coupled lines of 50 and 75 ohms are presented.

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Nuclear Radiation Perturbation of a Semiconductor-Filled Microwave Cavity

C.R. Haden and T.D. Shockley, Jr.. "Nuclear Radiation Perturbation of a Semiconductor-Filled Microwave Cavity." 1966 Transactions on Microwave Theory and Techniques 14.7 (Jul. 1966 [T-MTT]): 347-349.

The perturbation of a semiconductor-filled microwave cavity by nuclear radiation particles is considered as a possible means of radiation counting. The TE/_r/ mode equations for a spherical cavity are summarized, and the charge diffusion-recombination equation is solved for this spherical geometry. The case of a spherical cavity operating in the TE/₀₁₁/ mode, with the charge ionization occurring at the center, is analyzed. Through the utilization of a semisteady-state approach, a normalized expression for the power change as a function of time is obtained. This quantitative description for the output pulse shape is applied to the case of high-purity CdS at a frequency of 46.5 Gc/s. These results are presented in an accompanying figure.

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Quasi-TE/sub 11/ Modes in an Anisotropic Plasma Waveguide (Correspondence)

R.N. Carlile. "Quasi-TE/sub 11/ Modes in an Anisotropic Plasma Waveguide (Correspondence)." 1966 Transactions on Microwave Theory and Techniques 14.7 (Jul. 1966 [T-MTT]): 350-351.

The purpose of this correspondence is to demonstrate a fairly simple technique for measuring the propagation constants of the quasi-TE/sub 11/ modes in a cylindrical waveguide partially filled with an anisotropic plasma. A cross section of the system that was investigated is shown in the inset of Fig. 1.



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Design of Comb-Line Band-Pass Filters (Correspondence)

R.M. Kurzrok. "Design of Comb-Line Band-Pass Filters (Correspondence)." 1966 Transactions on Microwave Theory and Techniques 14.7 (Jul. 1966 [T-MTT]): 351-353.

Comb-line band-pass filters are filters using direct-coupled quarter-wave TEM resonators with adjacent resonators having the same open- and short-circuit reference planes. This is in the contrast to interdigital band-pass filters where adjacent resonators alternate the open- and short-circuit reference planes. Comb-line band-pass filters can be realized using either strip (rectangular center conductors) or transmission line resonators. When partitions are employed between adjacent resonators, the comb-line filter structure evolves into a coaxial filter structure. Consequently, comb-line and coaxial nomenclature will be used interchangeably herein. In this correspondence, the published design procedure for comb-line band-pass filters will be related to existing narrow-band filter theory. Certain aspects of the evolution of comb-line structures into coaxial structures will also be discussed.

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Simplified Determination of Impedances of Chebyshev Transformers (Correspondence)

R.J. Stegen. "Simplified Determination of Impedances of Chebyshev Transformers (Correspondence)." 1966 Transactions on Microwave Theory and Techniques 14.7 (Jul. 1966 [T-MTT]): 354-354.

If it is desired to match two different impedances by means of cascaded quarter-wavelength transformers, one may possibly refer to the tables of Young or to the design curves of Jasik. Because these works limit their information to less than seven sections, it is not possible to easily obtain the characteristic impedances for transformers which must operate over a large frequency band or which have very low reflection coefficients. The evaluation of the characteristic impedances for transformers having eight or more sections is very tedious. One can, however, evolve a relationship between the characteristic impedances of Chebyshev transformers and the excitation coefficients of Chebyshev arrays.

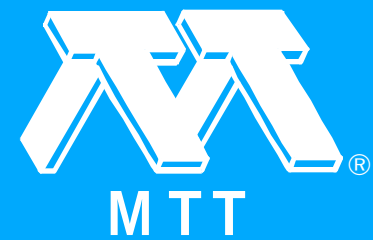
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E.G. Cristal, C.R. Haden, R.D. Larrabee, D.S. Levinson, H.C. Okean, I. Rubinstein and T.D. Shockley, Jr.. "Contributors (Jul. 1966 [T-MTT])." 1966 Transactions on Microwave Theory and Techniques 14.7 (Jul. 1966 [T-MTT]): 354-355.



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Cutoff Phenomena for Guided Waves in Moving Media

L.J. Du and R.T. Compton, Jr.. "Cutoff Phenomena for Guided Waves in Moving Media." 1966 Transactions on Microwave Theory and Techniques 14.8 (Aug. 1966 [T-MTT]): 358-363.

This paper treats the propagation of electromagnetic waves in the interior of a waveguide that is filled with a moving medium. The medium is assumed to be homogeneous, isotropic, and lossless, and to move with a constant velocity along the axis of the waveguide. The Maxwell-Minkowski equations for the electromagnetic fields are solved by means of a pair of vector potential functions similar to those frequently used for stationary media. The fields inside the waveguide are derived for both rectangular and cylindrical waveguides. The well-known cutoff phenomenon for a waveguide is found to be modified in an interesting way when the medium inside the waveguide is moving. The results show that for a slowly moving medium (a medium for which $n\beta < 1$, where n is the index of refraction and β is the velocity of the medium divided by the velocity of light in vacuum), there are two critical frequencies, separating three frequency ranges in each of which there is a different type of propagation. For a high-speed medium ($n\beta > 1$), it is found that there is no cutoff phenomenon at all, although there is one critical frequency separating two frequency ranges in which the propagation is different.



Abstracts

A Diplexer Using Hybrid Junctions

L.J. Ricardi. "A Diplexer Using Hybrid Junctions." 1966 Transactions on Microwave Theory and Techniques 14.8 (Aug. 1966 [T-MTT]): 364-371.

A diplexer is a filter which connects a transmitter and a receiver to a common antenna so that both the transmitter and the receiver may be operated simultaneously when their frequencies are not identical. The diplexer described in this report uses hybrid junctions, is easily tuned, and can be designed in a simple, straight-forward manner. Its maximum power-handling capacity is the same as that of the connecting transmission line, and its insertion loss is unusually low. An analysis of this filter and a long-stub filter is presented, in addition to the design procedure for, and the experimental results obtained with, a specific model.



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Short-Step Chebyshev Impedance Transformers

G.L. Matthaei. "Short-Step Chebyshev Impedance Transformers." 1966 Transactions on Microwave Theory and Techniques 14.8 (Aug. 1966 [T-MTT]): 372-383.

Impedance transforming networks are described which consist of short lengths of relatively high impedance transmission line alternating with short lengths of relatively low impedance line. The sections of transmission line are all exactly the same length (except for corrections for fringing capacitances), and the lengths of the line sections are typically short compared to a quarter wavelength throughout the operating band of the transformer. Tables of designs are presented which give exactly Chebyshev transmission characteristics between resistive terminations having ratios ranging from 1.5 to 10, and for fractional bandwidths ranging from 0.10 to 1.20. These impedance-transforming networks should have application where very compact transmission-line or dielectric-layer impedance transformers are desired.



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Resonant Cavity Type Mode Transducer

S. Shimada. "Resonant Cavity Type Mode Transducer." 1966 Transactions on Microwave Theory and Techniques 14.8 (Aug. 1966 [T-MTT]): 384-391.

This paper describes the operating principle and the properties of a resonant cavity type mode transducer which was newly devised. The theoretical equations necessary for designing the mode transducer from a TE/sub 10/ mode of a rectangular waveguide to an arbitrary mode of a circular waveguide have been derived, and a design method using the coupling parameters is discussed. The experiments were made for the rectangular TE/sub 10/-circular TE/sub 01/ mode transformation in the 50 Gc band. Showing an example (N=1), the transfer loss, input SWR and mode purity were 1.34 dB, 1.13, and 95 percent (power contents), respectively, at the resonant frequency of 50 Gc/s. The 3 dB bandwidth of the transfer loss was 83 Mc/s at the constant cavity length, but it can be made much larger if the cavity length is adjusted according to the frequency change. This mode transducer is unique in that various modes can be excited purely in the circular guide by merely varying the cavity length.

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Abstracts

Dispersion Characteristics of an Array of Parasitic Linear Elements

E.R. Nagelberg and J. Shefer. "Dispersion Characteristics of an Array of Parasitic Linear Elements." 1966 Transactions on Microwave Theory and Techniques 14.8 (Aug. 1966 [T-MTT]): 391-396.

In this paper we study the properties of a transmission line consisting of an infinite array of conducting cylinders, placing emphasis on the dispersion characteristics of the lowest order slow wave mode. We present experimental results for the variation of phase velocity with frequency, and then, using a method of parameter estimation, determine the element current (distribution which best explains these observations. Assuming this distribution to be of the form we find that, for a given size of element, there is a value of gamma which gives very good agreement for the variation of phase velocity over the frequency range of interest.



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Gap Effect in Measurement of Large Permittivities (Correspondence)

K.S. Champlin and G.H. Glover. "Gap Effect in Measurement of Large Permittivities (Correspondence)." 1966 Transactions on Microwave Theory and Techniques 14.8 (Aug. 1966 [T-MTT]): 397-398.

Complex permittivity is frequently determined from measurements of the transmission--or reflection coefficient of the dominant mode of a uniformly-filled waveguide section. Uniformity is difficult to achieve in practice, however, because of unavoidable gaps between the sample and the waveguide walls. The importance of gaps increases with increasing magnitude of the complex permittivity and may cause large errors in measurements of high-permittivity or high-loss (e.g., semiconducting) dielectrics if proper corrections are not made. The purpose of this note is to examine the range of validity of several correction formulas found in the literature by comparing their predictions of measured permittivity with values actually measured with germanium. During these measurements, the true magnitude of the complex relative permittivity of the germanium was varied between 16.4 and 860.0 by varying the sample temperature.



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Fringing Capacitance in Strip-Line Coupler Design (Correspondence)

J. Singletary, Jr.. "Fringing Capacitance in Strip-Line Coupler Design (Correspondence)." 1966 Transactions on Microwave Theory and Techniques 14.8 (Aug. 1966 [T-MTT]): 398-398.

Very useful relationships between stripline directional coupler dimensions and the even- and odd-mode impedance have been derived by S. B. Cohn for both the case of side-by-side strips (edge coupling) and broadside coupling. In each case the relations for even- and odd-mode impedance contain, respectively, terms for even- and odd-mode fringing capacitance per unit length. Cohn has derived relationships for both even- and odd-mode fringing capacitances for the case of side-by-side strips and broadside coupling for strips of zero thickness, and has published a paper on thickness corrections. Gunderson and Guida have shown that for the broadside coupled case the even- and odd-mode fringing capacitances are not independent and have thus derived a relationship between the coupler dimensions and even and odd impedance which does not involve expressions for the fringing capacitances. This has led them to formulate a simpler design procedure.

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Abstracts

Frequency Responses in the Reflection Coefficient Plane Plotted by Digital Computer (Correspondence)

J.W. Bandler. "Frequency Responses in the Reflection Coefficient Plane Plotted by Digital Computer (Correspondence)." 1966 Transactions on Microwave Theory and Techniques 14.8 (Aug. 1966 [T-MTT]): 399-400.

It is very often necessary to predict changes in either reflection coefficient p , or VSWR, or input immittance as a function of frequency, say, caused by adjustment of some variable in the load of a transmission-line, or its transformation towards the generator. For an active load, e.g. a tunnel-diode amplifier, information on gain and stability may be required. The task is generally tedious if done manually.



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R.T. Compton, Jr., L.-J. Du, G.L. Matthaei, E.R. Nagelberg, L.J. Ricardi, J. Shefer and S. Shimada. "Contributors (Aug. 1966 [T-MTT])." 1966 Transactions on Microwave Theory and Techniques 14.8 (Aug. 1966 [T-MTT]): 401-402.



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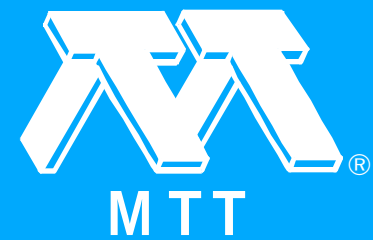
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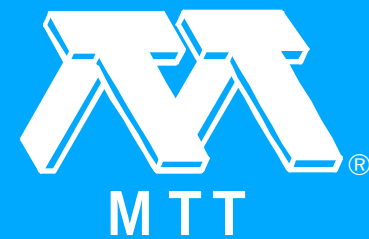
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Microwave Measurement of High-Dielectric-Constant Materials

S.B. Cohn and K.C. Kelly. "Microwave Measurement of High-Dielectric-Constant Materials." 1966 Transactions on Microwave Theory and Techniques 14.9 (Sep. 1966 [T-MTT]): 406-410.

A particularly severe source of error in the microwave measurement of high dielectric constants has been the presence of small air gaps between dielectric surfaces and metal walls. In this paper, two precise measurement techniques are described that eliminate the effect of air gaps through the use of resonant modes, for which $E_{\text{tan}}=0$ at the dielectric-to-metal interface. In one method a cylindrical sample is resonated within a closely fitting circular waveguide, and in the other a cylindrical sample is placed at the center of a radial waveguide. Both methods utilize a circular-electric-mode whose electric field is parallel to the metal walls. The waveguides are dimensioned to be cut off in their air regions at the resonant frequency of the dielectric sample. Formulas yield ϵ_r as a function of the resonant frequency, and of diameter and length of the dielectric cylinder. Measured data on samples having $\epsilon_r \approx 85$ show the two methods to agree within a few tenths of one percent. The accuracy of the methods is on the order of 0.5 percent maximum error and 0.2 percent probable error when ϵ_r is measured within 0.1 percent and D and L within 0.0005 inch (for $D \approx 0.3$ inch and $L \approx 0.1$ inch).

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Abstracts

The Measurement of Phase at UHF and Microwave Frequencies

J.D. Dyson. "The Measurement of Phase at UHF and Microwave Frequencies." 1966 Transactions on Microwave Theory and Techniques 14.9 (Sep. 1966 [T-MTT]): 410-423.

A theoretical analysis and a unifying classification of methods of measuring phase at UHF and microwave frequencies are presented. The coherent phase bridge circuits are analyzed in terms of the type of modulation applied to the channels of the bridge and the type of combiner and mixer employed at the output of the bridge. In this analysis and classification, identifying characteristics, and some of the relative advantages and disadvantages of these circuits become obvious.



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A Compact, Wide-Tuning Range, Dual TE/sub 111/ Mode Preselector

R.L. Fjerstad. "A Compact, Wide-Tuning Range, Dual TE/sub 111/ Mode Preselector." 1966 Transactions on Microwave Theory and Techniques 14.9 (Sep. 1966 [T-MTT]): 424-427.

This paper describes the development of a dual TE/sub 111/ mode cavity preselector that is centrally loaded with a large, nonferrous, metallic perturbation plug. The cavity tunes over the 6 to 8 GHz range. Dual mode operation reduces the size of the cavity to one-half the size of a conventional cavity. The perturbing plug increases the separation between the desired TE/sub 111/ mode and the undesired, next higher TM/sub 011/ mode from 15 Percent to 33 Percent. The result is a 29 percent tuning range that is free from unwanted modes. The preselector exhibits a 3 dB bandwidth of 60 MHz, a 40 dB bandwidth of about 400 MHz, and an insertion loss that is no more than 1 dB.

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



An Approximate Wave Equation for an Axially Symmetric Periodic Waveguide

C.R. James and G.B. Walker. "An Approximate Wave Equation for an Axially Symmetric Periodic Waveguide." 1966 Transactions on Microwave Theory and Techniques 14.9 (Sep. 1966 [T-MTT]): 428-430.

The field problem of wave propagation in a waveguide of periodically varying section is investigated. An orthogonal curvi-linear coordinate system is developed leading to a separable wave equation. As a result, the problem is reduced to solving Hills Equation. The discussion is limited to the case of a waveguide with slowly varying radius but there is some expectation that useful results would be obtained, particularly for axial fields, without this restriction.





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A Simple and Rugged Wide-Band Gas Discharge Detector for Millimeter Waves

P.J.W. Severin and A.G. van Nie. "A Simple and Rugged Wide-Band Gas Discharge Detector for Millimeter Waves." 1966 Transactions on Microwave Theory and Techniques 14.9 (Sep. 1966 [T-MTT]): 431-436.

Detection of 4 and 2 millimeter waves by a small, low-pressure, anomalous burning glow discharge in He or Ne is described. The responsivity and the noise equivalent power are discussed. Typical values are presented in a table: the former is found to be about 50 V/W, the latter about 5 μ W. The device is linear over about 30 dB, it has a LF bandwidth of about 50 kc/s and the same tube can be used both for detection of 4 and 2 mm waves by simply raising the applied dc potential a few volts. Since the device is very rugged it can withstand a high local oscillator power, so that in a synchronous detection circuit the noise equivalent power can be about 10/sup -11/ W at 1 c/s bandwidth.

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

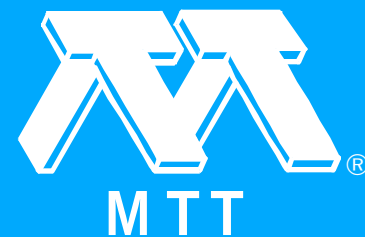


Abstracts

A Nonresident Perturbation Theory (Correction)

C.W. Steele. "A Nonresident Perturbation Theory (Correction)." 1966 Transactions on Microwave Theory and Techniques 14.9 (Sep. 1966 [T-MTT]): 436-436.

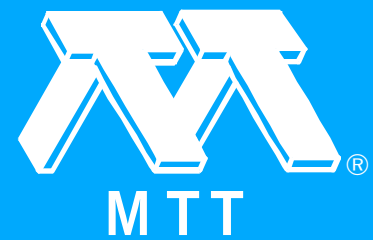
Equation (35) applies only to linearly polarized electric and magnetic fields at the point of perturbation. (This restriction was not stated.) Equation (34) is, however, more general and applies to the elliptically polarized waves as well.



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Band-Pass Spurline Resonators (Correction)

E.G. Cristal. "Band-Pass Spurline Resonators (Correction)." 1966 Transactions on Microwave Theory and Techniques 14.9 (Sep. 1966 [T-MTT]): 436-436.

Figures 1 and 2, as follows, should have appeared in place of the ones printed.



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



Abstracts

A Note on Bolometer Mount Efficiency Measurement Technique by Impedance Method in Japan (Correspondence)

T. Tamaru. "A Note on Bolometer Mount Efficiency Measurement Technique by Impedance Method in Japan (Correspondence)." 1966 Transactions on Microwave Theory and Techniques 14.9 (Sep. 1966 [T-MTT]): 437-437.

As mentioned by Engen in his correspondence, the agreement between the microcalorimetric and impedance determinations of bolometer mount efficiencies was not so good in Japan at the time when the international comparison was performed. It was, however, promptly improved after that international comparison.



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Pickup Antennas for Waveguide Motors (Correspondence)

R.W. Steinhoff and T.K. Ishii. "Pickup Antennas for Waveguide Motors (Correspondence)." 1966 Transactions on Microwave Theory and Techniques 14.9 (Sep. 1966 [T-MTT]): 438-438.

A parametric motor energized by radio waves at 425 kHz was first built by Schudner while Stockman was the first to utilize a directive antenna for a radio wave motor operated at 50 mHz. Stockman also analyzed the parametric motor circuit with low-frequency models and found that the differential equation of the motor circuit was a Mathiew-Hill Equation. His experimental results of low-frequency parametric motors were also theoretically analyzed by Blasgen and Monson. For the Stockman's radio-frequency motor with a directive antenna, the analysis is yet incomplete. The feasibility and design of a waveguide motor operating on microwave energy has been reported previously by Gamier and Ishii. Recent investigation by Sedivy revealed that the differential equation of torque for the "microwave motors" is not a Mathiew-Hill equation. The purpose of this correspondence is to present the effect of various pickup antennas on the waveguide motors speed vs. input power relationship at frequencies of 2.56, 3.0 and 3.44 GHz.



Abstracts

On the Solution and Field Pattern of Cylindrical Dielectric Resonators (Correspondence)

K.K. Chow. "On the Solution and Field Pattern of Cylindrical Dielectric Resonators (Correspondence)." 1966 Transactions on Microwave Theory and Techniques 14.9 (Sep. 1966 [T-MTT]): 439-439.

Recent publications on dielectric resonators have shown the importance and applications of these devices. The usual method of analytic solution has been to approximate the cylindrical wall with a perfect open circuit boundary (magnetic wall) and to allow decaying fields outside the flat ends. These approximations have given good agreement between the calculated and measured frequencies for the mode having a fraction of a half cycle variation along the resonator length. In connection with our work on the coupling of ferromagnetic and dielectric resonances, we have occasion to investigate higher order modes in the resonator. The approach taken is different and gives interesting and more accurate results as will be discussed below.



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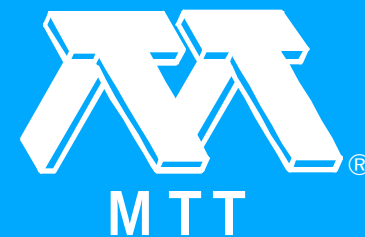
Click on title for a complete paper.



Abstracts

Contributors (Sep. 1966 [T-MTT])

S.B. Cohn, J.D. Dyson, R.L. Fjerstad, C.R. James, K.C. Kelly, P.J.W. Severin, A.G. van Nie and G.B. Walker. "Contributors (Sep. 1966 [T-MTT])." 1966 Transactions on Microwave Theory and Techniques 14.9 (Sep. 1966 [T-MTT]): 440-441.



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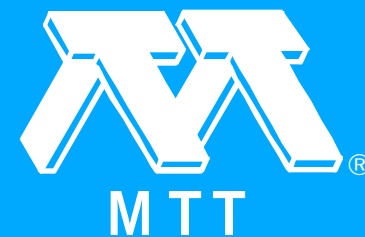
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Abstracts

1966 International Electron Devices Meeting (Announcement) (Sep. 1966 [T-MTT])

"1966 International Electron Devices Meeting (Announcement) (Sep. 1966 [T-MTT])." 1966 Transactions on Microwave Theory and Techniques 14.9 (Sep. 1966 [T-MTT]): 442-442.



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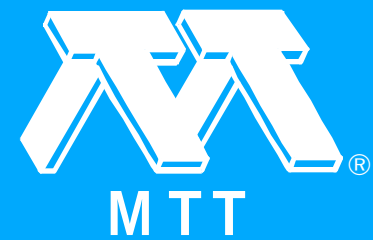
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Abstracts

Membership Application (Sep. 1966 [T-MTT])

"Membership Application (Sep. 1966 [T-MTT])." 1966 Transactions on Microwave Theory and Techniques 14.9 (Sep. 1966 [T-MTT]): 443-443.



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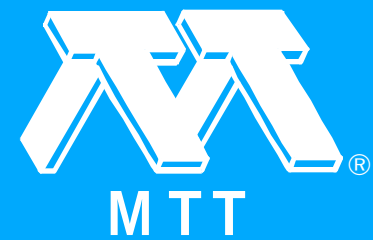
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"Table of Contents (Oct. 1966 [T-MTT])." 1966 Transactions on Microwave Theory and Techniques 14.10 (Oct. 1966 [T-MTT]): 445-445.



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Coupled Strip Transmission Line with Three Center Conductors

S. Yamamoto, T. Azakami and K. Itakura. "Coupled Strip Transmission Line with Three Center Conductors." 1966 Transactions on Microwave Theory and Techniques 14.10 (Oct. 1966 [T-MTT]): 446-461.

An exact analysis is made for the shielded coupled strip transmission line with three center conductors. By means of the immittance matrices presented, the electrical behavior of the coupled strip transmission line of this type may be completely described. Design formulas which enable one to evaluate the cross-section dimensions from the desired values of characteristic immittances are derived for the two kinds of the line configurations. Equivalent circuits of the two-port networks for various port conditions are also presented. In addition, an application is discussed involving the asymmetrical coupled strip transmission line with two center conductors. The appendix gives the derivation of the design formulas by means of conformal mapping techniques.

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Synthesis and Design of Wide-Band Equal-Ripple TEM Directional Couplers and Fixed Phase Shifters

J.P. Shelton and J.A. Mosko. "Synthesis and Design of Wide-Band Equal-Ripple TEM Directional Couplers and Fixed Phase Shifters." 1966 Transactions on Microwave Theory and Techniques 14.10 (Oct. 1966 [T-MTT]): 462-473.

An approximate synthesis technique is described for TEM directional couplers and fixed phase shifters consisting of multiple parallel-coupled quarter-wave sections. Synthesis is accomplished without the use of polynomials by a first-order relationship between the components and Chebyshev antenna arrays. The design procedure has the important advantage of allowing the maximum coupling coefficient between transmission lines to be an independent parameter. An iterative correction procedure for bringing the performance arbitrarily close to equal-ripple is described. The process has been programmed for electronic computation, and the results have been tabulated for directional couplers of 3, 6, 10, and 20 dB overall coupling and for phase shifters of 90, 45, and 22.5 degrees differential phase shifts. Bandwidth ratios range between 2 and 25, and the number of coupled sections ranges from 3 to 21 for couplers and from 2 to 9 sections for phase shifters. Maximum normalized even-mode impedance ranges from 1.83434 to 4.5.

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Abstracts

Design Tables for an Elliptic-Function Band-Stop Filter (N=5)

B.M. Schiffman and L. Young. "Design Tables for an Elliptic-Function Band-Stop Filter (N=5)." 1966 Transactions on Microwave Theory and Techniques 14.10 (Oct. 1966 [T-MTT]): 474-482.

Design tables for a wide-band elliptic-function band-stop transmission-line filter are described. The filter consists of five alternating quarter-wave and half-wave stubs separated by quarter-wave lines. The characteristic impedances of the filter elements were computed from published tables of the lumped-element prototype by an exact method. The filter elements are assumed to be lossless.



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Propagation Characteristics of a Partially Filled Cylindrical Waveguide for Light Beam Modulation

D. Chen and T.C. Lee. "Propagation Characteristics of a Partially Filled Cylindrical Waveguide for Light Beam Modulation." 1966 Transactions on Microwave Theory and Techniques 14.10 (Oct. 1966 [T-MTT]): 482-486.

Propagation characteristics of a cylindrical waveguide partially filled with a cylindrical dielectric light modulation material is analyzed and numerical computation is performed for a few typical cases. This type of traveling-wave structure supports a TE or TM mode, and therefore is useful for light beam modulation applications requiring a longitudinal magnetic or electric field. Numerical analysis indicates that for the TM case, a broadband region occurs near a crossover point and broadband synchronization between the modulating microwave and the parallel-launched light beam can be obtained by a suitable choice of the dielectric medium surrounding the central dielectric.

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Cutoff Frequencies of Eccentric Waveguides

H.Y. Yee and N.F. Audeh. "Cutoff Frequencies of Eccentric Waveguides." 1966 Transactions on Microwave Theory and Techniques 14.10 (Oct. 1966 [T-MTT]): 487-493.

This paper discusses the uniform cylindrical waveguide formed by placing one conductor inside a conducting tube. Because of the complexity of the guide's cross section, the numerical technique of the point-matching method is adopted to solve the boundary-value problem. The formulations are carried out for the case when each of the conductors has an arbitrary cross section and also for the case when one of the conductors has a circular cross section. The coaxial waveguide modes, in which the field components have angular variations, split into odd and even modes when the center conductor begins to shift axis to form the uniform eccentric waveguide. However, only even modes in the eccentric guide correspond to the coaxial modes with no angular variations. The dependence of the cutoff frequency on the eccentricity of the guide is determined numerically for even and odd TE and TM modes. Experimental results verify the theoretical calculations for TE modes.

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Abstracts

On Longitudinal Waves in a Hot-Nonuniform Plasma (Correspondence)

K.E. Lonngren. "On Longitudinal Waves in a Hot-Nonuniform Plasma (Correspondence)." 1966 Transactions on Microwave Theory and Techniques 14.10 (Oct. 1966 [T-MTT]): 494-495.

Recently, measurements have been made of wave propagation whose characteristic velocities have been on the order of the speed of sound for the electron gas, $(\gamma k T/m)^{1/2}$ where γ is a constant on the order of unity. Harmonic generation of these modes has been detected and they have been used to study drift velocities in the positive column of a mercury vapor discharge tube. In this correspondence, we will study the propagation of these temperature dependent waves in a slightly inhomogeneous hot plasma. The positive column of a mercury vapor discharge possesses this slight inhomogeneity in its "long" dimension.



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Excitation of Spin Waves by Wire Arrays (Comments)

R. LaRosa, C.F. Vasile, I. Kaufman and R.F. Soohoo. "Excitation of Spin Waves by Wire Arrays (Comments)." 1966 Transactions on Microwave Theory and Techniques 14.10 (Oct. 1966 [T-MTT]): 495-496.

Kaufman and Soohoo have suggested that spin waves involving exchange forces can be excited by means of a fine wire at the end of a YIG crystal. It would be very desirable to do this, for then the entire crystal might be kept at a low enough dc field to avoid coupling to acoustic waves. We have made a detailed analysis of an array of flat wires immersed in an infinite YIG medium and also printed on the air-YIG interface of a semi-infinite YIG medium. The dc magnetic field has been taken both perpendicular to the plane of the array and parallel to the array conductors.

Abstracts

Reflection Measurements with Broadband Frequency Modulation Using Long Transmission Lines (Correspondence)

C. Mahle and G. Epprecht. "Reflection Measurements with Broadband Frequency Modulation Using Long Transmission Lines (Correspondence)." 1966 Transactions on Microwave Theory and Techniques 14.10 (Oct. 1966 [T-MTT]): 496-497.

This correspondence describes some applications of broadband frequency modulation for measuring reflections on moderately long transmission lines. As known from earlier publications on this subject, and from FM-radar techniques, a frequency modulated wave train from a sweep generator is fed into a transmission line. A part of the energy is scattered back by reflections produced on the line or at the end of it. A detector conveniently coupled to the line near the generator provides for mixing of transmitted and scattered wave amplitudes, thus generating an intermediate frequency signal (generally 0.1...15 kHz) which can be processed by audio frequency techniques.



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Upper and Lower Bounds on the Characteristic Impedance of TEM Mode Transmission Lines (Correspondence)

C.T. Carson and G.K. Cambrell. "Upper and Lower Bounds on the Characteristic Impedance of TEM Mode Transmission Lines (Correspondence)." 1966 Transactions on Microwave Theory and Techniques 14.10 (Oct. 1966 [T-MTT]): 497-498.

A numerical method of obtaining the characteristic impedance of TEM mode transmission lines, which has been described by several authors, has the major disadvantage of giving little indication of the resulting error. This correspondence shows how it is possible to extend the finite difference solution of Laplace's Equation to extract an upper and lower bound on the exact solution by using variational formulas. Examples illustrate the high accuracy of solutions obtained with the aid of a digital computer which has been programmed not only to set up and solve the Laplace finite difference equations by systematic over-relaxation but also, at the same time, to compute an upper and a lower bound on the exact solution. Although the method has been used in conjunction with a finite difference solution of Laplace's Equation it can also be used in conjunction with the Rayleigh Ritz method.

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Abstracts

General Four-Resonator Filters at Microwave Frequencies (Correction)

R.M. Kurzrok. "General Four-Resonator Filters at Microwave Frequencies (Correction)." 1966 Transactions on Microwave Theory and Techniques 14.10 (Oct. 1966 [T-MTT]): 498-498.

R. M. Kurzrok, author of the above, has called the following to the attention of the Editor.



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Abstracts

Analysis and Exact Synthesis of Cascaded Commensurate Transmission-Line C-Section All-Pass Networks (Addendum)

E.G. Cristal. "Analysis and Exact Synthesis of Cascaded Commensurate Transmission-Line C-Section All-Pass Networks (Addendum)." 1966 Transactions on Microwave Theory and Techniques 14.10 (Oct. 1966 [T-MTT]): 498-499.

In a previous publication a method for the exact synthesis of cascaded commensurate transmission-line C-section all-pass networks was presented.



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Abstracts

Contributors (Oct. 1966 [T-MTT])

N.F. Audeh, T. Azakami, D. Chen, K. Itakura, T.C. Lee, J.A. Mosko, B.M. Schiffman, J.P. Shelton, Jr., S. Yamamoto, H.Y. Yee and L. Young. "Contributors (Oct. 1966 [T-MTT])." 1966 Transactions on Microwave Theory and Techniques 14.10 (Oct. 1966 [T-MTT]): 499-500.



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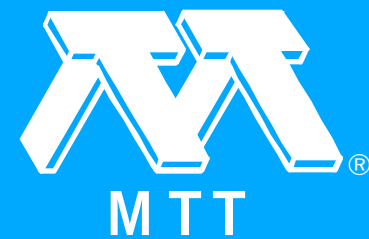
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Abstracts

Synthesis of Distributed Elliptic-Function Filters from Lumped-Constant Prototypes (Nov. 1966 [T-MTT])

R. Levy and I. Whiteley. "Synthesis of Distributed Elliptic-Function Filters from Lumped-Constant Prototypes (Nov. 1966 [T-MTT])." 1966 Transactions on Microwave Theory and Techniques 14.11 (Nov. 1966 [T-MTT]): 506-517.

A synthesis procedure for distributed elliptic-function filters utilizing published tables of lumped-constant elliptic-function filters has been devised. It is dependent upon the application of a new generalized transformation for distributed networks. The filters often require the realization of distributed Brune sections, and several novel practical realizations are given both for general and degenerate Brune (i.e., Foster) sections. Examples are given of elliptic function stop band and pass band filters having both wide and narrow bandwidths, and experimental results show good agreement with theory.



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Propagation of TE Modes in Dielectric Loaded Waveguides

R. Seckelmann. "Propagation of TE Modes in Dielectric Loaded Waveguides." 1966
Transactions on Microwave Theory and Techniques 14.11 (Nov. 1966 [T-MTT]): 518-527.

The propagation of TE/sub no/ modes in rectangular wave-guides that contain two dielectric slabs parallel to the narrow wall and extending over the full height of the guide is investigated. Waveguide and dielectric are assumed to be lossless and infinitely long. Apart from these restrictions, the dielectric slabs may have arbitrary thickness, position, and dielectric constant. The analysis is restricted to TE/sub no/ modes with the E-field parallel to the narrow guidewall. The guide containing only one dielectric slab is covered by this analysis. The even modes $n = 2, 4, 6, \dots$ of the guide with two slabs correspond to the odd modes $n' = n/2 = 1, 2, 3, \dots$ of the guide with one slab half the width of the guide with two slabs. For six relative dielectric constants ($\epsilon_r = 2.25, 4.00, 9.00, 12.25, 16.00, 25.00$) the cutoff frequencies for TE 10, 20, 30, 40, 60 modes and the normalized propagation constants for TE 10 and TE 20 modes between their respective cutoff frequencies and a frequency slightly above the second- and fourth-order mode cutoff frequency for the empty guide, respectively, have been computed for a large range of slab thicknesses and slab positions. Selected results are presented graphically. These results are discussed. The parametric dependence of field distributions, of normalized characteristic impedances, of the ratio of cutoff frequencies (fractional bandwidth), and of the ratio of magnetic field components (ellipticity) are illustrated.

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The Transient Analysis of Certain TEM Mode Four-Port Networks

G.F. Ross. "The Transient Analysis of Certain TEM Mode Four-Port Networks." 1966 Transactions on Microwave Theory and Techniques 14.11 (Nov. 1966 [T-MTT]): 528-542.

This paper presents the transient analysis of certain four-port TEM mode microwave networks. Flow graph techniques are employed to determine in closed form the system function between two given ports. This representation reveals the pole-zero pattern of the component which is used to graphically obtain the amplitude spectrum (CW response). In the time domain, the impulse response (the inverse transform of the system function) is used to determine the step modulated response of the network at its resonant frequency. This proves to be a particularly easy task for certain symmetrical networks. The flow graph technique is illustrated by analyzing three often used microwave networks (namely; the ring hybrid, the 3-dB branch line coupler, and the branch line phase shifter), and an estimate is made of their "settling times" for a step modulated input. Experimental methods are introduced which permit an investigator to generate a 0.2 nanosecond pulse and/or a microwave step modulated source. These test functions are then used to critically evaluate the theoretical results in the laboratory.

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Slit-Coupled Strip Transmission Lines

S. Yamamoto, T. Azakami and K. Itakura. "Slit-Coupled Strip Transmission Lines." 1966 Transactions on Microwave Theory and Techniques 14.11 (Nov. 1966 [T-MTT]): 542-552.

Two types of slit-coupled strip-line configuration are presented which are especially useful for the realization of multi-section components using printed-circuit techniques. The slit-coupled configurations described consist of a pair of strips oriented face to face and either parallel or perpendicular to the outer ground planes. Coupling is achieved through a longitudinal slit. Exact conformal mapping solutions of the even- and odd-mode characteristic impedances are arranged in the forms of the design equations for both parallel and perpendicular cases. In order to facilitate design, nomograms are presented for the parallel case which give the physical line dimensions in terms of the even- and odd-mode characteristic impedances. Furthermore, the exact design equations for both parallel and perpendicular broadside-coupled strip configurations, which are considered to be special cases of the slit-coupled configurations, are presented. Formulas for the terminating lines are also included. The proposed parallel-coupled strip transmission line configurations permit smooth variation of coupling and applications to a wide variety of circuit components.

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Some Designs of X/sub L/ Band Diode Switches

R.N. Assaly. "Some Designs of X/sub L/ Band Diode Switches." 1966 Transactions on Microwave Theory and Techniques 14.11 (Nov. 1966 [T-MTT]): 553-563.

X/sub L/-band waveguide switches, using PIN diodes for the switching elements, were developed in the SPST, SP2T, SP4T, and SP8T configurations. At the frequency of 7.75 GHz, for which they were tuned, they exhibited insertion losses on the average of 0.1, 0.4, 0.6, and 1.1 dB, respectively. In all cases, the signal going out of each switch port when turned OFF decreased in excess of 29 dB. The bandwidth of each switch, whose values are indicated, is narrower for the switch which has the larger number of ports or which contains diodes of lower capacitance. Semiempirical formulas are developed which predict performance characteristics of the SPST switch in particular.

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Microwave Varactor Tuned Transistor Oscillator Design

K.M. Johnson. "Microwave Varactor Tuned Transistor Oscillator Design." 1966 Transactions on Microwave Theory and Techniques 14.11 (Nov. 1966 [T-MTT]): 564-572.

An analysis is made of the common base microwave transistor oscillator circuit which uses a varactor in series with the collector to tune over octave bandwidths. Equations are derived giving the required feedback capacitances and resonating elements required for octave tuning. Normally, the collector-emitter capacitance C_{ce} is made approximately equal to the transistor collector capacitance C_c . The emitter-base capacitance C_{eb} is important only at very high frequencies. It is shown that a high-Q varactor must be used and that only a limited amount of collector-base capacitance C_{cb} may be added if the circuit is to be resonated over an octave. The output power for such a circuit is normally about 1/5 the maximum power available from the transistor. Experimental oscillators were made from 0.5 to 1 GHz and 1 to 2 GHz which substantially verified the analysis. Using the TIXS13 transistor, an output power of 200 mW was obtained from 430 to 860 MHz tuning from -2 to -115 volts. In the 1 to 2 GHz range a TIXS13 transistor oscillator was tuned from 1.09-1.96 GHz with about 40 mW power tuning from -2 to -115 volts. By use of a lower case capacitance varactor, the 1 to 2 GHz oscillator could be made to tune over the full octave.



Abstracts

Propagation in a Microwave Model Waveguide of Variable Surface Impedance--Theory and Experiment

E. Bahar. "Propagation in a Microwave Model Waveguide of Variable Surface Impedance--Theory and Experiment." 1966 Transactions on Microwave Theory and Techniques 14.11 (Nov. 1966 [T-MTT]): 572-578.

In this paper propagation in a model terrestrial waveguide is investigated. The surface impedance of the waveguide boundary is assumed to vary along the path of propagation. A quasioptical approach is used to derive the solution for the case of an abrupt variation in the surface impedance. The reciprocity theorem is employed to facilitate that solution for both directions of propagation. Experimental verification of this technique is obtained from measurements in the model waveguide.



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Abstracts

Multiline 2N-Port Directional Couplers (Correspondence)

E. Ott. "Multiline 2N-Port Directional Couplers (Correspondence)." 1966 Transactions on Microwave Theory and Techniques 14.11 (Nov. 1966 [T-MTT]): 578-579.

In 1954, Oliver described the basic theory and design of a four-port contradirectional coupler which utilized two sets of coupled transmission lines. We attempt here to generalize this result so as to obtain a 2N-port contradirectional coupler.



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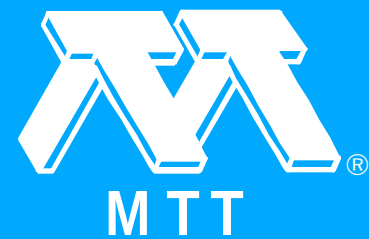
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Polarization Transformation in Twisted Anisotropic Media (Comments)

P. Shelton. "Polarization Transformation in Twisted Anisotropic Media (Comments)." 1966 Transactions on Microwave Theory and Techniques 14.11 (Nov. 1966 [T-MTT]): 579-579.

The artificial anisotropic medium illustrated in Fig. 1 of Van Doeren's Paper is not twistable in the sense intended by the author. A moment's contemplation reveals that the lateral distance moved by the rotating layers, for given distance moved in a direction parallel with the twist axis, is directly proportional to the distance from the twist axis. The result is a medium with characteristics that vary drastically as a function of the position relative to the twist axis.

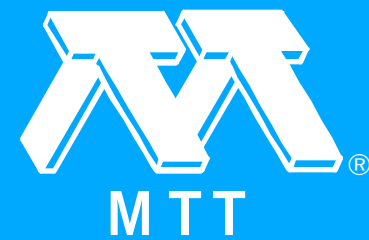
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Contributors (Nov. 1966 [T-MTT])

R.N. Assaly, T. Azakami, E. Bahar, K. Itakura, K. Johnson, R. Levy, G.F. Ross, R. Seckelmann, I. Whiteley and S. Yamamoto. "Contributors (Nov. 1966 [T-MTT])." 1966 Transactions on Microwave Theory and Techniques 14.11 (Nov. 1966 [T-MTT]): 580-581.



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Microwave Abstracts (Nov. 1966 [T-MTT])

"Microwave Abstracts (Nov. 1966 [T-MTT])." 1966 Transactions on Microwave Theory and Techniques 14.11 (Nov. 1966 [T-MTT]): 581-582.



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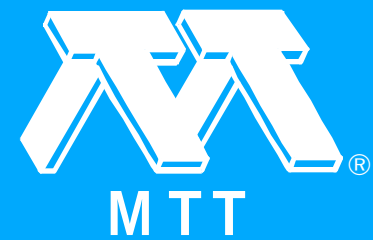
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Membership Application (Nov. 1966 [T-MTT])

"Membership Application (Nov. 1966 [T-MTT])." 1966 Transactions on Microwave Theory and Techniques 14.11 (Nov. 1966 [T-MTT]): 583-583.



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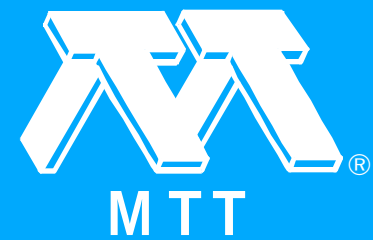
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"Table of Contents (Dec. 1966 [T-MTT])." 1966 Transactions on Microwave Theory and Techniques 14.12 (Dec. 1966 [T-MTT]): 585-585.



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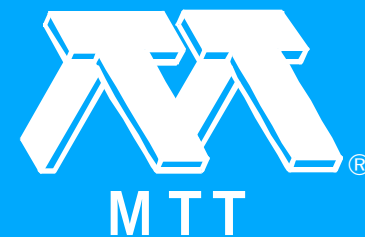
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1966 International Microwave Symposium (Dec. 1966 [T-MTT])

"1966 International Microwave Symposium (Dec. 1966 [T-MTT])." 1966 Transactions on Microwave Theory and Techniques 14.12 (Dec. 1966 [T-MTT]): 586-587.



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Quantitative Comparison of Solid-State Microwave Detectors (Dec. 1966 [T-MTT])

M. Cowley and H.O. Sorensen. "Quantitative Comparison of Solid-State Microwave Detectors (Dec. 1966 [T-MTT])." 1966 Transactions on Microwave Theory and Techniques 14.12 (Dec. 1966 [T-MTT]): 588-602.

A method for quantitative comparison of solid-state microwave square-law detectors is presented. The threshold response of the square-law detectors are compared for unit video bandwidth using the concept of noise equivalent power (NEP). NEP is the microwave input power required for unity signal-to-noise ratio in a 1 Hz bandwidth at the output of the detector. Contours of constant NEP in the microwave (RF) and video frequency plane clearly describe the dependence of threshold sensitivity on both video and radio frequencies, and thereby provide comparison of the threshold sensitivities of devices over the entire video and RF frequency spectrum. A criterion for the upper RF power lid of square-law operation for detectors is also presented. Dynamic range for a device can be found using this criterion and the threshold sensitivity of the device. Six solid-state detection devices are described briefly, then compared on the basis of the foregoing concepts. Four of these devices are familiar: the point-contact and planar Schottky-barrier ("hot carrier") diodes, and the tunnel and back diodes. Two relatively new devices are also discussed: the so-called "hot carrier" thermoelectric detector, and the space-charge-limited (SCL) dielectric diode.





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A Power Reflection Technique for Characterization of High Quality Varactor Diodes (Dec. 1966 [T-MTT])

G.D. Vendelin and S.A. Robinson. "A Power Reflection Technique for Characterization of High Quality Varactor Diodes (Dec. 1966 [T-MTT])." 1966 Transactions on Microwave Theory and Techniques 14.12 (Dec. 1966 [T-MTT]): 603-608.

High quality varactor diodes are currently characterized by either a "relative impedance" or a "transmission" technique. In view of the present limitations of these methods, a third method, a "reflection" technique, has been proposed. This method requires measuring the power reflected from a diode near its series resonant frequency. The diode is located as the termination of a low impedance coaxial line. The primary virtue of the power reflection technique is the possibility of accurate determination of the diode series resistance. Both the reflection method and the transmission method offer the advantage of microwave characterization near the diode series resonant frequency. The power reflection technique is presently limited to diodes that series resonate below 24 GHz. The accuracy of the technique is limited by possible impedance transformations due to the diode mount and diode package.

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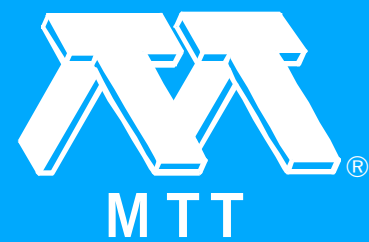
A Positive Resistance Up-Converter for Ultra-Low-Noise Amplification

E. Sard, B. Peyton and S. Okwit. "A Positive Resistance Up-Converter for Ultra-Low-Noise Amplification." 1966 Transactions on Microwave Theory and Techniques 14.12 (Dec. 1966 [T-MTT]): 608-618.

An ultra-low-noise two-channel tunable amplifier system, operating in the 1.5 to 2.5 GHz frequency range, consisting of a cooled positive resistance parametric up-converter followed by a traveling-wave maser (TWM) and down-converter, has been developed. A theoretical analysis of the important operating and design parameters of the up-converter is presented and experimentally verified. Experimental data is given on the operation of the up-converter with the input and output ports reversed (down-converter), and is shown to correlate with the theoretical model. A brief discussion is presented on the TWM, and the spurious signal considerations which govern the choice of maser center frequency (up-converter output frequency). Finally, some preliminary system data is given showing the low noise performance of the overall cascaded amplifier integrated with a 4.2°K closed-cycle refrigerator.

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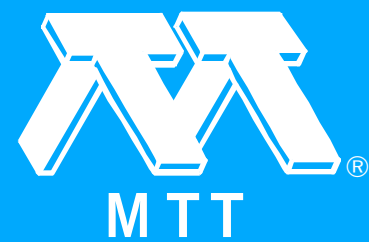
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Improved Intermodulation Rejection in Mixers (Dec. 1966 [T-MTT])

J.H. Lepoff and M. Cowley. "Improved Intermodulation Rejection in Mixers (Dec. 1966 [T-MTT])." 1966 Transactions on Microwave Theory and Techniques 14.12 (Dec. 1966 [T-MTT]): 618-623.

Intermodulation is one of the most pernicious forms of spurious response in superheterodyne receivers. This type of interference cannot be completely eliminated by narrowband filters. Improvements in receiver performance can be made only by improving and making more effective use of the mixing element. Intermodulation results from terms of higher order than two in the v-i power series expansion about the dc operating point of the mixing element. The magnitude of these higher order terms must be reduced in order to improve intermodulation rejection. In the work described in this paper, it has been observed that such a reduction in higher order terms can be obtained by proper design of the mixing element and by a proper choice of dc operating point. More than 80 dB intermodulation rejection was obtained with a single ended hot carrier diode mixer. Best performance is obtained by operating two hot carrier diodes at different operating points in a balanced mixer arrangement. Intermodulation ratios greater than 100 dB have been measured for this operating mode. Optimization of performance for IM rejection has little effect on sensitivity or rejection of other spurious responses. A new mixing element, the space-charge-limited resistor (SCLR), was designed to minimize the higher order terms in the current function. A balanced mixer provided the best performance with these mixing elements also. Intermodulation from +5 dBm inputs can be rejected below the mixer noise level. Early models of this device are not as sensitive as hot carrier mixers, but improvement appears to be possible.





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Accurate Phase-Length Measurements of Large Microwave Networks (Dec. 1966 [T-MTT])

J. Weaver and R. Alvarez. "Accurate Phase-Length Measurements of Large Microwave Networks (Dec. 1966 [T-MTT])." 1966 Transactions on Microwave Theory and Techniques 14.12 (Dec. 1966 [T-MTT]): 623-629.

The stanford two-mile linear accelerator uses 240, single-input-port, four output-port, S-band, rectangular-waveguide networks to feed RF energy sixty to seventy feet from the klystrons above ground to ten-foot-long, disk-leaded, circular-waveguide, accelerator sections below ground. During installation it is necessary to permanently adjust the phase lengths of the four network branches to be within ± 4.5 electrical degrees of the design lengths for RF wave and electron beam synchronization. A modulated reflection phase-length comparison method is used, whereby a small signal is sent into each branch and reflected, in turn, by a diode switch, which is turned on and off at a 1 kHz rate. A null occurs in the amplitude modulation of the sum of a large reference signal and the small reflected signal, when the two signals are nearly in-phase quadrature. The reflectors are placed so that the network branches are properly adjusted when the nulls from all branches occur for the same setting of a variable phase shifter in the measurement line. Small mismatches and multiple power divisions do not affect the accuracy of this method. Frequency, temperature, and air pressure are the main environmental conditions affecting the measurement and are discussed along with the design of the reflecting diode switch, which is mounted in a vacuum-sealed waveguide flange.

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Abstracts

Sampling for Oscilloscopes and other RF Systems: Dc Through X-Band (Dec. 1966 [T-MTT])

W.M. Grove. "Sampling for Oscilloscopes and other RF Systems: Dc Through X-Band (Dec. 1966 [T-MTT])." 1966 Transactions on Microwave Theory and Techniques 14.12 (Dec. 1966 [T-MTT]): 629-635.

Sampling techniques as used in wideband oscilloscopes have, in the past, yielded bandwidths up to 4000 MHz. This approach has now been employed to achieve bandwidths in excess of 15 GHz. The design requirements necessary for this extended bandwidth are presented along with a detailed description of one solution to the design problem. The device is basically a two-diode sampler located at the center of a dielectric filled, biconical cavity containing the RF transmission line. The RF line is perpendicular to the axis of the biconical cavity. The sampling pulse is introduced into the cavity by applying it directly between the centers of the opposite faces of the cavity. This establishes a potential difference between two points on the ground conductor of the RF transmission line being sampled. This technique is basic to the operation of the device and plays a key role in the reduction of sampling loop inductance, which would limit the bandwidth. The equivalent circuits are presented along with the appropriate defining equations. The relationship between bandwidth, input VSWR, and step response overshoot, are presented, along with the typical measured results.



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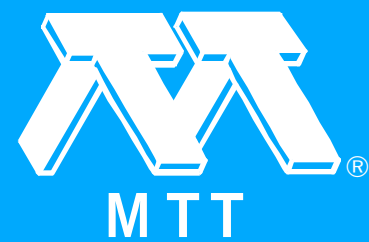
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Theoretical and Practical Applications of Capacitance Matrix Transformations to TEM Network Design (Dec. 1966 [T-MTT])

R.J. Wenzel. "Theoretical and Practical Applications of Capacitance Matrix Transformations to TEM Network Design (Dec. 1966 [T-MTT])." 1966 Transactions on Microwave Theory and Techniques 14.12 (Dec. 1966 [T-MTT]): 635-647.

TEM propagation on an array of parallel conductors is described in terms of the normalized static capacitance matrix. Important properties of capacitance matrices are discussed and a physical and network interpretation is given to a useful linear transformation of the static capacitance matrix. Several practical applications of capacitance matrix transformations are given. These include 1) equivalent circuits for directional couplers with equal terminations, 2) design procedures for directional couplers with unequal terminations, and 3) element value tables and design details for compact coaxial filter-transformers. Construction details and experimental results are presented for a 3:1 bandwidth filter-transformer constructed with multiple re-entrant coaxial lines.

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Abstracts

The Design and Construction of Broadband, High-Directivity, 90-Degree Couplers Using Nonuniform Line Techniques (Dec. 1966 [T-MTT])

C.P. Tresselt. "The Design and Construction of Broadband, High-Directivity, 90-Degree Couplers Using Nonuniform Line Techniques (Dec. 1966 [T-MTT])." 1966 Transactions on Microwave Theory and Techniques 14.12 (Dec. 1966 [T-MTT]): 647-656.

It is possible, at present, to obtain multioctave bandwidth in symmetrical couplers that employ cascaded quarter-wave-length sections of uniformly coupled line. However, the physical junctions between the various sections contribute reactive discontinuities, which significantly degrade coupler directivity. This paper describes a coupler design employing a continuously tapered coupling coefficient that helps to circumvent the directivity problem. Two classes of couplers have been investigated, including one which provides optimum equal-ripple performance. Synthesis has been performed with the aid of both digital and fourier integral computers. Somewhat tighter center coupling is required in the tapered design to produce bandwidth-mean-coupling-level performance comparable to stepped-coupling design. Experimental data is presented on several models constructed in three-layer polyolefin stripline.



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A Light Beam Waveguide Using Hyperbolic-Type Gas Lenses (Dec. 1966 [T-MTT])

Y. Suematsu, K. Iga and S. Ito. "A Light Beam Waveguide Using Hyperbolic-Type Gas Lenses (Dec. 1966 [T-MTT])." 1966 Transactions on Microwave Theory and Techniques 14.12 (Dec. 1966 [T-MTT]): 657-665.

This paper is concerned with the optimum design of a light beam waveguide constructed with a proposed lens-like medium, namely, a hyperbolic-type gas lens which has a hyperbolic temperature distribution on its transverse cross section. In such a medium, the temperature distribution is ideally quadratic in the transverse directions, and so the mode conversion due to the higher order variation of the dielectric constant can be minimized. Moreover, this guide has the following merits; the design procedure is simple, the mode matching at the input part is easy, and it is possible to construct a waveguide using ordinary air as the lens medium. And this consideration can be easily extended to the guide with curved configuration. It was shown that the experimental convergency of this gas lens was in agreement with the theoretical one.



Abstracts

A Switching Circulator: S-Band; Stripline; Remanent; 15 kilowatts; 10 microseconds; Temperature-Stable

F. Betts, D.H. Temme and J.A. Weiss. "A Switching Circulator: S-Band; Stripline; Remanent; 15 kilowatts; 10 microseconds; Temperature-Stable." 1966 Transactions on Microwave Theory and Techniques 14.12 (Dec. 1966 [T-MTT]): 665-669.

A stripline, three-port remanence circulator switch has been designed for high-speed switching of time delay in a phased array radar at S-band (2.9 GHz). Special attention was devoted to minimizing switching time and energy through design of the magnetic circuit and suppression of eddy currents. Temperature stabilization of insertion phase was accomplished by means of a flux regulating magnetic circuit. Switching performance: time: less than 10 micro-seconds; energy: 450 microjoules. Circulator performance: bandwidth for >26 dB isolation, 8.9 percent; insertion loss, 0.35 dB. Temperature stability of insertion phase: one electrical degree per 10°C. Peak RF power: 15 kW. The discussion includes details of the junction design and performance, techniques of eddy current suppression, temperature stabilization, and the method of switching energy measurements.



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A 35-GHz Latching Switch (Dec. 1966 [T-MTT])

W.C. Passaro and J.W. McManus. "A 35-GHz Latching Switch (Dec. 1966 [T-MTT])." 1966 Transactions on Microwave Theory and Techniques 14.12 (Dec. 1966 [T-MTT]): 669-672.

The development of a fast switching, small, lightweight latching three-port ferrite circulator is outlined. Geometrical configurations, as relating to the toroidal ferrite element and their apparent effects on operating characteristics, are presented. Considerations relating to the proper selection of ferromagnetic materials, compatible with latching applications, are discussed. The finalized device operates at 35 GHz with an instantaneous bandwidth of 5 percent. Total weight is less than 0.6 oz, while total volume is less than 0.750 cubic inch. Performance characteristics are presented, showing a maximum insertion loss of 0.50 dB and a minimum isolation of 15.0 dB, while switching times of less than 0.3 μ s have been achieved (under dynamic operating conditions). The unit exhibits highly stable characteristics over the temperature range of -60°C to + 100°C.

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Circularly-Polarized Phase Shifter for Use in Phased Array Antennas (Dec. 1966 [T-MTT])

M.C. Mohr and S. Monaghan. "Circularly-Polarized Phase Shifter for Use in Phased Array Antennas (Dec. 1966 [T-MTT])." 1966 Transactions on Microwave Theory and Techniques 14.12 (Dec. 1966 [T-MTT]): 672-683.

An X-band, circularly-polarized, nonreciprocal, ferrite phase shifter has been developed whose size and electrical performance are favorably suited for use in transmission or reflection-type phased arrays requiring element center-to-center spacings of about 0.5 lambda. The phase shifter has the same configuration as a Faraday rotator with a ferrite rod located at the center of a circular waveguide with an axially applied field. If a circularly polarized wave is passed through this geometry, a nonreciprocal phase-current characteristic is obtained. The array antenna is configured so that no phase-control field reversals are needed between transmit and receive modes of radar operation. The radiating element has been designed as an integral part of the beam steering element using waveguide array simulator techniques, this paper will discuss various design problems and performance of the beam steering element. A 1300-element phased array was constructed and tested. Its performance, as it relates to the phase-setting accuracy of 1300 phase-shifter constituents, is stated briefly.

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Abstracts

A Slow Wave Digital Ferrite Strip Transmission Line Phase Shifter (Dec. 1966 [T-MTT])

R.R. Jones. "A Slow Wave Digital Ferrite Strip Transmission Line Phase Shifter (Dec. 1966 [T-MTT])." 1966 Transactions on Microwave Theory and Techniques 14.12 (Dec. 1966 [T-MTT]): 684-688.

This paper is concerned with the development of a nonreciprocal, digital, slow wave phase shifter which combines submicrosecond switching times with a compact strip transmission line structure. After a qualitative explanation of the operation of the phase shifter is given, an analysis of the dispersion characteristics of the meander line is presented. Impedance matching techniques are discussed along with the experimental results. Various design parameters, which affect the device performance, are examined.



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A Miniaturized C-Band Digital Latching Phase Shifter (Dec. 1966 [T-MTT])

J.K. Parks, B.R. Savage, L.J. Lavedan, Jr. and J. Brown, Jr.. "A Miniaturized C-Band Digital Latching Phase Shifter (Dec. 1966 [T-MTT])." 1966 Transactions on Microwave Theory and Techniques 14.12 (Dec. 1966 [T-MTT]): 688-694.

This paper describes a digital-latching phase shifter which combines the electrical advantages of waveguide design with the compactness of a strip transmission-line structure. Two multibit, nonreciprocal, C-band models are described, which combine the electronic drivers and the microwave structure in an 0.8 by 0.8 inch cross section designed specifically for half-wavelength stacking in an antenna array. A new technique of antisymmetric dielectric loading to convert microwave energy from a TEM mode in stripline transmission to a TE-type mode propagating in a dielectrically loaded rectangular waveguide is presented. Data for a one-bit model are presented along with an investigation into an optimum material choice. Temperature stability and peak power capability are also discussed. The performance of two multibit models are presented, including VSWR, insertion loss, and average power characteristics of the final microwave structures. Temperature variation of phase shift and peak power performance of these devices are also presented. Particular attention is given the electronic drivers for the multibit models which must latch the toroids into their remanent states. The driver circuit is designed to permit switching of each bit between states with a single wire trigger. Finally, the advantages of this design over previous miniaturized models are summarized, and further investigations into other features for greater optimization are suggested.

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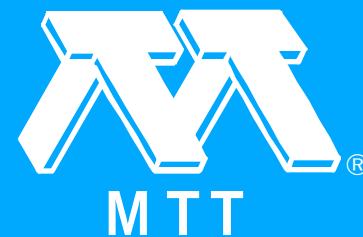


Abstracts

Microwaves at Japanese Universities (Correspondence)

N. Kumagai. "Microwaves at Japanese Universities (Correspondence)." 1966 Transactions on Microwave Theory and Techniques 14.12 (Dec. 1966 [T-MTT]): 694-696.

The present status of the research in the fields of microwaves, millimeter waves, and coherent optical waves at Japanese universities is reviewed. A representative bibliography of over 90 references, which have appeared during the period of the last two years, including the papers to be published shortly, appears at the end of this summary. Among these, some selected topics are described herein briefly. Excluded are most of the works in microwave antennas and propagations, microwave tubes, and the physics of quantum electronics.



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Abstracts

Optimal Design of Matching Networks for Microwave Transistor Amplifiers (Correspondence)

F.E. Emery and M. O'Hagan. "Optimal Design of Matching Networks for Microwave Transistor Amplifiers (Correspondence)." 1966 Transactions on Microwave Theory and Techniques 14.12 (Dec. 1966 [T-MTT]): 696-698.

The design of input and output matching networks for transistor microwave frequency amplifiers has been optimized by the use of an efficient computer program. Power amplifiers capable of 2.5 watt peak power output with a 400 MHz bandwidth at 2.25 GHz have been fabricated.



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Confocal Resonator Band-Pass Filters (Dec. 1966 [T-MTT])

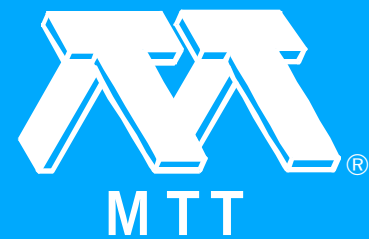
J. Cohen and J. Taub. "Confocal Resonator Band-Pass Filters (Dec. 1966 [T-MTT])." 1966 Transactions on Microwave Theory and Techniques 14.12 (Dec. 1966 [T-MTT]): 698-699.

Direct-coupled confocal resonators are considered for use as band-pass filters at millimeter wavelengths in this correspondence. In previous work on band-pass filters for millimeter wavelengths, two flat reflectors were used to form resonators; these resonators could not produce high unloaded Q values because of the critical tolerances of maintaining parallelism between reflectors. To overcome these difficulties, resonators with curved spherical surfaces have been used at millimeter wavelengths to achieve high Q. Single-resonator Fabry-Perot interferometers and absorption wavemeters were considered (in these references), and the possibility of using them as band-pass filter elements was suggested. One- and two-resonator band-pass filters are described herein together with experimental data. Emphasis is placed on types of coupling structures, reduction of spurious responses, and an extension to filters of arbitrary numbers of resonators.

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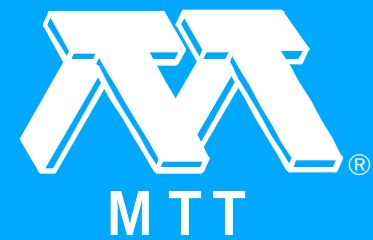
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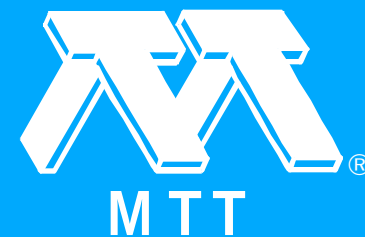
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Index, IEEE Transactions on Microwave Theory and Techniques, Volume MTT-14, 1966

*"Index, IEEE Transactions on Microwave Theory and Techniques, Volume MTT-14, 1966."
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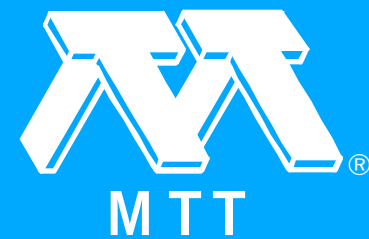
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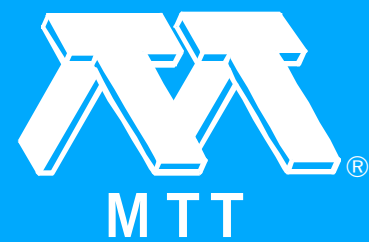


Imaging Property of a Gas Lens

Y. Aoki and M. Suzuki. "Imaging Property of a Gas Lens." 1967 Transactions on Microwave Theory and Techniques 15.1 (Jan. 1967 [T-MTT]): 2-8.

Theoretical and experimental analyses on the imaging properties of gas lenses have been performed. The ray trajectory, ray matrix, lens formula, and optical transfer function of gas lenses are discussed. A gas lens of laminar flow type, using temperature gradients of air, has been made and some experiments on the image formation by the gas lens are conducted. To estimate the lens effect, the line spread functions are measured changing the variables which are concerned with the imaging action of the gas lens. The focal length of the gas lens is obtained from the characteristics of the line spread functions. The space-frequency bandwidth of the gas lens is expressed by the optical transfer functions obtained from the line spread functions and from the images of the Siemensstar. Further, a telescope arrangement has been made using a gas lens for an object lens and a concave mirror for an eye lens. Experiments were performed with this telescope.





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Multiple-Idler Parametric Amplifiers

R.L. Ernst. "Multiple-Idler Parametric Amplifiers." 1967 Transactions on Microwave Theory and Techniques 15.1 (Jan. 1967 [T-MTT]): 9-22.

The input resistance and noise performance of multiple-idler parametric amplifiers are examined in this paper. General expressions applicable to any given amplifier are derived. Simplifications resulting from a sinusoidal elastance variation permit writing an expression for the input resistance of an amplifier having any given number of idlers by inspection. These expressions are then applied to examine the properties of an amplifier having two idlers. The conditions required for minimum noise performance are derived, and it is found that high pump frequencies and external resistive loading of one idler are required. When the two-idler amplifier is compared to a conventional single-idler amplifier under those conditions which permit operation of the same diode at the same signal and pump frequencies, it is found that an improvement in noise figure results. However, the single idler amplifier pumped at the optimum frequency is capable of better noise performance, because minimum noise conditions cannot be satisfied for the two-idler device at this pump frequency. When below-signal-frequency pumping is utilized in the two-idler amplifier, the reduction in required pump power is substantial, but the noise figure is degraded by a minimum of approximately 3 dB.

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Abstracts

A Simple Diode Parametric Amplifier Design for Use at S, C, and X Band

C.S. Aitchison, R. Davies and P.J. Gibson. "A Simple Diode Parametric Amplifier Design for Use at S, C, and X Band." 1967 Transactions on Microwave Theory and Techniques 15.1 (Jan. 1967 [T-MTT]): 22-31.

A simple diode parametric amplifier is described which has been designed for use at S, C, and X band frequencies. Bandwidth and noise measurements show the performance to be substantially in agreement with the theoretical predictions. Details are given of compensating circuits which improve the gain-frequency response of the amplifier by up to 5.6 times.



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Millimeter Wave Diodes for Harmonic Power Generation

L.E. Dickens. "Millimeter Wave Diodes for Harmonic Power Generation." 1967 Transactions on Microwave Theory and Techniques 15.1 (Jan. 1967 [T-MTT]): 32-37.

A discussion of the application of point contact, electrically formed semiconductor junctions to harmonic generating applications is presented. Three different combinations of materials are considered. First, the more popular phosphor-bronze point on gallium arsenide combination is discussed. Results with this material combination when used as millimeter wave multipliers are given as a reference point. The combination n-GaAs/Cu is then examined. The slope parameter of these diodes shows that the junction is very close to that of a Schottky barrier. The conversion efficiency measured for these diodes shows a 2 to 4 dB improvement over the n-GaAs/P-Br diodes. The third combination, and by far the most efficient, was the n-GaAs/Zn diode. These are true p-n junctions (as opposed to Schottky barriers) and have measured zero bias cutoff frequencies on the order of 1000 GHz. The efficiency realized with these diodes in doubling from 70 GHz to 140 GHz typically ranged from 20 percent to 30 percent. The highest output power at 140 GHz that was measured was 16 milliwatts.

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A Nonreciprocal Circular Polarizer

M.L. Reuss, Jr.. "A Nonreciprocal Circular Polarizer." 1967 Transactions on Microwave Theory and Techniques 15.1 (Jan. 1967 [T-MTT]): 37-41.

A nonreciprocal circular polarizer has been developed. This ferrite device converts linear polarization propagating in rectangular waveguide into circular polarization propagating in circular waveguide. The sense, right- or left-hand, of the circular polarization is determined by the direction of a longitudinal magnetic field applied to the ferrite. If one sense of circular polarization, e.g., right-hand, is transmitted, then only left-hand circular polarization can be received. Performance data indicate good ellipticity with reasonable loss and VSWR for two models of the circular polarizer, and for two devices--a circulator and a nonreciprocal antenna element--based on the polarizer. The antenna element permits one antenna to be used both to transmit and to receive the reflected circularly polarized signals from a target.



Abstracts

An Analysis of Broadband Circulators with External Tuning Elements

L.K. Anderson. "An Analysis of Broadband Circulators with External Tuning Elements." 1967 Transactions on Microwave Theory and Techniques 15.1 (Jan. 1967 [T-MTT]): 42-47.

Equations are presented which show how the isolation-bandwidth characteristic of a given Y-circulator junction can be modified by external tuning elements. Results are given for tuning with one, two and, as a limiting case, an infinite number of resonant elements. The results suggest that there is only limited room for improvement in the best of the current state-of-the-art empirically designed circulators.



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Abstracts

The Computation of Coaxial Line Step Capacitances

P.I. Somlo. "The Computation of Coaxial Line Step Capacitances." 1967 Transactions on Microwave Theory and Techniques 15.1 (Jan. 1967 [T-MTT]): 48-53.

Accurate values of coaxial line step capacitances have been computed by the method of 'mode matching' at the plane of the discontinuity in a coaxial line, as described by Whinnery, Jamieson, and Robbins in 1944. The capacitances are given in tables, graphs, and as empirical explicit expressions, suitable for programming in digital computers.



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Abstracts

Microwave Optical Ring Resonators (Correspondence)

G. Schulten. "Microwave Optical Ring Resonators (Correspondence)." 1967 Transactions on Microwave Theory and Techniques 15.1 (Jan. 1967 [T-MTT]): 54-55.

Ring resonators have been investigated theoretically and experimentally in the optical region. The ring is formed by three or four mirrors arranged in a triangle or quadrangle, respectively. Although waveguide-type ring resonators have been known since 1956, little is known about mirror ring resonators in the microwave region.



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Cross Polarization in a General Two Plate Polarizer (Correspondence)

R.W. Breithaupt. "Cross Polarization in a General Two Plate Polarizer (Correspondence)." 1967 Transactions on Microwave Theory and Techniques 15.1 (Jan. 1967 [T-MTT]): 55-57.

A common type of polarizer consists of two quarter-wave plates in a circular TE/sub 11/ mode waveguide. Ideally, the first plate converts linear to circular polarization, and the second rotatable plate converts from circular to linear polarization at an angle $\pi/4$ to this plate. The plates take various forms such as dielectric vanes and disks, or capacitive pins.

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Solid-State Plasma Controlled Nonreciprocal Microwave Device (Correspondence)

H.J. Kuno and W.D. Hershberger. "Solid-State Plasma Controlled Nonreciprocal Microwave Device (Correspondence)." 1967 Transactions on Microwave Theory and Techniques 15.1 (Jan. 1967 [T-MTT]): 57-58.

Various types of nonreciprocal microwave devices have been developed through the use of the tensor permeability of magnetic materials such as ferrites. In a solid-state plasma such as a semiconductor, the conductivity becomes a tensor quantity under a de magnetic field. Toda developed an isolator using a solid-state plasma under a transverse magnetic field and obtained the isolation ratio of about 10 dB. Recently, we have reported the result of the experimental observation o fthe microwave Faraday effect in a solid state plasma waveguide under a longitudinal magnetic field. It was found that a large amount of rotation of the plane of polarizaton with very small attenuation of power can be obtained in a solid-state plasma under a relatively high magnetic field. In this paper, an experimental nonreciprocal microwave device which makes use of the Faraday rotation in a solid-state plasma is presented.

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Further Generalization of Waveguide Theorems (Correspondence)

P. Chorney, A. Bers and P. Penfield. "Further Generalization of Waveguide Theorems (Correspondence)." 1967 Transactions on Microwave Theory and Techniques 15.1 (Jan. 1967 [T-MTT]): 58-59.

In a recent paper by Laxpati and Mittra, the bidirectional waveguide theorems were extended to both periodic and open waveguide structures. In the original derivation of the theorems an artifice was employed in which Poynting's theorem was applied to a standing complex wave setup in the general bidirectional waveguide by a shorting plane. The point was well taken in the recent paper that a short-circuit termination is not necessary and that the same results may be derived in just as straightforward a manner by considering a termination of arbitrary, non-zero reflection coefficient which also sets up a complex standing wave. The important features of the power and pseudo-energy relations result from the cross terms arising in the complex standing wave and are lost if only a traveling-wave without a reflection is operated on by Poynting's theorem.

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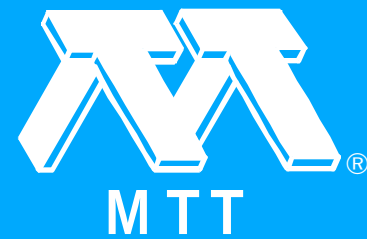


Abstracts

Plotting the Electromagnetic Field by Power Dissipation (Correspondence)

*C.M. Ottavi. "Plotting the Electromagnetic Field by Power Dissipation (Correspondence)."
1967 Transactions on Microwave Theory and Techniques 15.1 (Jan. 1967 [T-MTT]): 59-60.*

Useful information on the electromagnetic field traveling inside a waveguide can be obtained by detecting, with temperature sensitive paints, the dissipated power on diaphragms placed transversely to the guide axis.



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A Note on "Submillimeter Wave Harmonic Mixing" (Correspondence)

G. Schulten, J.P. Stoll, R.G. Strauch, R.A. Miesch and R.E. Cupp. "A Note on "Submillimeter Wave Harmonic Mixing" (Correspondence)." 1967 Transactions on Microwave Theory and Techniques 15.1 (Jan. 1967 [T-MTT]): 60-60.

In their recent correspondence, Strauch et al., described two ways to prove the generation of harmonics by a crystal harmonic generator. In their experiments they used two millimeter-wave klystrons, one of them was swept with A}, the other acted as local oscillator operated in CW. The two outputs were mixed at the diode of a crossed-waveguide device. There, a fundamental or a harmonic mixing, respectively, took place. The difference frequency signals produced in this way were amplified in a 30 MHz IF amplifier. The detected video output was displayed on an oscilloscope. They observed upper and lower sidebands. The distances between these were 60, 30, 20, 150 · · · MHz, in general 60 MHz/n. Now they stated that all these beats were produced by harmonics, moreover they claimed to have observed more than 20 harmonics from a 72.9 GHz klystron. We have strong objections to these statements. This also holds for the papers of Murai, who claimed to have observed harmonics of the order of 14 in a similar experiment.



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Abstracts

Propagation in Cylindrical Waveguide Containing Inhomegenous Dielectric (Correspondence)

E. AhSam and Y. Klinger. "Propagation in Cylindrical Waveguide Containing Inhomegenous Dielectric (Correspondence)." 1967 Transactions on Microwave Theory and Techniques 15.1 (Jan. 1967 [T-MTT]): 60-61.

Considerable attention is being paid to the problem of propagation of electromagnetic waves in inhomogeneous media. Little appears to have been published in systems with cylindrical symmetry. Typical of a numerical approach is the paper by Clarricoats and Oliner where an equivalent circuit is used to represent the inhomogeneous waveguide. On the other hand, Yamada and Watanabe have solved analytically a special case where the dielectric constant is a parabolic function of the radius. The solution obtained was restricted to circularly symmetrical modes, and was exact for TE modes only.



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Dielectric Constant of Atlas at 9363 MHz (Correspondence)

R. Das. "Dielectric Constant of Atlas at 9363 MHz (Correspondence)." 1967 Transactions on Microwave Theory and Techniques 15.1 (Jan. 1967 [T-MTT]): 61-62.

Monoarsenate double d'ammonium de thallium (Atlas), $(\text{NH}_4)_4\text{Tl}_3(\text{H}_2\text{AsO}_4)_7$, has been reported to be ferroelectric. The complex dielectric constant of Atlas has been measured by LeDonche. These measurements made at 50 Hz displayed ferroelectric hysteresis loops in the temperature range between 150°K and 110°K with maximum dielectric constant occurring at 150°K. At room temperature Atlas is hexagonal. The present correspondence reports measurements of the temperature dependence of the dielectric constant at 9363 MHz at right angles to the "c" axis of the crystal, i.e., along the length of the crystal.

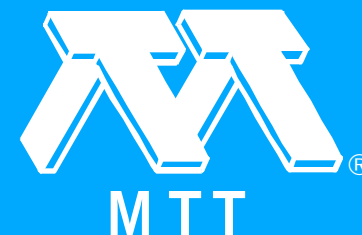
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Abstracts

Contributors (Jan. 1967 [T-MTT])

C.S. Aitchison, L.K. Anderson, Y. Aoki, R. Davies, L.E. Dickens, R.L. Ernst, P.J. Gibson, M.L. Reuss, Jr., P.I. Somlo and M. Suzuki. "Contributors (Jan. 1967 [T-MTT])." 1967 Transactions on Microwave Theory and Techniques 15.1 (Jan. 1967 [T-MTT]): 63-64.



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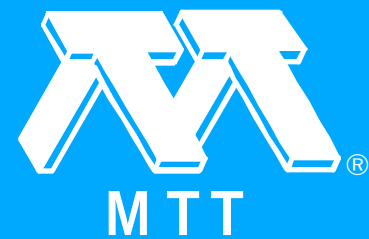


Guided Beam Waves Between Parallel Concave Reflectors

T. Nakahara and N. Kurauchi. "Guided Beam Waves Between Parallel Concave Reflectors." 1967 Transactions on Microwave Theory and Techniques 15.2 (Feb. 1967 [T-MTT]): 66-71.

A new guided beam wave transmission system is proposed here, which is composed of two parallel concave reflectors. The principle is a combination of waveguide and beam wave transmission. The shape of the reflector cross section and the corresponding mode functions were obtained. Attenuation due to wall current and limited aperture of the reflectors were calculated. Experiments were made to confirm the modes and the attenuation. One of the remarkable features of this transmission system is its field distribution, which is concentrated into a belt-shaped space between reflectors. Considering this feature, this system seems to be effectively applied to the railways as a medium for obstacle detection and communication.





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A 500-to-1000 MHz Magnetically Tunable Bandpass Filter Using Two YIG-Disk Resonators

L. Young and D.B. Weller. "A 500-to-1000 MHz Magnetically Tunable Bandpass Filter Using Two YIG-Disk Resonators." 1967 Transactions on Microwave Theory and Techniques 15.2 (Feb. 1967 [T-MTT]): 72-86.

A magnetically tunable UHF bandpass filter designed in strip transmission line and with two disk-shaped resonators of yttrium-iron-garnet (YIG) is described. Single crystals of both pure YIG and gallium-substituted YIG were used. The properties of the disk resonators were first investigated by testing them in a bandstop filter configuration. Linewidths were measured as a function of both frequency and temperature over the band 500 to 1000 MHz and sometimes beyond. The effect of metal boundaries near the ferrimagnetic resonator on its linewidth and resonant magnetic field was determined. Magnetostatic modes were examined. Methods for adjusting the resonant frequency of a disk are discussed. A description is given of the filter coupling structure, which includes two 50-to-5-ohm transformers in strip line. The experimental tuning procedure is outlined. Tests of the filter with gallium-YIG disks revealed a midband insertion loss of less than 3.3 dB from 500 to 1200 MHz and less than 2 dB from 600 to 1100 MHz; the filter with pure YIG disks had a midband insertion loss of less than 3.2 dB from 450 to 1100 MHz and had fewer spurious responses than the gallium-YIG filter. Response curves, limiting characteristics, and other experimental results are also presented.

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Nonreciprocal Remanence Phase Shifters in Rectangular Waveguide

W.J. Ince and E. Stern. "Nonreciprocal Remanence Phase Shifters in Rectangular Waveguide." 1967 Transactions on Microwave Theory and Techniques 15.2 (Feb. 1967 [T-MTT]): 87-95.

Three types of nonreciprocal remanent phase shifters in rectangular waveguide are described which are approximated by a simple model consisting of twin ferrite slabs symmetrically placed in rectangular waveguide and separated by a dielectric rib. The model has been analyzed with the assumption that a fundamental TE mode wave propagates in the structure. Simultaneous solution of Maxwell's equations in the three regions of dielectric, ferrite, and air within the waveguide enables the characteristic equation to be formed. The characteristics of the model have been obtained with the aid of a computer as a function of dimensions, dielectric and magnetic constants, frequency, and power. The theoretical results are compared with experimental data obtained on a double toroid structure. Correction factors applied to the experimental data, which are necessary to account for differences between the practical structure and the ideal model, are discussed.

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A Two-Port Magnetoelastic Delay Line in the UHF Region

W. Skudera, Jr., R.H. Sproat, I. Bady and E. Gikow. "A Two-Port Magnetoelastic Delay Line in the UHF Region." 1967 Transactions on Microwave Theory and Techniques 15.2 (Feb. 1967 [T-MTT]): 96-100.

Results are presented on the investigation of an experimental two-port magnetoelastic delay line using a single crystal rod of yttrium-iron-garnet, over the frequency range of 200 to 1000 MHz. A magnetic bias field is applied parallel to the rod axis. Data is given on delay time and insertion loss as a function of bias field. Both a slow and fast variation of insertion loss with bias field are noted. The slow variation of insertion loss is quite flat and insertion loss is at a minimum, over the range of 900 to 1050 oersteds, for all frequencies from 200 to 1000 MHz. A study of the fast variation of insertion loss shows that this variation occurs only over a portion of the pulse and if the pulse is short enough the fast variation is absent. A study of the effects of small permanent magnets that supply a biasing field orothogonal to the primary biasing field is presented. Insertion loss and pulse distortion are substantially reduced by these magnets.

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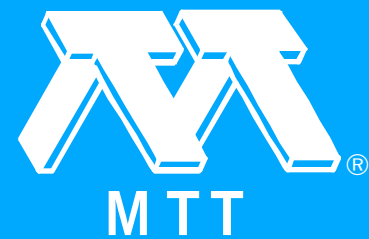


Spreading Resistance as a Function of Frequency

L.E. Dickens. "Spreading Resistance as a Function of Frequency." 1967 Transactions on Microwave Theory and Techniques 15.2 (Feb. 1967 [T-MTT]): 101-109.

The equivalent circuit applicable to most semiconductor diodes contains a term R_{ss} called the spreading resistance which is a very critical parameter of any diode. In a mixer diode, R_{ss} limits the conversion efficiency and increases the noise temperature. In parametric amplifiers, R_{ss} affects the overall impedance levels and determines the minimum noise figure of which the amplifier is capable. In harmonic generators it drastically affects the conversion efficiency, as it dissipates power not only at the input and output harmonic frequencies but also at every idler frequency for which current may flow through the diode. This paper details more specifically the problems encountered when high frequency operation must be evaluated. The cylindrical capacitor is examined with emphasis on the configuration which applies to the variable-capacitor diode, which is used primarily for harmonic power generation. The point-contact diode configuration is examined and the field equations are derived in terms of the oblate spheroidal coordinates. It is shown that this is the natural coordinate system for such an analysis and that the spreading resistance is quite easily derived in this system.





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An Exact Calculation for a T-Junction of Rectangular Waveguides Having Arbitrary Cross Sections

E.D. Sharp. "An Exact Calculation for a T-Junction of Rectangular Waveguides Having Arbitrary Cross Sections." 1967 Transactions on Microwave Theory and Techniques 15.2 (Feb. 1967 [T-MTT]): 109-116.

An exact method is developed for the calculation of the electrical performance of the rectangular waveguide T-junction. This method is used to find the equivalent circuit of a rectangular waveguide T-junction in which both cross-sectional dimensions of the side waveguide are different from the cross-sectional dimensions of the through waveguide. The theoretical calculations for a particular T-junction of this type are verified by experimental measurements. In this method the electrical performance is analyzed by using equivalent-circuit concepts applied to waveguide modes to calculate an admittance matrix relating propagating and cutoff waveguide modes to each other. Then the cutoff modes are terminated in their characteristic impedance, and an equivalent admittance matrix of the junction is found relating only the propagating modes in each waveguide to each other. The analysis is valid when any number of modes can propagate in the waveguides forming the junction. The inversion of an infinite matrix is required; however, any desired accuracy can be obtained by considering a matrix of finite but sufficient size or equivalently by considering a sufficient number of cutoff modes.

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The Microwave Properties of Adhesively Bonded Aluminum Foil Seams (Correspondence)

W. Rueggeberg. "The Microwave Properties of Adhesively Bonded Aluminum Foil Seams (Correspondence)." 1967 Transactions on Microwave Theory and Techniques 15.2 (Feb. 1967 [T-MTT]): 117-118.

Various interests prompted the electrical evaluation of adhesively bonded aluminum foil seams at microwave frequencies. Since epoxy resin adhesives are virtually free of volatile constituents, they are ideally suited to this application because of the vapor proof metallic boundaries containing the adhesive film. A general purpose aluminum foil of one film thickness was used for all tests, whereas the two epoxy adhesives consisted of a conventional formulation and a silver particle filled modification.

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Large Signal Effects in Parametric Amplifiers (Correspondence)

H.E. Brenner. "Large Signal Effects in Parametric Amplifiers (Correspondence)." 1967 Transactions on Microwave Theory and Techniques 15.2 (Feb. 1967 [T-MTT]): 118-119.

It is well known that a change in pump power level usually causes a severe slope in the gain versus frequency characteristics of a parametric amplifier. A gain peak moves toward the higher end of the signal frequency band when the pump power level is increased. This is due to the increase in average capacitance of the diode with increasing the pump power level, causing a decrease in the resonant frequency of the idler circuit. To minimize this gain slope, sometimes a self bias is super-imposed onto the fixed bias of the diode to cancel the change in average capacitance. This technique is successful in minimizing the effect of pump power variation on the gain slope. However, under large signal conditions (output power > -12 dBm), the average capacitance of the diode is also changed by the input signal level. Since the rectified diode current due to the large signal is much larger than that due to the pump for the same change in average capacitance, an optimum compensation bias resistance for pump power variation is too large for signal power variation. This results in an overcompensation and causes a large opposite gain slope.





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Symmetry in a High Power Circulator for 35 GHz (Correspondence)

A.P. Darwent. "Symmetry in a High Power Circulator for 35 GHz (Correspondence)." 1967 Transactions on Microwave Theory and Techniques 15.2 (Feb. 1967 [T-MTT]): 120-120.

A ferrite loaded junction circulates at many values of frequency and applied magnetic field, sometimes giving circulation over a useful bandwidth. In the empirical design of a circulator, the various combinations of field and frequency must be found and modified to give circulation at the required frequency. An E-plane junction with a ferrite disk on each narrow wall was selected for high power operation. (Figure 1 shows the final circulator with a permanent magnet.) The best conditions for circulation were found, but results from the three-ports differed substantially with the circulation bands for the three-ports in some cases not overlapping. This asymmetry was independent of mechanical tolerances in waveguide manufacture and cleanliness of ferrite. It was presumably due to differential scatter caused by inhomogeneity of the ferrite material of the linear effects of surface grinding. As it was easier to investigate surface finish effects, three forms of improved finish were devised and tested.

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Abstracts

The Directional Coupler--1966 (Correspondence)

W.E. Caswell and R.F. Schwartz. "The Directional Coupler--1966 (Correspondence)." 1967 Transactions on Microwave Theory and Techniques 15.2 (Feb. 1967 [T-MTT]): 120-123.

The directional coupler is a well-known device used as an attenuator, power splitter, hybrid junction, local oscillator injection device, and, most commonly, a sampling device for measuring separately the forward and backward waves on a transmission line. Over a period of twenty-five years many papers have appeared dealing with analysis, design, and application of the device.



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Reflections from Rotary-Vane Precision Attenuators (Correspondence)

J.D. Holm, D.L. Johnson and K.S. Champlin. "Reflections from Rotary-Vane Precision Attenuators (Correspondence)." 1967 Transactions on Microwave Theory and Techniques 15.2 (Feb. 1967 [T-MTT]): 123-124.

Due to finite thickness of the absorbing vanes, the scattering coefficients S_{11} and S_{22} of a rotary-vane attenuator are not zero (as would be true of an "ideal" device) but are, in fact, functions of attenuator setting. Thus, terminal reflections cannot be eliminated by simply fixed-tuning the ports. In this correspondence we derive an equation relating S_{11} (S_{22}) to the attenuator setting by considering the effects of small reflections from vanes of an otherwise perfect attenuator. The result is found to contain three complex constants that can be determined experimentally, with this expression one can, when necessary, take reflections into account analytically by determining the constants appropriate to the attenuator under consideration. This procedure is useful, e.g., when using a combination of an attenuator and a movable short-circuit as a variable impedance standard; or, when determining "mismatch error" in a transmission system in which the generator or load are not matched to the line.

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Temperature Dependence of Composite Coaxial Resonators (Correspondence)

L.C. Gunderson. "Temperature Dependence of Composite Coaxial Resonators (Correspondence)." 1967 Transactions on Microwave Theory and Techniques 15.2 (Feb. 1967 [T-MTT]): 124-127.

Under certain circumstances, it is necessary to construct a composite coaxial resonator using inner and outer conductors having different thermal expansion coefficients. This may be required for mechanical reasons or as a means of adjusting the resonator temperature stability. This correspondence describes an analysis of such a resonator as well as some experimental results.

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Isolation of Lossy Transmission Line Hybrid Circuits (Correspondence)

R.M. Kurzrok. "Isolation of Lossy Transmission Line Hybrid Circuits (Correspondence)." 1967 Transactions on Microwave Theory and Techniques 15.2 (Feb. 1967 [T-MTT]): 127-128.

With the advent of integrated microwave circuit techniques, use of lossy transmission lines to achieve miniaturization can seriously affect circuit performance. A frequently used performance characteristic of hybrid circuits is the isolation between conjugate ports. Such isolation is normally limited to maximum values of 40 dB to 50 dB due to incidental mismatch of terminations and capabilities of test equipment. When lossy transmission lines are employed to realize the hybrid circuits, an additional constraint is placed upon the peak isolation that can be achieved. In this correspondence, the theoretical isolations of lossy hybrids will be determined at their design center frequencies. Two different hybrid circuits will be considered: the square hybrid and the "rat race" hybrid ring. The preferred method of analysis of symmetrical four-port networks will be used herein.

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A Stepped Mode Transducer Using Homogeneous Waveguides (Correspondence)

D.A. Bathker. "A Stepped Mode Transducer Using Homogeneous Waveguides (Correspondence)." 1967 Transactions on Microwave Theory and Techniques 15.2 (Feb. 1967 [T-MTT]): 128-130.

A rectangular to cylindrical waveguide transducer is described which couples the dominant rectangular (TE_{10}) and dominant cylindrical (TE_{11}) modes. The maximum age reflection coefficient remains less than 0.025 over the design bandwidth. Symmetry considerations substantiated by moding tests show the transducer to be higher-order mode free. Previous work is reviewed, the design method discussed, and experimental data shown.

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Abstracts

An Approximate Formula for Calculating Z_0 of a Symmetric Strip Line (Correspondence)

J.K. Richardson. "An Approximate Formula for Calculating Z_0 of a Symmetric Strip Line (Correspondence)." 1967 Transactions on Microwave Theory and Techniques 15.2 (Feb. 1967 [T-MTT]): 130-131.

The equations available to determine the characteristic impedance of a symmetric strip line (Fig. 1) to high accuracy are difficult to utilize without a computer. Other less accurate equations which are easier to apply have been developed, and the one most frequently quoted has been given by Cohn.



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Abstracts

An Improved Method for Measuring Scattering Parameters of Nonreciprocal Two-Ports (Correspondence)

G.R. Hoffman and A.A. Willem. "An Improved Method for Measuring Scattering Parameters of Nonreciprocal Two-Ports (Correspondence)." 1967 Transactions on Microwave Theory and Techniques 15.2 (Feb. 1967 [T-MTT]): 131-133.

Usual methods for measuring the characteristic parameters of reciprocal structures fail when applied to nonreciprocal structures.



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A Technique for Measuring Individual Modes Propagating in Overmoded Waveguide (Comments)

R.E. Puttre, D.S. Levinson and I. Rubinstein. "A Technique for Measuring Individual Modes Propagating in Overmoded Waveguide (Comments)." 1967 Transactions on Microwave Theory and Techniques 15.2 (Feb. 1967 [T-MTT]): 133-134.

In a recent paper, Levinson and Rubinstein presented a technique for measuring individual modes propagating in overmoded waveguide. Although the measurement technique described therein is practical and effective, one of the conclusions drawn from the results appears to be misleading. The measurement consists of sampling the voltage amplitude and relative phase of a propagating multimode 7 GHz signal by means of a series of probes located about the walls of a section of WR 650 waveguide. From this voltage data and the appropriate calculations, the relative power propagating in each mode through the WR 650 waveguide is determined. One advantage of measuring in oversized waveguide is that the modes of interest are far from cutoff for the tests performed at 7 GHz. According to Taub a maximum error of only six percent can occur in the calculations of relative power if, for simplicity, free-space impedance is assumed instead of the individual wave impedance for each mode.



Constructive Coupling in Directional Couplers (Correspondence)

J.W. Gewartowski and C.B. Swan. "Constructive Coupling in Directional Couplers (Correspondence)." 1967 Transactions on Microwave Theory and Techniques 15.2 (Feb. 1967 [T-MTT]): 134-134.

During the course of some diagnostic studies of varactor harmonic generators, we discovered a surprising result using the experimental setup shown in Fig. 1. A signal source is connected through an isolator to port 1 of a 10-dB directional coupler, with the output load connected to port 4 through a slide-screw tuner. Port 2 is internally terminated, and port 3 has connected to it a slide-screw tuner and termination.



Abstracts

Precision Design of Direct Coupled Filters (Correspondence)

J. Reed. "Precision Design of Direct Coupled Filters (Correspondence)." 1967 Transactions on Microwave Theory and Techniques 15.2 (Feb. 1967 [T-MTT]): 134-136.

The direct coupled filter to be discussed in this correspondence consists of a length of transmission line with reflecting obstacles spaced at approximately half wavelength intervals. High-power capabilities can be achieved because the filter can be made without changing the size of the transmission line and, as will be described, without any special tuning devices. The following analysis is applicable for waveguides with inductive obstacles and also to coaxial lines with inductive posts. By duality it is also valid for coaxial or strip line with capacitive gaps.



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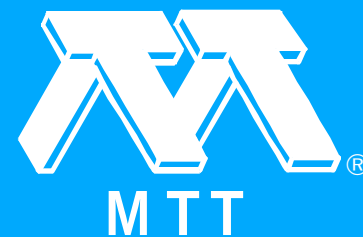


Abstracts

Comments on 'Excitation of Spin Waves by Wire Arrays' (Correction)

R. LaRosa and C.F. Vasile. "Comments on 'Excitation of Spin Waves by Wire Arrays' (Correction)." 1967 Transactions on Microwave Theory and Techniques 15.2 (Feb. 1967 [T-MTT]): 136-136.

In the year since the original comment was written, we have been working on related problems. In October 1966, we discovered an error in the boundary value solution for the case of wires embedded in YIG with dc field perpendicular to the array. In this case the solution is mainly medium-k rather than low-k. We believe our other statements are valid.



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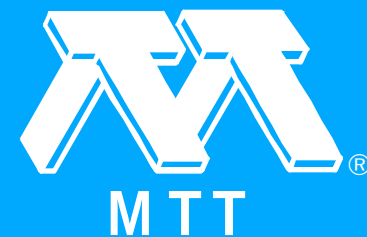
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Contributors (Feb. 1967 [T-MTT])

I. Bady, L.E. Dickens, E. Gikow, W.J. Ince, N. Kurauchi, T. Nakahara, E.D. Sharp, W.J. Skudera, Jr., R.H. Sproat, E. Stern, D.B. Weller and L. Young. "Contributors (Feb. 1967 [T-MTT])." 1967 Transactions on Microwave Theory and Techniques 15.2 (Feb. 1967 [T-MTT]): 137-138.



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Membership Application (Feb. 1967 [T-MTT])

"Membership Application (Feb. 1967 [T-MTT])." 1967 Transactions on Microwave Theory and Techniques 15.2 (Feb. 1967 [T-MTT]): 139-139.



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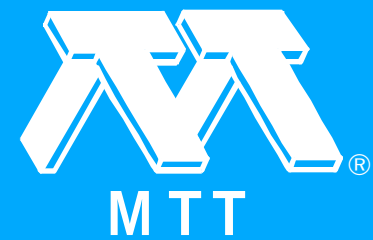
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Information for Authors (Feb. 1967 [T-MTT])

"Information for Authors (Feb. 1967 [T-MTT])." 1967 Transactions on Microwave Theory and Techniques 15.2 (Feb. 1967 [T-MTT]): 140-140.



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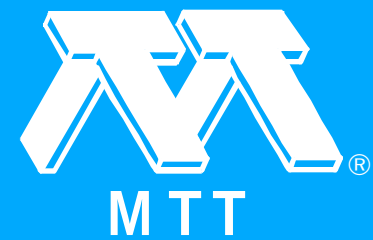
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Table of Contents (Mar. 1967 [T-MTT])

"Table of Contents (Mar. 1967 [T-MTT])." 1967 Transactions on Microwave Theory and Techniques 15.3 (Mar. 1967 [T-MTT]): 141-141.



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Analysis and Intrinsic Properties of the General Nonuniform Transmission Line

E.N. Protonotarios and O. Wing. "Analysis and Intrinsic Properties of the General Nonuniform Transmission Line." 1967 Transactions on Microwave Theory and Techniques 15.3 (Mar. 1967 [T-MTT]): 142-150.

A new formulation for the analysis of the general nonuniform transmission line is presented. A characterization of the line in terms of its ABCD parameters is given. Explicit formulas for these parameters are obtained from which any network function can be calculated to any degree of accuracy. The new formulation leads to a description of the line in terms of a Sturm-Liouville equation from which all of the natural frequencies of the line can be found and their distribution bounds and asymptotic behavior specified. The ABCD parameters are shown to be entire functions of order 1 and genus 1.

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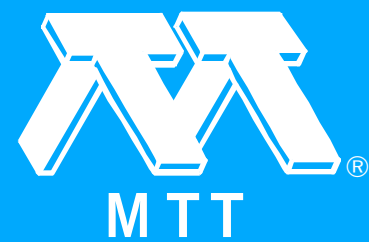
Higher-Order Cylindrical Surface-Wave Modes

J.Y. Savard. "Higher-Order Cylindrical Surface-Wave Modes." 1967 Transactions on Microwave Theory and Techniques 15.3 (Mar. 1967 [T-MTT]): 151-155.

A general theory of the propagation of higher-order modes on cylindrical surface-wave structures is examined and applied to the dielectric-clad rod. A theory is developed in which the boundary conditions at the guide are specified by an impedance dyadic. The characteristic equation for the structure is then obtained in terms of the elements of the dyadic. The equation is solved and yields a set of conditions which are satisfied by the values of the dyadic elements at the cutoff points for each of the higher-order modes. A mode without a cutoff frequency is shown to exist on the structure used. The relationship between the guide wavelength and frequency has been verified experimentally.

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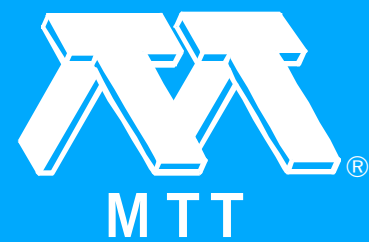
A Complete Solution of the Inductive Iris with TE/sub k₀/ Incidence in Rectangular Waveguide

J.C. Palais. "A Complete Solution of the Inductive Iris with TE/sub k₀/ Incidence in Rectangular Waveguide." 1967 Transactions on Microwave Theory and Techniques 15.3 (Mar. 1967 [T-MTT]): 156-160.

A TE/sub k₀/ wave incident on an inductive metal iris in a rectangular waveguide excites a reflected and a transmitted wave in the TE/sub k₀/ mode. The reflection and transmission coefficients describing these waves are computed. In addition to the incident mode, a number of other modes are excited by the discontinuity. The amount of coupling to these other modes, given by coupling coefficients, is determined using the variational technique. The method developed makes it possible to find the coupling to any desired mode without first finding the coupling to any other mode or group of modes. The analysis shows under what conditions certain modes can be suppressed or eliminated. The method should be applicable to other problems of interest where modes other than the incident one are excited. Since the reflection, transmission, and coupling coefficients are known, the total field at any point in the waveguide can be computed. As an example, the total field at the discontinuity when the TE/sub 10/ mode is incident is calculated. The result closely resembles the expected result (of zero electric field over the metal iris).

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An Explicit Derivation of the Relationships Between the Parameters of an Interdigital Structure and the Equivalent Transmission-Line Cascade

H.J. Riblet. "An Explicit Derivation of the Relationships Between the Parameters of an Interdigital Structure and the Equivalent Transmission-Line Cascade." 1967 Transactions on Microwave Theory and Techniques 15.3 (Mar. 1967 [T-MTT]): 161-166.

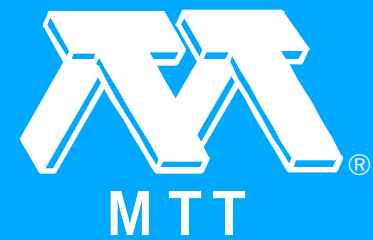
The general n th-order admittance matrix for an array of parallel conductors placed between ground planes is exhibited, subject to the assumption that direct coupling exists only between adjacent conductors and that only a TEM wave is present whenever all the conductors but one are grounded. When the alternate terminals of one of these arrays are connected to ground, as in an interdigital bandpass filter, the admittance matrix yields a subsystem of equations which, except for sign, is identical in form with the node equations of suitably selected transmission-line cascade. The identification of the coefficients in these similar systems of equations explicitly determines the coefficients of the admittance matrix in terms of the parameters of the prototype transmission-line cascade. In turn, the capacities to ground and the mutual capacities, each per unit length, for the array of parallel conductors can be determined from the coefficients of its admittance matrix by imposing the pertinent voltage conditions on the admittance equations. Thus, one arrives, explicitly, at the general formulas used in the design of interdigital filters which relate the capacities per unit length of the parallel conductors to the parameters of the prototype transmission-line cascade. It is shown that, if the first element of the interdigital structure is open-circuited, the transmission-line cascade begins with a series, open-circuited quarter-wave stub while, if the first element of the interdigital structure is short-circuited, the first element of the cascade is a shunt, short-circuited quarter-wave stub. Extensions of the method to equivalences with other prototype networks are suggested. In the Appendix, closed expressions for the self and mutual admittances of the parallel conductor array are given in terms of the self impedances and coupling coefficients of the n th-order impedance matrix proposed by Bolljahn and Matthaei for this structure, subject to the assumption of no coupling between nonadjacent conductors.

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These are shown to be consistent with the requirement that the admittance matrix be the reciprocal of the impedance matrix.



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Probability of Ray Position in Beam Waveguides

D. Marcuse. "Probability of Ray Position in Beam Waveguides." 1967 Transactions on Microwave Theory and Techniques 15.3 (Mar. 1967 [T-MTT]): 167-171.

For the case of infinitely large apertures the following probability distributions are derived in this paper: the probability of finding a ray at the n th lens at a distance r from the axis, the probability of finding a ray with an amplitude A at lens n , the cumulative probability of finding a ray with a displacement less than r and the cumulative probability of finding a ray with an amplitude less than A . The case of lenses with finite apertures was explored with the help of computer simulated experiments whose results are given. These experiments show that the probability distributions for the ray amplitudes which were derived for infinite apertures are still useful even in the case of lenses with finite apertures as long as the probability of losing the ray is less than 20 percent.



Abstracts

The DIGILATOR, a New Broadband Microwave Frequency Translator

G. Klein and L. Dubrowsky. "The DIGILATOR, a New Broadband Microwave Frequency Translator." 1967 Transactions on Microwave Theory and Techniques 15.3 (Mar. 1967 [T-MTT]): 172-179.

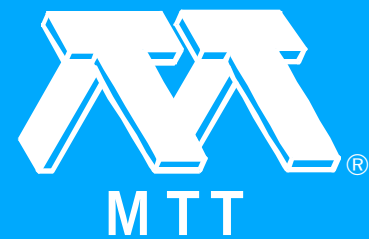
Frequency translation of an RF wave can be accomplished by subjecting it to a constant rate of phase shift or by applying an ideal repetitive sawtooth phase function which snaps to zero at 360 degrees (serrodyne modulation). The DIGILATOR is a new type of frequency translator which employs a multibit latching ferrite phase shifter with a suitable digital switching driver to obtain a multiple-step approximation to the serrodyne phase function. This paper reviews the theory of an N-step DIGILATOR and describes the design of a 16-step, X-band device. Experiments showed that performance is independent of microwave frequency over the design frequency band of the phase shifter. The carrier and close-in sidebands were suppressed by 39 dB and predicted far-out sidebands were within 1 dB of theoretical amplitudes.



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Oversize Bolometer Unit for Short Millimeter Wave Region (Correspondence)

H. Kashiwagi. "Oversize Bolometer Unit for Short Millimeter Wave Region (Correspondence)." 1967 Transactions on Microwave Theory and Techniques 15.3 (Mar. 1967 [T-MTT]): 180-180.

A bolometer unit has been developed with broad VSWR (less than 1.3) for frequencies to 100 GHz. This unit uses no matching elements, is easy to construct, and is highly efficient (90 percent).

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Abstracts

The Harmonics Produced by a PIN Diode in a Microwave Switching Application (Correspondence)

H. Mott and D.N. McQuiddy, Jr.. "The Harmonics Produced by a PIN Diode in a Microwave Switching Application (Correspondence)." 1967 Transactions on Microwave Theory and Techniques 15.3 (Mar. 1967 [T-MTT]): 180-181.

The advantages of using semiconductor diodes to control power flow in microwave transmission lines, in such applications as phase shifting and array beam selecting, are well known. Less well known, however, is the extent to which the nonlinear characteristics of these devices cause the generation of harmonic signals.



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Abstracts

Phase Shifter C-, X-, and Ku-Bands Using Segregated-Mode Resonance in Single Crystal YIG (Correspondence)

M.E. Hines and K.K. Chow. "Phase Shifter C-, X-, and Ku-Bands Using Segregated-Mode Resonance in Single Crystal YIG (Correspondence)." 1967 Transactions on Microwave Theory and Techniques 15.3 (Mar. 1967 [T-MTT]): 181-183.

Single crystal YIG has long been regarded as an ideal material for ferromagnetic resonance type devices. However, the performance of all such devices is far from ideal due to excitation of spin-waves at moderate power levels. The excitation of these spurious responses limits the device's power handling capability, as well as degrades its performance, such as insertion loss, noise figure, etc. In order to extend the usefulness of this material, it is necessary, either to suppress all spin-waves, or to segregate one resonant mode out of the manifold.



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A Large Signal Analysis Leading to Intermodulation Distortion Prediction in Abrupt Junction Varactor Upconverters (Comments)

A.I. Grayzel, S.M. Perlow and B.S. Perlman. "A Large Signal Analysis Leading to Intermodulation Distortion Prediction in Abrupt Junction Varactor Upconverters (Comments)." 1967 Transactions on Microwave Theory and Techniques 15.3 (Mar. 1967 [T-MTT]): 183-184.

In the above paper by Perlow and Perlman, the authors use steps that are not mathematically correct and which lead to incorrect results. The authors write the matrix equations for the three-frequency upconverter relating the Fourier coefficients $i_{\text{sub } 1/}$, $i_{\text{sub } 2/}$, and $i_{\text{sub } 3/}$ to the Fourier coefficients of the pump and signal voltages. They then derive an expression for the gain $G_{\text{sub } i/}$ as a function of $i_{\text{sub } 1/}$ the Fourier coefficient of the signal current. After expanding $G_{\text{sub } i/}$ in a power series they substitute a time function for the Fourier coefficient $i_{\text{sub } 1/}$ which is clearly not permissible. They further substitute for $i_{\text{sub } 1/}$ the sum of two sinusoids although (1) and (2) are valid for only a single sinusoid at the input.

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Abstracts

On Changing the Coupling into a Microwave Cavity by Means of a Stub Tuner (Correspondence)

B. Kulke. "On Changing the Coupling into a Microwave Cavity by Means of a Stub Tuner (Correspondence)." 1967 Transactions on Microwave Theory and Techniques 15.3 (Mar. 1967 [T-MTT]): 184-185.

In microwave measurements involving a resonant cavity it is sometimes desirable to be able to make a continuous adjustment of the coupling coefficient.



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Abstracts

The Point-Matching Method for Interior and Exterior Two-Dimensional Boundary Value Problems (Correspondence)

R.H.T. Bates. "The Point-Matching Method for Interior and Exterior Two-Dimensional Boundary Value Problems (Correspondence)." 1967 Transactions on Microwave Theory and Techniques 15.3 (Mar. 1967 [T-MTT]): 185-187.

There have appeared recently some papers on a "point-matching method" for solving electromagnetic boundary value problems. The only attempts at justifying its use have been qualitative, but the method is plausible, and in some instances gives accurate results. Nevertheless, the method is unsound, in general, as has been pointed out by Harrington. It will be demonstrated, however, that when certain symmetries are maintained, the point-matching method is valid. These symmetries are maintained, or nearly maintained, in the majority of test cases used for "demonstrating" the validity of the method, which explains its apparent success. Yee and Laura describe the background of the method and the motivation for its use.



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Computer-Graphic Analysis of Dielectric Waveguides (Correspondence)

E.R. Nagelberg and J.N. Hoffspiegel. "Computer-Graphic Analysis of Dielectric Waveguides (Correspondence)." 1967 Transactions on Microwave Theory and Techniques 15.3 (Mar. 1967 [T-MTT]): 187-189.

The solutions to microwave problems are often enhanced by a visual representation of the fields, especially when the mathematical expressions are so complex as to resist physical interpretation by themselves. The particular graphical aid which is the subject of this correspondence is the field mapping, defined as a family of curves drawn parallel to the vector field being represented. Although such diagrams have been considered to be of great value since the early study of electrodynamics, the analytical and numerical complexities of modern engineering problems have inhibited their use on any wide scale. However, the current availability of digital computers, with compatible automatic plotting equipment, has made the numerical determination and display of field mappings a very practical adjunct to established analytical methods. The purpose of this correspondence is to illustrate the utility of field mapping by displaying the transverse electric field for the HE/sub 11/ mode on a dielectric rod. It will be shown that the curvature of the field lines is in the opposite direction to that commonly assumed.

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Abstracts

On the Reflection of Waves by a Sinusoidally Stratified Half-Space (Correspondence)

R. Burman. "On the Reflection of Waves by a Sinusoidally Stratified Half-Space (Correspondence)." 1967 Transactions on Microwave Theory and Techniques 15.3 (Mar. 1967 [T-MTT]): 189-190.

In this correspondence electromagnetic waves are taken to be obliquely incident on a sinusoidally stratified half-space. Both horizontally and vertically polarized waves are considered, and approximate reflection coefficients are obtained by using some formulas given by Heading [7].



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Abstracts

Y-Junction Circulator at 258 Ghz (Correspondence)

H.J. Liebe and B. Senitzky. "Y-Junction Circulator at 258 Ghz (Correspondence)." 1967 Transactions on Microwave Theory and Techniques 15.3 (Mar. 1967 [T-MTT]): 190-191.

We have developed a three-port circulator at 258 GHz as part of an amplifier operating on the principle of resonance saturation of a dipolar gas.



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Beam Waveguide Excitation by the Aperture Field of a Tubular Waveguide (Correspondence)

F. Schwering and A. Zarfler. "Beam Waveguide Excitation by the Aperture Field of a Tubular Waveguide (Correspondence)." 1967 Transactions on Microwave Theory and Techniques 15.3 (Mar. 1967 [T-MTT]): 191-192.

The excitation of a lens-type beam waveguide by the aperture field of a conventional waveguide of circular cross section is treated, assuming that a superposition of an H_{11} -mode and a E_{11} -mode is propagating in the metallic waveguide. The launching efficiency for the dominant beam mode depends on the amplitude ratio of the H_{11} - and E_{11} -modes and on the ratio of the beam mode parameter to the radius of the tubular waveguide. If both quantities are chosen appropriately a theoretical launching efficiency of 98.3 percent can be achieved.

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Abstracts

Loaded Q of a Waveguide Cavity Resonator (Comments)

R.M. Kurzrok. "Loaded Q of a Waveguide Cavity Resonator (Comments)." 1967 Transactions on Microwave Theory and Techniques 15.3 (Mar. 1967 [T-MTT]): 192-193.

Several equations relating the doubly loaded Q of a lossless waveguide cavity resonator to the normalized susceptance of the input/output inductive coupling obstacles (i.e., posts or irises) have appeared in the literature. These equations employ transcendental functions that are not convenient for many design calculations. In this correspondence, an approximate equation will be presented that does not employ transcendental functions and gives reasonably accurate results for most practical cases.



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Control of Resonant Frequency of YIG-Disk Filter by Doublet Tuning (Correspondence)

A. Karp and L. Young. "Control of Resonant Frequency of YIG-Disk Filter by Doublet Tuning (Correspondence)." 1967 Transactions on Microwave Theory and Techniques 15.3 (Mar. 1967 [T-MTT]): 193-195.

Magnetically tunable filters generally use ferromagnetic resonators in the shape of a sphere. The most common ferromagnetic material is single-crystal yttrium iron garnet (YIG), which has a saturation magnetization $4\pi M$, of approximately 1750 Oe. YIG spheres are satisfactory at frequencies down to almost 2 GHz, but doping is required (for instance, with gallium) to obtain high-Q resonance at lower frequencies. Since it is difficult to control the $4\pi M$, of Ga YIG, tuning adjustments have to be provided in multi-resonator filters, usually by a rotation of one of the Ga YIG spheres on a dielectric rod, changing the angles between its crystalline axes and the applied magnetic field. The lower the operating frequency of the filter, the more doping is required, and the greater the variation in $4\pi M$, from resonator to resonator. By using disks rather than spheres, less doping is required. However, it is more difficult to adjust the resonant frequency of a disk by rotation, than it is for a sphere. Another technique was therefore developed, using a pair of disks with adjustable spacing between them for each resonator; the spacing is adjusted to control the resonant frequency of the composite resonator.

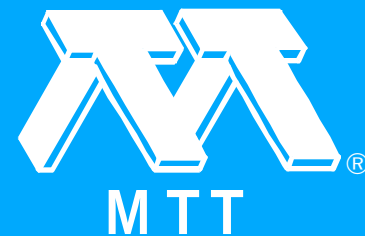


Abstracts

Bandstop Filter Formulas (Correspondence)

E.G. Cristal, L. Young, B.M. Schiffman and D.B. Weller. "Bandstop Filter Formulas (Correspondence)." 1967 Transactions on Microwave Theory and Techniques 15.3 (Mar. 1967 [T-MTT]): 195-195.

This correspondence summarizes a few simple formulas for single-resonator bandstop filters. We have found the formulas useful mainly in the tuning procedure or to determine the individual resonator Qs of multi-resonator bandstop filters. These equations arose and were developed at the Stanford Research Institute during various applications; the exact formulas have not been published before.



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Abstracts

Design Data for UHF Circulators (Correspondence)

K. Whiting. "Design Data for UHF Circulators (Correspondence)." 1967 Transactions on Microwave Theory and Techniques 15.3 (Mar. 1967 [T-MTT]): 195-198.

Davies and Cohen have described detailed calculations based upon the theoretical investigations of Bosma into stripline circulator operation. The calculations yielded design curves for various modes of circulation but were applicable only for a particular relationship between center conductor width and ferrite radius. This correspondence describes an extension of their calculations to a wide range of strip line geometries, permitting greater freedom in circulator design.



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Abstracts

Broadband, Lumped Element UHF Circulator (Correspondence)

G. McChesney and V. Dunn. "Broadband, Lumped Element UHF Circulator (Correspondence)." 1967 Transactions on Microwave Theory and Techniques 15.3 (Mar. 1967 [T-MTT]): 198-199.

A triple-tuned, broadband circulator covering the 400-700 MHz range has been developed utilizing lumped element techniques.



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Cutoff Characteristics of the Channel Waveguide (Correspondence)

C.A. Muilwyk and J.B. Davies. "Cutoff Characteristics of the Channel Waveguide (Correspondence)." 1967 Transactions on Microwave Theory and Techniques 15.3 (Mar. 1967 [T-MTT]): 199-200.

Some time ago, Vilmur and Ishii reported the results of an investigation to determine the cutoff characteristics of the channel waveguide. Their analysis was based on the methods of Iashkin and Cohn. However, they found that the two approaches produced appreciably different results. Subsequently, Roth and Ishii attempted to resolve this discrepancy by experiments. Their observations seemed to indicate that there were indeed two modes of propagation, one following Iashkin's method and one following Cohn's method.

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Abstracts

Fringing Capacitance in Strip-Line Coupler Design (Correction)

J. Singletary, Jr.. "Fringing Capacitance in Strip-Line Coupler Design (Correction)." 1967 Transactions on Microwave Theory and Techniques 15.3 (Mar. 1967 [T-MTT]): 200-200.

The author of the above wishes to thank Charles Lamensdorf, of the Hazeltine Corp., Greenlawn, N.Y., for pointing out the following.



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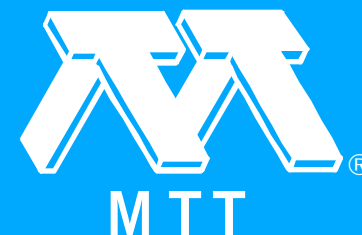
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Abstracts

Contributors (Mar. 1967 [T-MTT])

L. Dubrowsky, G. Klein, D. Marcuse, J.C. Palais, E.N. Protonotarios, H.J. Riblet, J.-Y. Savard and O. Wing. "Contributors (Mar. 1967 [T-MTT])." 1967 Transactions on Microwave Theory and Techniques 15.3 (Mar. 1967 [T-MTT]): 201-202.



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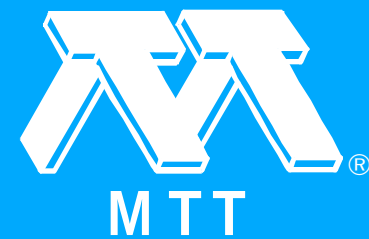
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Membership Application (Mar. 1967 [T-MTT])

"Membership Application (Mar. 1967 [T-MTT])." 1967 Transactions on Microwave Theory and Techniques 15.3 (Mar. 1967 [T-MTT]): 203-203.



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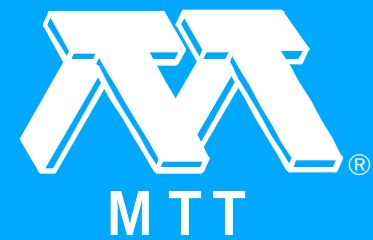
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"Information for Authors (Mar. 1967 [T-MTT])." 1967 Transactions on Microwave Theory and Techniques 15.3 (Mar. 1967 [T-MTT]): 204-204.



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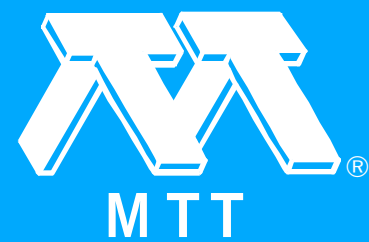
"Table of Contents (Apr. 1967 [T-MTT])." 1967 Transactions on Microwave Theory and Techniques 15.4 (Apr. 1967 [T-MTT]): 205-205.



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On the Theory of Randomly Misaligned Beam Waveguides

F.K. Schwering. "On the Theory of Randomly Misaligned Beam Waveguides." 1967 Transactions on Microwave Theory and Techniques 15.4 (Apr. 1967 [T-MTT]): 206-215.

A straightforward method for the determination of the expected attenuation in misaligned beam waveguides is presented. It applies to confocal guides and assumes that the misalignment consists of random displacements of the lenses in directions perpendicular to the beam axis. Reiterative fields, as they are present in perfectly aligned beam waveguides, do not exist in misaligned guides. However, it can be shown that there are beams whose expected field distribution is repeated from lens to lens. These "statistical modes" are determined by the eigenfunctions of a homogeneous integral equation of the second kind. The corresponding eigenvalues determine the expected attenuation per iteration. The absolute squares of the eigenvalues yield an upper bound for the expected power loss per iteration. The integral equation is solved for small mean square displacements of the lenses by a perturbation method. For infinitely extended lenses, the equation can be solved in closed form. In both cases the expected attenuation of the lower-order statistical modes has been calculated; the results are shown as function of the mean square displacement of the lenses.

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Abstracts

Further Investigations with an Optical Beam Waveguide for Long Distance Transmission

J.R. Christian, G. Goubau and J.W. Mink. "Further Investigations with an Optical Beam Waveguide for Long Distance Transmission." 1967 Transactions on Microwave Theory and Techniques 15.4 (Apr. 1967 [T-MTT]): 216-219.

Measurements made with an optical beam waveguide employing quartz lenses for the beam iteration demonstrate that a transmission loss of 0.5 dB/km is readily obtainable, and that this loss is solely determined by the absorption, scatter, and reflection losses of the lenses. The transmission loss and its variation depends on the air pressure along the light path. Photometric measurements of the energy distribution of the transmitted beam illustrate that distortions in the mode pattern of the laser are the major cause of the launching loss which for the available laser was measured to be approximately 0.4 dB.



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Coupled Nonuniform Transmission Line and its Applications

S. Yamamoto, T. Azakami and K. Itakura. "Coupled Nonuniform Transmission Line and its Applications." 1967 Transactions on Microwave Theory and Techniques 15.4 (Apr. 1967 [T-MTT]): 220-231.

Theory and applications of coupled nonuniform transmission lines are described. Matrix representations of a general coupled nonuniform transmission line are presented, by means of which the behavior of any coupled nonuniform transmission line maybe completely described. Among a wide variety of applications of coupled nonuniform transmission lines, two typical networks, one the coupled nonuniform transmission-line folded all-pass network and the other the coupled nonuniform transmission-line directional coupler, are treated in detail. Equivalent circuit representations of these two networks are presented, which enable the designer to synthesize them in a greatly simplified manner by making use of the theories now available for more conventional single nonuniform transmission lines. In addition, the properties of these two networks using coupled exponential line are investigated. Design procedure is also given for asymmetrical coupled exponential-line directional couplers having excellent characteristics.

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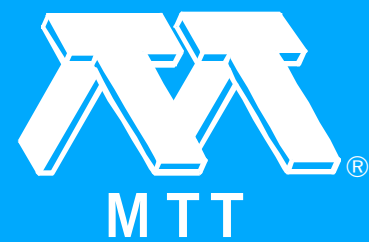
Propagation Constants of a Waveguide Containing Parallel Sheets of Finite Conductivity

H.R. Witt, R.E. Biss and E.L. Price. "Propagation Constants of a Waveguide Containing Parallel Sheets of Finite Conductivity." 1967 Transactions on Microwave Theory and Techniques 15.4 (Apr. 1967 [T-MTT]): 232-239.

The propagation constants of a rectangular waveguide containing periodic, parallel sheets having finite conductivity were determined using an iterative computer program. The dispersion equation was found in a matrix formulation which was conducive to computer solution. This equation was solved for various values of conductivity and sheet spacing. Comparisons were made with the propagation constants found assuming an infinite array of thin parallel resistive sheets in free space for the case where the direction of propagation and the electric field vector were both parallel to the sheets. The propagation constants for the infinite array case have been determined by both conformal mapping techniques for certain limiting conditions and by a computer solution of the dispersion equation for sheet spacings and conductivities of interest. The results should prove useful for the design of absorbing elements and terminations for waveguides.

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Solution of the Finite Length Septum Problem with Application to Periodic Mode Suppressors

S.B. Franklin. "Solution of the Finite Length Septum Problem with Application to Periodic Mode Suppressors." 1967 Transactions on Microwave Theory and Techniques 15.4 (Apr. 1967 [T-MTT]): 240-249.

A square waveguide with periodic septums is considered with a view towards determining the parameters of a structure which suppresses three of four possible propagating modes. The analysis is presented in two parts, the first of which is concerned with the isolated septum. Using available techniques, semi-infinite scattering matrices are determined for the semi-infinite septum for arbitrary TE/sub N0/, TE/sub N1/, and TM/sub N1/ incident modes. These are used to derive Fredholm matrix equations which yield the field everywhere near the finite length septum. The leading terms of the inverted equations are the far-field transmission and reflection coefficients. The solutions are evaluated for several frequencies, and fifth degree polynomials are fitted for the computation of S/sub 11/ and S/sub 12/. The analysis for the TE/sub 10/ mode is applicable to an arbitrary height waveguide and may be used without modification for the "finite length" septum in conventional waveguide. The second part is concerned with the periodic waveguide and assumes that the septums are far apart. A contour chart is introduced to visualize the performance of the periodic structure. The chart is especially useful when more than one propagating mode is involved and simplifies the design problem so that the parameters of practical structures may be obtained with little effort.

Click on title for a complete paper.



The Comparison Reflectometer

D.L. Hollway. "The Comparison Reflectometer." 1967 Transactions on Microwave Theory and Techniques 15.4 (Apr. 1967 [T-MTT]): 250-259.

The comparison reflectometer is an instrument designed to locate and measure the characteristics of reflections in waveguide and transmission-line systems: it is particularly suitable for measuring small reflections in precise microwave measuring instruments up to one meter in length. It consists of a reflectometer in which the returning waves are combined with an accurately known reference wave and a measure of the total reflection coefficient is recorded automatically on punched paper tape at a number of preset frequencies covering a particular waveband. From sets of readings taken without, and with, the test component connected, a computer calculates and plots the distribution of reflections as a function of distance and prints out their magnitudes and phases. The reflection coefficients of individual discontinuities are also plotted by the computer as a function of frequency on Smith charts. Under suitable conditions point reflections may be located in X-band waveguide within a few tenths of a millimeter and measured with an accuracy of ± 3 percent in magnitude and $\pm 5^\circ$ in phase angle. The method compensates for imperfections in the reflectometer and so reduces the background level of spurious reflections to less than 0.00006.

Abstracts

Multiple-Idler Parametric Amplifiers (Corrections)

R.L. Ernst. "Multiple-Idler Parametric Amplifiers (Corrections)." 1967 Transactions on Microwave Theory and Techniques 15.4 (Apr. 1967 [T-MTT]): 259-259.

R. L. Ernst, author of the above paper, which appeared on pp. 9-22 of the January 1967, issue of this Transactions, has called the following to the attention of the Editor.



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Characteristics of Waveguide Resonant-Iris Filters (Correspondence)

T.-S. Chen. "Characteristics of Waveguide Resonant-Iris Filters (Correspondence)." 1967 Transactions on Microwave Theory and Techniques 15.4 (Apr. 1967 [T-MTT]): 260-262.

This correspondence describes the theory and performance of a new waveguide filter that has both very wide passband and stopbands suitable for use with modern microwave generators. The filter is composed of resonant irises placed across a waveguide at quarter-wave intervals. The irises are proportioned to have the same resonant frequency but different Q-factors graded according to the maximally flat principle.

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Abstracts

Considerations in Comb-Line Bandpass Filter Interstage Couplings (Addendum)

R.M. Kurzrok. "Considerations in Comb-Line Bandpass Filter Interstage Couplings (Addendum)." 1967 Transactions on Microwave Theory and Techniques 15.4 (Apr. 1967 [T-MTT]): 262-263.

In a prior correspondence, various aspects of narrowband comb-line bandpass filters were discussed. Experimental data were presented showing that nonzero coupling is obtained between adjacent quarter-wave combline resonators when a nonuniform (i.e., compound) center conductor is employed. In this correspondence, additional techniques for controlling this interstage coupling will be discussed.



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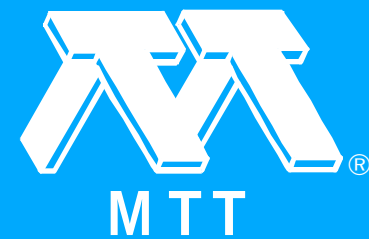


Abstracts

High-Frequency Transistor Evaluation by Three-Port Scattering Parameters

A.P. Anderson. "High-Frequency Transistor Evaluation by Three-Port Scattering Parameters." 1967 Transactions on Microwave Theory and Techniques 15.4 (Apr. 1967 [T-MTT]): 263-265.

Semiconductor technology has developed sufficiently for transistors to retain useful properties up into the microwave region. One GHz is the approximate lower-frequency limit of this region, although a preferable concept might be to consider a transistor in microwave terms when the encapsulation design and associated jig or holder impedances have significant effect. One such effect is the reduction of measurement accuracy for admittance parameters, due to the increasing difficulty of specifying reference planes. Frequency characteristics of the jig and its interaction with the device must also be considered.



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Transmission-Line Treatment of Waveguides Filled with a Moving Medium (Correspondence)

H. Fujioka, K. Yoshida and N. Kumagai. "Transmission-Line Treatment of Waveguides Filled with a Moving Medium (Correspondence)." 1967 Transactions on Microwave Theory and Techniques 15.4 (Apr. 1967 [T-MTT]): 265-267.

To the author's knowledge, a theoretical study of guided waves in a moving isotropic medium was first investigated by Collier and Tai. They derived the electromagnetic fields within a source-free region of a circular or rectangular waveguide by the method of vector potentials

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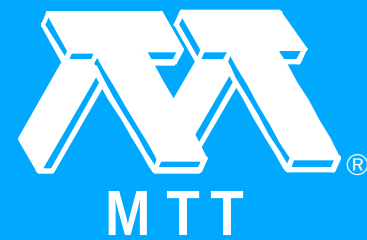


Abstracts

Synthesis of Particular Unit Real Functions of Reflection Coefficient (Apr. 1967 [T-MTT])

C.S. Gledhill. "Synthesis of Particular Unit Real Functions of Reflection Coefficient (Apr. 1967 [T-MTT])." 1967 Transactions on Microwave Theory and Techniques 15.4 (Apr. 1967 [T-MTT]): 267-268.

Physically realizable input reflection coefficients of circuits consisting of commensurable lossless transmission lines and resistors have been described in terms of the parameter $z = e / \sup -1[f/(f/\text{sub } 0) \mu /$ where f is frequency and $f/\text{sub } 0/$ the frequency at which a line is a quarter-wavelength long, resulting in a function of z , $\rho(z)$, introduced in Young and there called unit real (ur) functions. Later, the definition of ur functions was extended, and a test procedure was given for them.



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Coupling to a Desired Wave (Correspondence)

J. Van Bladel. "Coupling to a Desired Wave (Correspondence)." 1967 Transactions on Microwave Theory and Techniques 15.4 (Apr. 1967 [T-MTT]): 268-269.

Technical situations often arise where a wave of given characteristics must be propagated from a transmitting antenna to a receiving antenna. An example is shown in Fig. 1, where a Goubau wave must be launched along a dielectric-clad metallic conductor. The problem then arises of finding out how efficiently the wave is launched, i.e., how much of the total radiated power is propagated in the desired form. In this correspondence we attempt to give a very general definition of this coupling coefficient. Figure 2 illustrates a typical structure in which a radiating system is bounded by a surface $S_{\text{sub } 1}$ consisting of a conducting wall $S_{\text{sub } 1}$ and a radiating aperture S' .

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Abstracts

The Numerical Solution of TEM Mode Transmission Lines with Curved Boundaries (Correspondence)

C.T. Carson. "The Numerical Solution of TEM Mode Transmission Lines with Curved Boundaries (Correspondence)." 1967 Transactions on Microwave Theory and Techniques 15.4 (Apr. 1967 [T-MTT]): 269-270.

A finite difference solution of Laplace's equation has been used by several authors to obtain the transmission-line parameters of uniform TEM transmission lines with straight-line boundaries. This correspondence shows that useful results can also be obtained where the finite difference solution is modified to permit curved boundaries.



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Abstracts

A Wideband Coaxial-Line Power Divider (Correspondence)

S. David. "A Wideband Coaxial-Line Power Divider (Correspondence)." 1967 Transactions on Microwave Theory and Techniques 15.4 (Apr. 1967 [T-MTT]): 270-270.

In a recent paper, Parad and Moynihan discussed a strip-line three-port power divider impedance matched in all three ports. Previously, a coaxial-line version of the above type of power divider was developed by Kaplan. This correspondence discusses a method of significantly increasing the bandwidth of this type of device; it is accomplished by open-circuited quarter-wave transmission lines introduced at a novel location within the device. A wideband power divider has been designed, fabricated, and tested; its measured performance over an octave frequency band is presented.



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Octave Bandwidth L- and S-Band Stripline Discriminators (Correspondence)

M.L. Sisodia and O.P. Gandhi. "Octave Bandwidth L- and S-Band Stripline Discriminators (Correspondence)." 1967 Transactions on Microwave Theory and Techniques 15.4 (Apr. 1967 [T-MTT]): 271-272.

The purpose of this correspondence is to describe the design details and measured characteristics of two octave bandwidth stripline discriminators for L- and S-bands. The discriminators are constructed with the schematic arrangement described by Mohr using two 3 dB wideband directional couplers with an additional 3A/4 line (at the center frequency) in one of the branches. Mohr's correspondence, though briefly describing the experimental results on an L-band coaxial line discriminator, does not give design details of the unit.

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High-Q Microwave Filters Employing IMPATT Active Elements (Correspondence)

R.W. Dawson and L.P. Marinaccio. "High-Q Microwave Filters Employing IMPATT Active Elements (Correspondence)." 1967 Transactions on Microwave Theory and Techniques 15.4 (Apr. 1967 [T-MTT]): 272-273.

During the course of switching studies an unusually large transmission on/off ratio was obtained from an X-band single PIN diode switch operating in the milliwatt range. The phenomenon is attributed to the generation of a microwave negative resistance of the IMPATT type (Impact Avalanche Transit Time) when reverse bias current flows. This negative resistance cancels the normal series R_s loss of the diode and associated contact losses giving a true wideband zero loss waveguide switch.

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Microstrip Transmission-Line Transitions to Dielectric-Filled Waveguide (Correspondence)

J.C. Hoover and R.E. Tokheim. "Microstrip Transmission-Line Transitions to Dielectric-Filled Waveguide (Correspondence)." 1967 Transactions on Microwave Theory and Techniques 15.4 (Apr. 1967 [T-MTT]): 273-274.

The highly asymmetrical electric fields of microstrip transmission lines have been found to make an ideal TEM (coaxial) transition to reduced height dielectric-filled waveguide. Such a transition from an OSM connector has been designed and optimized to provide a better than 1.5 to 1 VSWR over a 2.0 to 4.0 GHz frequency band into a slab of metalized dielectric of $K=15$. The transition takes the form of a microstrip transformer cut into the metalized surface of the dielectric-filled guide. Figure 1 shows an experimental transition. In use, the top surface of the transition would be shielded by a shallow cavity.

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Abstracts

Guided Waves in Moving Media (Apr. 1967 [T-MTT])

P. Daly. "Guided Waves in Moving Media (Apr. 1967 [T-MTT])." 1967 Transactions on Microwave Theory and Techniques 15.4 (Apr. 1967 [T-MTT]): 274-275.

In a recent paper, the problem of electromagnetic wave propagation in a waveguide containing a moving dielectric medium was considered. It is shown in this correspondence that the approach used is unnecessarily complicated and that the mode behavior can be simply derived from the stationary problem by a Lorentz transformation to the frame of a moving observer.



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Abstracts

Contributors (Apr. 1967 [T-MTT])

T. Azakami, R.E. Biss, J.R. Christian, S.B. Franklin, G. Goubau, D.L. Hollway, K. Itakura, J.W. Mink, E.L. Price, F.K. Schwering, H.R. Witt and S. Yamamoto. "Contributors (Apr. 1967 [T-MTT])." 1967 Transactions on Microwave Theory and Techniques 15.4 (Apr. 1967 [T-MTT]): 275-276.



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G-MTT Symposium (Apr. 1967 [T-MTT])

"G-MTT Symposium (Apr. 1967 [T-MTT])." 1967 Transactions on Microwave Theory and Techniques 15.4 (Apr. 1967 [T-MTT]): 277-279.



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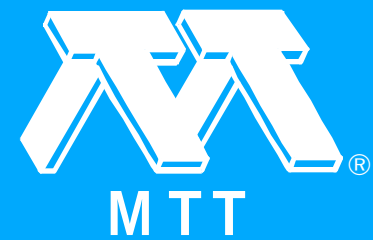
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Information for Authors (Apr. 1967 [T-MTT])

"Information for Authors (Apr. 1967 [T-MTT])." 1967 Transactions on Microwave Theory and Techniques 15.4 (Apr. 1967 [T-MTT]): 280-280.



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"Table of Contents (May 1967 [T-MTT])." 1967 Transactions on Microwave Theory and Techniques 15.5 (May 1967 [T-MTT]): 281-281.



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Abstracts

Propagation in the Off Center E-Plane Dielectrically Loaded Waveguide

N. Eberhardt. "Propagation in the Off Center E-Plane Dielectrically Loaded Waveguide." 1967 Transactions on Microwave Theory and Techniques 15.5 (May 1967 [T-MTT]): 282-289.

Rectangular waveguides containing a full height lossless dielectric slab in arbitrary positions are theoretically treated. Numerical data about the cutoff frequencies of the three lowest TE-modes in the case of loading with alumina are presented. A graphical method is developed to determine cutoff frequencies for other dielectric constants as well. Graphs are given to determine the propagation constant and its frequency dependence. Figures of some characteristic mode patterns are added. A possible application to dissipative filters and frequency separators is discussed.



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Stabilization of the Gain versus Frequency Characteristics of Parametric Amplifiers at High Input Signal Levels

H.E. Brenner. "Stabilization of the Gain versus Frequency Characteristics of Parametric Amplifiers at High Input Signal Levels." 1967 Transactions on Microwave Theory and Techniques 15.5 (May 1967 [T-MTT]): 290-294.

Decreasing the negative bias voltage of varactor diodes in a parametric amplifier causes the gain versus frequency characteristic of the amplifier to shift to the higher-frequency side, resulting in a so-called "positive slope" at the signal center frequency. The same happens when the pump power is increased or when the signal power is increased, but in the latter case only when the idler circuit load resistance is below a certain value. The slope of the gain characteristic can be partially or completely compensated by detuning the signal-circuit characteristic relative to the gain versus frequency characteristic in such a way that the latter is located on a certain point of the left or right slope of the signal-circuit characteristic, or by resistive loading of the idler circuit. Complete cancellation was achieved in the range from -30 to -20 dBm signal input power by using both methods simultaneously on a practical model of a parametric amplifier operating at a signal center frequency of 3.95 GHz and a pump frequency of 11.76 GHz. The loading of the idler circuit was done by drawing a little rectified diode current. The necessary increase in pump power, in order to maintain the same gain as with both signal and idler circuits tuned to resonance, was less than 3 dB, the increase in noise figure a few tenths of 1 dB from a typical value of approximately 3 dB.

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Abstracts

A Light Beam Waveguide Using Hyperbolic-Type Gas Lenses (Correction)

Y. Suematsu, K. Iga and S. Ito. "A Light Beam Waveguide Using Hyperbolic-Type Gas Lenses (Correction)." 1967 Transactions on Microwave Theory and Techniques 15.5 (May 1967 [T-MTT]): 294-294.

Y. Suematsu, K. Iga, and S. Ito, authors of "A Light Beam Waveguide Using Hyperbolic-Type Gas Lenses", which appeared on pages 657-665 of the December, 1966, issue of this Transactions, have called the following to the attention of the Editor.



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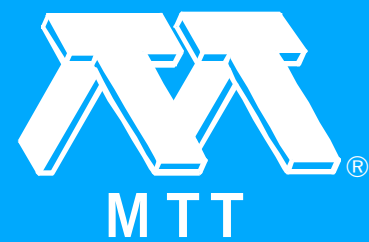
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Design of Composite Magnetic Circuits for Temperature Stabilization of Microwave Ferrite Devices

E. Stern and W.J. Ince. "Design of Composite Magnetic Circuits for Temperature Stabilization of Microwave Ferrite Devices." 1967 Transactions on Microwave Theory and Techniques 15.5 (May 1967 [T-MTT]): 295-300.

The magnetic flux density of unsaturated microwave ferrites can be made almost constant although microwave ferrite saturation magnetization, coercive force, and hysteresis loop shapes change substantially. Temperature stabilization of flux is achieved by a composite series magnetic circuit consisting of microwave, driver, and flux-limiter ferrites, and a control coil. The flux limiter constrains the circuit flux to an almost constant level throughout the operating temperature range, despite large changes in the size and shape of the microwave ferrite hysteresis loop. The driver ferrite supplies the MMF necessary to sustain the flux. Current impulses in the control coil energize and switch the circuit flux. Estimates of the required lengths and cross-sectional areas of the circuit elements, and of the required switching field and energy for a waveguide remanence phase shifter are given, along with the effects of leakage and fringing fluxes. Composite circuit techniques have been applied to an experimental remanence phase shifter. Unstabilized, a 16 percent loss of phase shift was incurred as a result of an 80°C rise in temperature. By applying composite circuit techniques, this value was reduced to less than 2½ percent for the same temperature range.

Click on title for a complete paper.



A Unilateral Parametric Amplifier

H.E. Brenner. "A Unilateral Parametric Amplifier." 1967 Transactions on Microwave Theory and Techniques 15.5 (May 1967 [T-MTT]): 301-306.

A theoretical investigation of a unilateral parametric amplifier using two varactor diodes indicates an improvement of unilateral stability over already existing types. A circuit is suggested which uses lower sideband idler energy for achieving forward gain and upper sideband energy to obtain substantial reverse loss. The phases of the applied signals and of the pump at the two varactors have to be 90° out of phase to achieve unilateral operation. Numerical evaluation of the theoretical results for a signal frequency at 4.0 GHz and a pump frequency at 12.0 GHz, assuming a diode junction capacitance of $C_{j/} = 0.4$ pF and a bulk resistance of $R_{s/} = 20\Omega$ was done for several pump power levels. For 14 dB maximum forward gain, the 3 dB bandwidth of the gain versus frequency characteristic of the unilateral amplifier is about 18 percent smaller than that of the reflection type amplifier. The maximum reverse loss for these conditions is 7.3 dB. For lower forward gain the backward loss increases relatively until for very low gain values (about 1 dB) the amplifier is unconditionally stable, i.e., the backward loss is larger than the forward gain. The theoretical noise figure is about 1.95 dB at signal center frequency for 14 dB forward gain and, for ± 80 MHz from the center frequency, only 0.1 dB higher than for the reflection type amplifier.



Abstracts

The Digital Elliptic Filter--A Compact Sharp-Cutoff Design for Wide Bandstop or Bandpass Requirements

M.C. Horton and R.J. Wenzel. "The Digital Elliptic Filter--A Compact Sharp-Cutoff Design for Wide Bandstop or Bandpass Requirements." 1967 Transactions on Microwave Theory and Techniques 15.5 (May 1967 [T-MTT]): 307-314.

Detailed design procedures are presented for a practical elliptic-function filter form capable of achieving high selectivity in a very compact configuration. This filter form, called the digital elliptic because of its digital construction and elliptic function response, can provide either bandpass or bandstop characteristics. Examples are given to illustrate typical design procedures for both bandpass and bandstop applications. Experimental results are presented for an octave bandstop design.



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On the Mode and Square Correspondence Between Circular Multimode Tapered Waveguides

C.C.H. Tang. "On the Mode and Square Correspondence Between Circular Multimode Tapered Waveguides." 1967 Transactions on Microwave Theory and Techniques 15.5 (May 1967 [T-MTT]): 314-317.

In an axially straight multimode circular waveguide taper excited with a pure TE_{11} dominant mode, the first and only converted mode at and near cutoff is the TM_{11} mode. It is shown that in an axially straight multimode square waveguide taper excited with a pure TE_{10} dominant mode, the TM_{12} mode corresponding to the TM_{11} mode in circular case is not the only first converted mode at and near cutoff. The overall behavior or coupling mechanism of waveguides is similar whether the waveguide is rectangular, square, circular, or elliptical: i.e., the overall coupling coefficient at cutoff of a converted mode or modes approaches an infinity of the order $O(\omega - \omega_c)^{-1/4}$.

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Theory of Unidirectionality and Conjugate Matching in Three-Port Time-Varying Reactance Circuits (Correspondence)

A.E. Fantom. "Theory of Unidirectionality and Conjugate Matching in Three-Port Time-Varying Reactance Circuits (Correspondence)." 1967 Transactions on Microwave Theory and Techniques 15.5 (May 1967 [T-MTT]): 318-320.

In recent years interest has been shown in parametric circuits having special properties such as unidirectionality and conjugate matching. This correspondence discusses the properties of a particular class of such circuits; viz., those which may be regarded as a three-port time-varying reactance circuit terminated by complex impedances. The theory is presented in terms of characteristic terminations, to which constraints imposed by the Manley-Rowe relations are applied. Applications of the theory include the synthesis of a three-port time-varying reactance circulator and of unidirectional and conjugately matched amplifiers.

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Acoustic Gas Lenses for Light (Correspondence)

J. Kerdiles and J.R. Whinnery. "Acoustic Gas Lenses for Light (Correspondence)." 1967 Transactions on Microwave Theory and Techniques 15.5 (May 1967 [T-MTT]): 321-322.

It has been proposed that sound waves in acoustic waveguides might form lens systems useful for guiding light beams over reasonable distances. The pressure variations of the acoustic waves cause variations in the index of refraction which may have lens-like properties. The analysis of light guiding by a traveling acoustic waveguide mode has been given. Such a wave is an "alternating gradient" focusing system with alternating converging and diverging lenses of approximately equal strength. Such a system has net focusing properties since the average radius in the diverging lenses is less for such a system than in the converging lenses. Acoustic lenses without longitudinal variations have also been utilized for the modulation of lasers, but with solids instead of gases. Although liquids have a higher density of scattering particles than gases, the higher compressibility of gases make the net effect in the latter comparable to that in liquids for at least some applications. It is thus desirable to demonstrate some of the experimental effects in acoustic gas lenses for several acoustic modes.

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The Resonant Frequency of Interdigital Filter Elements (May 1967 [T-MTT])

D.D. Khandelwal. "The Resonant Frequency of Interdigital Filter Elements (May 1967 [T-MTT])." 1967 Transactions on Microwave Theory and Techniques 15.5 (May 1967 [T-MTT]): 322-324.

In a recent correspondence Nicholson has described a method of predicting the center frequency of a bandpass interdigital filter. On the basis of existing techniques the design of this type of filter usually results in an error in the center and bandedge frequencies of the filter. The most important reason for this is the arbitrary manner in which the lengths of the fingers (i.e., center conductor) must be shortened at the open end. By using Nicholson's method, it is possible to predict fairly accurately the distance between the end of the finger and the opposite end plate. The improved accuracy follows from the proper treatment given to the capacitances associated with the end of the finger. Gandhi and Khandelwal and Khandelwal have shown that these capacitances can also be included in the form of the effective length of a conductor (finger) in transverse TEM structures with an arbitrary conductor cross section. The interdigital structure is a special case of the transverse TEM structures.

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Simplifying Maxwell's Equations in Gyrotropic Media (Correspondence)

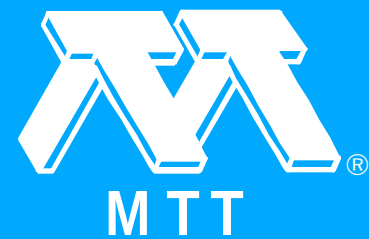
C.F. Vasile. "Simplifying Maxwell's Equations in Gyrotropic Media (Correspondence)." 1967 Transactions on Microwave Theory and Techniques 15.5 (May 1967 [T-MTT]): 324-325.

The purpose of this correspondence is to describe a method of handling Maxwell's equations in gyrotropic media. We have found this method to be particularly useful in the analysis of a small, ferrite filled waveguide, but believe it may be useful in general. The form of the equations appear to be considerably less complicated and capable of affording more insight than the methods employed in the literature. We will make use of a pair of oppositely rotating, elliptically polarized vectors which, as is well known, can be used to diagonalize parts of the permeability, permittivity, and conductivity tensors. However, except in infinite media, these polarized variables will not simplify Maxwell's equations unless a new formulation is used.

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A Wideband Microwave Solid-State FM Deviator (Correspondence)

W.J. Clemetson. "A Wideband Microwave Solid-State FM Deviator (Correspondence)." 1967 Transactions on Microwave Theory and Techniques 15.5 (May 1967 [T-MTT]): 326-326.

Existing frequency modulated microwave sources are typically limited to either relatively narrow frequency deviations ($\leq \pm 20$ MHz) relatively low baseband response (< 10 MHz), unless complicated techniques are employed. The objective of the work described in this correspondence was to develop a simple solid-state microwave deviator with greatly extended deviation and baseband response. Specifically, a frequency deviation of ± 100 MHz centered at 1.3 GHz with a linearity of less than 2 MHz, a power output of 120 mW flat to 1 dB and a baseband response from dc to 60 MHz were established as goals.

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Abstracts

Longitudinal Waves in a Hot-Nonuniform Plasma (Comments)

D. Kalluri, H. Unz and K.E. Lonngren. "Longitudinal Waves in a Hot-Nonuniform Plasma (Comments)." 1967 Transactions on Microwave Theory and Techniques 15.5 (May 1967 [T-MTT]): 326-327.

In a recent correspondence Lonngren derived the general wave equation for an inhomogeneous isotropic warm electron plasma in the form.



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Properties of a TEM Transmission Line Used in Microwave Integrated Circuit Applications (Correspondence)

H.C. Okean. "Properties of a TEM Transmission Line Used in Microwave Integrated Circuit Applications (Correspondence)." 1967 Transactions on Microwave Theory and Techniques 15.5 (May 1967 [T-MTT]): 327-328.

A somewhat unusual TEM transmission line configuration that is useful in certain microwave integrated circuit realizations, consists of a strip-line center conductor on a dielectric substrate coaxial with a cylindrical outer conductor, as shown in Fig. 1(a). The cylindrical outer conductor is perturbed slightly by slots that support the dielectric substrate. Due to the irregular conductor geometry and the presence of the dielectric substrate, exact closed-form theoretical solutions for the characteristic impedance Z_0 and the effective dielectric constant ϵ_{eff} of this transmission line have heretofore not been obtained.

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Abstracts

Contributors (May 1967 [T-MTT])

*H.E. Brenner, N. Eberhardt, M.C. Horton, W.J. Ince, E. Stern, C.C.H. Tang and R.J. Wenzel.
"Contributors (May 1967 [T-MTT])." 1967 Transactions on Microwave Theory and Techniques
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Resonant Frequency of Open-Ended Cylindrical Cavity

N.C. Wenger. "Resonant Frequency of Open-Ended Cylindrical Cavity." 1967 Transactions on Microwave Theory and Techniques 15.6 (Jun. 1967 [T-MTT]): 334-340.

The TE/sub 011/ mode of oscillation in an open-ended circular cylindrical microwave cavity is analyzed. The cavity consists of a circular waveguide that is terminated at each end with a thin cylindrical partition coaxial with the circular waveguide. The resonant frequency of the cavity is computed by using Laplace transform and Wiener-Hopf techniques. Numerical values for the resonant frequency are presented.

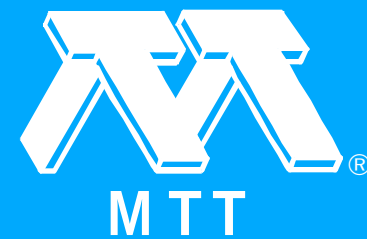


Abstracts

Theory of Direct-Coupled-Cavity Filters

R. Levy. "Theory of Direct-Coupled-Cavity Filters." 1967 Transactions on Microwave Theory and Techniques 15.6 (Jun. 1967 [T-MTT]): 340-348.

A new theory is presented for the design of direct-coupled-cavity filters in transmission line or waveguide.



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A Frequency Transformation for Commensurate Transmission-Line Networks (Jun. 1967 [T-MTT])

E.G. Cristal. "A Frequency Transformation for Commensurate Transmission-Line Networks (Jun. 1967 [T-MTT])." 1967 Transactions on Microwave Theory and Techniques 15.6 (Jun. 1967 [T-MTT]): 348-357.

The frequency transformation $W=1/S$, where $S = \tanh(\gamma L)$, is investigated for commensurate transmission-line networks consisting of stubs, resistors, ideal transformers, and unit elements. This transformation takes transmission-line transformers into transmission-line lowpass filters and vice versa, lowpass (or bandstop) filters into highpass (or band-pass) filters and vice versa, and elliptic-function bandstop filters into elliptic-function bandpass filters and vice versa. The practicality of the transformation lies in the fact that element values of the transformed network are easily related to the corresponding element values of the original network. The transformation is useful because it provides an alternative viewpoint for synthesis, and because it reduces the number of tables of designs needed for various filter types. Several examples of designs using the transformation are given. One design is an unusual narrowband 3-dB directional coupler.

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Abstracts

Current Distribution and Impedance of Lossless Conductor Systems

R.L. Brooke and J.E. Cruz. "Current Distribution and Impedance of Lossless Conductor Systems." 1967 Transactions on Microwave Theory and Techniques 15.6 (Jun. 1967 [T-MTT]): 358-364.

A general method for determining the characteristic impedance of uniform, lossless transmission systems is developed. The current distribution within the system is determined by means of a matrix equation programmed for computer solution. Once the current distribution is known, the inductance per unit length and characteristic impedance are determined. The results obtained by applying this method to several rectangular coaxial systems are compared with the predictions of an approximate analytic expression. The reflection coefficient of a variable characteristic impedance coaxial line is measured on a time-domain reflectometer (TDR), and the results are compared with both the matrix method and the approximate analytic expression.



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Radiation from an Infinite Array of Parallel-Plate Waveguides with Thick Walls

S.W. Lee. "Radiation from an Infinite Array of Parallel-Plate Waveguides with Thick Walls." 1967 Transactions on Microwave Theory and Techniques 15.6 (Jun. 1967 [T-MTT]): 364-371.

A semi-infinite array of parallel-plate waveguides with walls of finite thickness is excited by incident TEM modes in every waveguide identically. By proper application of the boundary conditions, two Wiener-Hopf equations are obtained which, however, cannot be solved by the standard techniques. A method originated by Jones is applied to recast these two equations so that the forms of the solutions are found. The solutions involve constants to be determined by an infinite set of linear simultaneous equations which converge absolutely. When the thickness of the walls b is small compared with the wavelength λ , explicit solutions in the order of $O(b/\lambda)$ are found in very simple forms.

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Propagation in Rectangular Waveguide Filled with Skew Uniaxial Dielectric

J.B. Davies. "Propagation in Rectangular Waveguide Filled with Skew Uniaxial Dielectric." 1967 Transactions on Microwave Theory and Techniques 15.6 (Jun. 1967 [T-MTT]): 372-376.

A solution is given for propagation in rectangular waveguide fully loaded with a uniaxial dielectric, with the C-axis lying anywhere in the transverse plane. This problem arises in the design of particular traveling-wave masers. By application of the Rayleigh-Ritz method to Berk's variational expression, the problem is reduced to a matrix eigenvalue problem, and in a form suitable for direct evaluation on a digital computer. An explicit approximate solution is, however, shown to give accurate results. The analysis can be interpreted directly in terms of mode coupling of the usual rectangular waveguide modes, and the possible extension is indicated to general tensor media and to circular or elliptical waveguide.

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Measurement of the Permittivity of Insulating Films at Microwave Frequencies (Correspondence)

H. Sobol and J.J. Hughes. "Measurement of the Permittivity of Insulating Films at Microwave Frequencies (Correspondence)." 1967 Transactions on Microwave Theory and Techniques 15.6 (Jun. 1967 [T-MTT]): 377-378.

Advances in the state of the art of both integrated circuit technology and solid-state devices have led to the integration of microwave circuits. Dielectric films may be used in a variety of applications for the integrated circuits, and a knowledge of the properties of the films at microwave frequencies is essential for circuit design and material evaluation. The transmission method and the standard cavity perturbation technique are difficult to use when measuring dielectric films. The film is usually grown or deposited on a substrate that may introduce a frequency or phase shift which masks the effect due to the film. This difficulty may be overcome by first introducing the substrate without any film and then repeating the measurement with a film on the substrate. The second difficulty consists in accurately measuring the very small frequency or phase shift which most films produce.

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Experimental 4-Port E-Plane Junction Circulators (Correspondence)

S.R. Longley. "Experimental 4-Port E-Plane Junction Circulators (Correspondence)." 1967 Transactions on Microwave Theory and Techniques 15.6 (Jun. 1967 [T-MTT]): 378-380.

This correspondence reports on the experimental investigation of broadbanding 4-port E-plane cross-junction circulators. The circulator experiments were carried out in X-band (WG 16). From previous work on 3-port E-plane circulators it was decided to adopt a ferrite configuration using two flat disks positioned against the narrow walls at the intersection of the crossed waveguides as shown in Fig. 1. The ferrite disks are magnetized by a dc magnetic field parallel to the ferrite axis.

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Gap Spacing for End-Coupled and Side-Coupled Strip-Line Filters (Correspondence)

J.K. Richardson. "Gap Spacing for End-Coupled and Side-Coupled Strip-Line Filters (Correspondence)." 1967 Transactions on Microwave Theory and Techniques 15.6 (Jun. 1967 [T-MTT]): 380-382.

Two of the simplest strip-line configurations for bandpass filters are those which utilize end coupling (Fig. 1) and side coupling (Fig. 2). For the special case of a symmetric strip line with center conductor of negligible thickness (Fig. 3), it is possible to establish expressions which explicitly relate gap spacing S to normalized bandwidth w . Generally it is found that the greater the gap width, the less important are the tolerance considerations; alternatively, a broader bandwidth may be achieved for a given tolerance. The purpose of this correspondence is to establish a criterion that will enable a designer to select the filter with the greater coupling gap for given values of ground plane spacing D , midband wavelength λ_0 , and normalized bandwidth.

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Abstracts

An Interesting Impedance Matching Network (Correspondence)

D.H. Steinbrecher. "An Interesting Impedance Matching Network (Correspondence)." 1967 Transactions on Microwave Theory and Techniques 15.6 (Jun. 1967 [T-MTT]): 382-382.

Any load impedance can be transformed to a real impedance by a $\lambda/8$ transformer whose characteristic impedance is equal to the magnitude of the load impedance.



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A Laminar Slow-Wave Coupler and its Application to Iridium Antimonide (Correspondence)

R.D. Larrabee and W.A. Hicinbotham, Jr.. "A Laminar Slow-Wave Coupler and its Application to Iridium Antimonide (Correspondence)." 1967 Transactions on Microwave Theory and Techniques 15.6 (Jun. 1967 [T-MTT]): 382-384.

The purpose of this correspondence is to describe a technique for coupling energy between a waveguide mode and a semiconductor (or gas discharge) slow wave that has a longitudinal component of microwave electric field. When a bar of semiconductor material which supports such a wave is mounted as a central inductive post in dominant mode waveguide, the energy coupling occurs by way of the microwave electric field existing between the top and bottom waveguide surfaces. If the post is many wavelengths long (i.e., wavelengths of the slow wave within the semiconductor), the contributions from alternate half-wavelength sections of the post will cancel and the net coupling will result from the last full or fractional half-wavelength in the post. The post, viewed as a whole, is thus coupled very poorly to the waveguide.

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Perturbations of the Critical Parameters of Quarter-Wave Directional Couplers (Correspondence)

H.E. Brenner. "Perturbations of the Critical Parameters of Quarter-Wave Directional Couplers (Correspondence)." 1967 Transactions on Microwave Theory and Techniques 15.6 (Jun. 1967 [T-MTT]): 384-385.

The theory of coupled transmission lines was discussed by Jones and Bolljahn on the assumption that the phase velocities for even and odd modes v_{e} and v_{o} were equal to each other. However, when the coupled lines are constructed in the microstrip geometry or on a hard substrate suspended between two ground planes, the phase velocities are in general unequal. As a result, the even- and odd-mode characteristic impedances $Z_{0\text{e}}$, and $Z_{0\text{o}}$, as well as the phase velocities, must be adjusted to prescribed values. However, little is known how critical these adjustments are in order to get desired coupler performance.

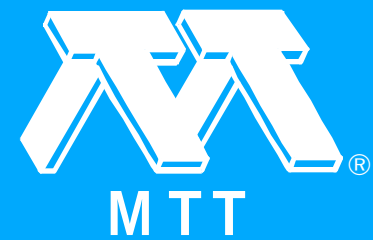
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Contributors (Jun. 1967 [T-MTT])

*R.L. Brooke, E.G. Cristal, J.E. Cruz, J.B. Davies, S.-W. Lee, R. Levy and N.C. Wenger.
"Contributors (Jun. 1967 [T-MTT])." 1967 Transactions on Microwave Theory and Techniques
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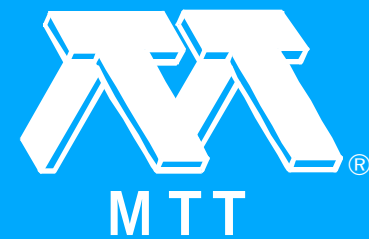
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Membership Application (Jun. 1967 [T-MTT])

"Membership Application (Jun. 1967 [T-MTT])." 1967 Transactions on Microwave Theory and Techniques 15.6 (Jun. 1967 [T-MTT]): 387-387.



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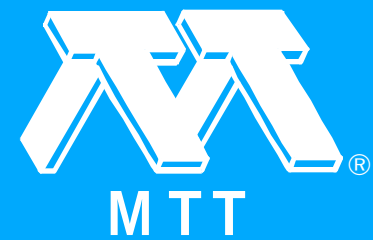
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Abstracts

Filters for High-Speed Diode Modulators and Demodulators

R.V. Garver and T.H. Mak. "Filters for High-Speed Diode Modulators and Demodulators." 1967 Transactions on Microwave Theory and Techniques 15.7 (Jul. 1967 [T-MTT]): 390-397.

The relationship between switching time, transient suppression, and filter complexity is derived for filter-type diode switches, along with the theoretical minimum switching time. Design criteria are developed for high-speed switches and detectors in waveguide and TEM transmission lines.



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An Equivalence Principle for Nonuniform Transmission-Line Directional Couplers

C.B. Sharpe. "An Equivalence Principle for Nonuniform Transmission-Line Directional Couplers." 1967 Transactions on Microwave Theory and Techniques 15.7 (Jul. 1967 [T-MTT]): 398-405.

The analysis of transmission-line directional couplers is formulated in terms of a pair of first-order matrix differential equations. It is shown that for every nonuniform directional coupler that is electrically symmetric, there exists an equivalent pair of dual nonuniform transmission lines. It is also shown that a matched, transmission-line directional coupler having an absolutely continuous characteristic impedance matrix must be symmetric. Restrictions on the terminating impedances and the implications of these restrictions on the realizability of transmission-line couplers are investigated. Finally, the tapered-line magic T is treated as an example.

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Dual-Mode Reflectometer for Measuring Microwave Magnetic Kerr Effect in Semiconductors

P.S. Hauge and K.S. Champlin. "Dual-Mode Reflectometer for Measuring Microwave Magnetic Kerr Effect in Semiconductors." 1967 Transactions on Microwave Theory and Techniques 15.7 (Jul. 1967 [T-MTT]): 406-410.

The "dual-mode reflectometer" is a device with which one can measure the relative off-diagonal terms of the tensor reflection coefficient of a hybrid mode composed of two degenerate, mutually perpendicular, independent modes. It differs from the conventional "single-mode reflectometer" in that it permits launching elliptically polarized waves of arbitrary orientation and ellipticity into the main (circular or square) waveguide and observing the orientation and ellipticity of the wave reflected by the load. This paper describes application of the dual-mode reflectometer to measurement of the magnetic Kerr effect in semiconductors. The accuracy and resolution of the apparatus is demonstrated with measurements of germanium and silicon at x band. A scattering matrix analysis is given which describes the measurement and calibration procedure.

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Abstracts

On the Theory of Shielded Surface Waves

J.R. Wait. "On the Theory of Shielded Surface Waves." 1967 Transactions on Microwave Theory and Techniques 15.7 (Jul. 1967 [T-MTT]): 410-414.

An analysis is given for the modes which will be excited between two parallel impedance boundaries. It is shown that, for inductive-type surfaces, two of these modes have a surface wave character even though the structure is bounded in the transverse dimension. The interaction between these surface waves and the accompanying waveguide modes is discussed for this model which is admittedly highly idealized.



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Tunnel Diode Oscillator in an Open Structure

E. Yamashita and J.R. Baird. "Tunnel Diode Oscillator in an Open Structure." 1967 Transactions on Microwave Theory and Techniques 15.7 (Jul. 1967 [T-MTT]): 415-421.

This paper describes a theoretical and experimental evaluation of the oscillation conditions of a microwave tunnel diode integrally mounted at the feed point of a semicircular loop antenna. The oscillation conditions are based on a quasi-linear equivalent circuit where the diode load impedance is the complex radiation impedance of the semicircular loop antenna. The results of a radiation impedance calculation based on a Fourier transform method are presented. Diode fabrication techniques are described and experimental results are reported to be consistent with the theory.

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Abstracts

Solid-State YIG Serrodyne

D.C. Webb and R.A. Moore. "Solid-State YIG Serrodyne." 1967 Transactions on Microwave Theory and Techniques 15.7 (Jul. 1967 [T-MTT]): 421-427.

Theory and operation of a serrodyne based upon phase velocity modulation of magnetostatic modes in YIG are described. Sources of limitation on the spectral performance are evaluated in terms of measured device parameters. The most critical sources of unwanted spectral generation are flyback time, nonlinear current sawtooth, logarithmic phase variation, and variation in attenuation with applied magnetic bias. Design and operation of a C-band stripline device is described. All unwanted sidebands were suppressed by 22 dB over the desired signal output, limited primarily by the flyback time.



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Abstracts

A Stability Criterion for Tunnel Diode Amplifier (Correspondence)

I. Hefni and W.C. Barnes. "A Stability Criterion for Tunnel Diode Amplifier (Correspondence)." 1967 Transactions on Microwave Theory and Techniques 15.7 (Jul. 1967 [T-MTT]): 427-429.

A relatively simple stability criterion is proposed for bandpass tunnel diode amplifiers. The results predicted from this criterion agree very closely with the results obtained from the analog computer simulation of an experimental amplifier. The derived criterion is solved to determine the limitation on the diode series inductance as a function of the diode negative resistance, and the results are plotted for a wide range of diode parameters and amplifier gains.



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Transient Thermal Behavior of Latching Ferrite Phase Shifters (Correspondence)

G. Klein. "Transient Thermal Behavior of Latching Ferrite Phase Shifters (Correspondence)." 1967 Transactions on Microwave Theory and Techniques 15.7 (Jul. 1967 [T-MTT]): 429-430.

Latching ferrite phase shifters have been under investigation and development for a number of years as digital phase control elements in electronically steerable arrays. This device employs the remanent magnetization available in a closed magnetic circuit to eliminate the large and inefficient electromagnets associated with previous ferrite phase shifters, and to provide for micro-second speed switching with low energy. The basic element of a waveguide latching phase shifter is a rectangular toroid of square hysteresis loop ferromagnetic material with an axial magnetizing wire. Current pulses are used to switch the toroid magnetization between the two possible remanent states. The effect of changing the direction of remanent magnetization is to perturb the propagation constant of the ferrite loaded guide in the order of 10 percent, creating a differential phase shift.



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A High-Precision Wideband Wavemeter for Millimeter Waves (Correspondence)

G. Schulten and J.P. Stoll. "A High-Precision Wideband Wavemeter for Millimeter Waves (Correspondence)." 1967 Transactions on Microwave Theory and Techniques 15.7 (Jul. 1967 [T-MTT]): 430-431.

The purpose of this correspondence is to describe a high-precision wideband wave-meter for millimeter waves. At longer wavelengths usually tunable cylindrical cavities are used, which are half a guide wavelength long. Going down to millimeter waves two disadvantages arise. One is the low Q factor as the result of increasing wall losses and the other is the low accuracy of measurements as the result of the smaller dimensions of the cavity. Both disadvantages can be overcome by a cavity of larger volume. The Q factor increases with the volume, and the accuracy is proportional to the length of the cavity. That means that the cavity is several or many wavelengths long and a mode of higher axial order (H_{01n} with $n > 1$) must be used. But then the problem arises that n has to be known for the determination of frequency. This can be achieved using two cavities of equal diameter but different lengths l_1 and l_2 which are independently coupled to the same waveguide.

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Abstracts

Broadband Hybrids (Correspondence)

M. Bouthinon and A. Coumes. "Broadband Hybrids (Correspondence)." 1967 Transactions on Microwave Theory and Techniques 15.7 (Jul. 1967 [T-MTT]): 431-432.

Marcatili and Ring have shown that using two 3 dB directional couplers with a $\pi/2$ phase shifter between them a broader band 3 dB directional coupler can be realized.



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Normal Incidence on Semi-Infinite Longitudinally Drifting Magnetoplasma: The Nonrelativistic Solution (Correspondence)

H. Unz. "Normal Incidence on Semi-Infinite Longitudinally Drifting Magnetoplasma: The Nonrelativistic Solution (Correspondence)." 1967 Transactions on Microwave Theory and Techniques 15.7 (Jul. 1967 [T-MTT]): 432-433.

The purpose of this correspondence is to present a nonrelativistic solution to the problem of normal incidence of electromagnetic waves on a semi-infinite longitudinally drifting homogeneous cold magnetoplasma. Reflected and transmitted waves from the drifting boundary are found and the results are identical with a relativistic solution presented by Chawla and Unz.

Abstracts

An Experimental Gas Lens Optical Transmission Line (Correspondence)

A.C. Beck. "An Experimental Gas Lens Optical Transmission Line (Correspondence)." 1967 Transactions on Microwave Theory and Techniques 15.7 (Jul. 1967 [T-MTT]): 433-434.

The advent of successful gas lenses started investigations of their performance in optical transmission lines. A test line of spaced thermal gas lenses was built at Holmdel in a long corridor using parts and techniques available from previous circular waveguide work.



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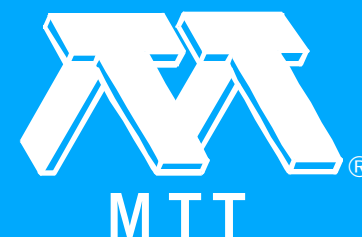
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J.R. Baird, K.S. Champlin, R.V. Garver, P.S. Hauge, T.H. Mak, R.A. Moore, C.B. Sharpe, J.R. Wait, D.C. Webb and E. Yamashita. "Contributors (Jul. 1967 [T-MTT])." 1967 Transactions on Microwave Theory and Techniques 15.7 (Jul. 1967 [T-MTT]): 435-436.



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The Amplitude Response of a Coupled Transmission Line, All-Pass Network Having Loss

R.A. Kolker. "The Amplitude Response of a Coupled Transmission Line, All-Pass Network Having Loss." 1967 Transactions on Microwave Theory and Techniques 15.8 (Aug. 1967 [T-MTT]): 438-443.

The voltage transfer function of a first- and second-order coupled transmission line, all-pass network having loss is derived. The amplitude response is calculated from the transfer function. It is shown that the amplitude response is completely determined when alpha, the real part of propagation function, is known. A method for calculating alpha is presented and an example is given. The results show that the losses (dielectric and conductor) cause periodic dips in the amplitude response of the all-pass networks. However, for practical materials and configurations, the peak amplitude loss is less than 0.4 dB for the first two periodicities. The results show that, for most applications, it is possible to cascade many first-order or second-order lines before the amplitude response must be equalized.

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Abstracts

Propagation through a Twisted Medium

G.C. McCormick. "Propagation through a Twisted Medium." 1967 Transactions on Microwave Theory and Techniques 15.8 (Aug. 1967 [T-MTT]): 443-450.

An explicit solution is obtained for propagation through a uniform twisted anisotropic medium subject to the conditions that propagation is along the twist axis, and that the structure is fine. The propagation constants are altered and coupling exists between the propagation modes. A parameter is defined which indicates the tendency of the radiation to adhere to the structure of the medium. The effects at boundary discontinuities are discussed, and tapers to an isotropic medium are dealt with. The particular application of the theory to cases of polarization conversion, circular to plane, and plane to plane are discussed.



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Abstracts

The Numerical Solution of Rectangular Waveguide Junctions and Discontinuities of Arbitrary Cross Section

C.A. Muilwyk and J.B. Davies. "The Numerical Solution of Rectangular Waveguide Junctions and Discontinuities of Arbitrary Cross Section." 1967 Transactions on Microwave Theory and Techniques 15.8 (Aug. 1967 [T-MTT]): 450-455.

A method is described of calculating automatically the performance of junctions of rectangular waveguides including conducting cylinders of arbitrary shape. The only restriction is that the overall problem should be effectively two-dimensional, i.e., the structure be uniform in some cross section. The one basic approximation made (which could be removed) is shown to give useful results for the devices tested, viz., for various shaped irises (inductive and capacitive) and the 4-port H-plane junction.



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The Green's Dyadic for Radiation in a Bounded Simple Moving Medium

Y.J. Seto. "The Green's Dyadic for Radiation in a Bounded Simple Moving Medium." 1967 Transactions on Microwave Theory and Techniques 15.8 (Aug. 1967 [T-MTT]): 455-462.

The studies here show that the wave equation for electromagnetic wave propagation in an isotropic and uniformly moving medium is solvable by the separation method in four coordinate systems. Solutions in the form of complete sets of eigenfunctions are possible for problems where boundary surfaces are presented. A Green's dyadic for finite or semi-infinite domain problems involving sources in the moving medium has been formulated through vector operation on the eigenfunction solutions of the homogeneous wave equation. The case of electromagnetic waves excited by a current loop, immersed in a moving medium, and confined by a circular cylindrical waveguide, was examined. The electric and magnetic field intensities in such a waveguide were compared with those obtained through a different approach. The Green's dyadic for electromagnetic waves in an infinite domain moving medium was shown to be obtainable from the finite domain Green's dyadic through a limiting process.

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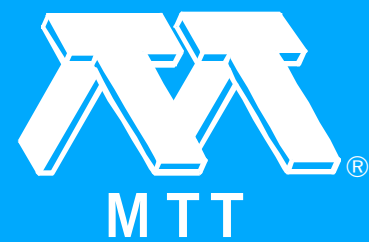
Coupler-Type Bend for Pillbox Antennas

V. Mazzola and J.E. Becker. "Coupler-Type Bend for Pillbox Antennas." 1967 Transactions on Microwave Theory and Techniques 15.8 (Aug. 1967 [T-MTT]): 462-468.

A new type of 180° H-plane bend has been developed for use in double-layer pillbox antennas. This bend, called a coupler-type bend, permits complete coupling between two pillbox layers with a minimum of reflection, cross-polarization, and defocusing. It can be used with short focus antennas where large feed angles are involved. The coupler-type bend utilizes a metal plate between the pillbox layers; the plate contains a pattern of holes which achieves the desired coupling. Analytical and experimental programs have been implemented to determine the optimum hole size and distribution. Simulation techniques in rectangular waveguide were employed for convenience in measurements. The bend design was measured to have a reflection less than 2 dB SWR over a ten percent frequency band; this is computed to contribute less than 0.2 dB SWR to the reflection seen by the feed-horn of a double-layer pillbox. The bend introduces less than -22 dB of cross-polarization in the antenna radiation. Measurements of a pillbox model incorporating the bend design have verified the predicted performance of the coupler-type bend.

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A Parallel-Plate Waveguide Approach to Microminiaturized, Planar Transmission Lines for Integrated Circuits

H. Guckel, P.A. Brennan and I. Palocz. "A Parallel-Plate Waveguide Approach to Microminiaturized, Planar Transmission Lines for Integrated Circuits." 1967 Transactions on Microwave Theory and Techniques 15.8 (Aug. 1967 [T-MTT]): 468-476.

The parallel-plate waveguide with a two-layer loading medium, a conducting semiconductor substrate, and a relatively thin dielectric layer approximates the interconnections in many integrated systems if the fringing fields are ignored. The fundamental mode of this structure is an E mode which is a surface wave. Its propagation behavior is analyzed in this paper and the equations are evaluated by highly accurate numerical methods. The semiconducting substrate is characterized by its dielectric constant and conductivity. A critical conductivity σ_{min} exists and is related to the cross sectional and material parameters. If the substrate conductivity is given by σ_{min} then the attenuation constant of the line is a minimum. The same value of conductivity yields minimum phase distortion at maximum bandwidth. If the conductivity is larger than σ_{min} the substrate acts as a poor conductor with associated skin effect; if it is smaller, lossy dielectric behavior results. Analysis shows that it is appropriate to subdivide the frequency range into three intervals. The lowest-frequency interval is characterized by propagation which resembles diffusion. This is caused by the loss in the dielectric layer. The next frequency range extends to some upper frequency which is determined by substrate conductivity and the cross-sectional dimensions. In this interval, the phase velocity of the fundamental mode is controlled by the ratio of dielectric to semiconductor thickness, which, if typical interconnections are considered, implies a very low velocity. This property indicates that the structure can serve as a delay line. Further increases in frequency result in higher phase velocities. Skin effect and dielectric loss behavior describe the propagation in this third interval.





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Analysis and Calibration of a Reflection Coefficient Bridge for Use with Any Waveguide Mode (Correspondence)

K.S. Champlin, J.D. Holm and D.B. Armstrong. "Analysis and Calibration of a Reflection Coefficient Bridge for Use with Any Waveguide Mode (Correspondence)." 1967 Transactions on Microwave Theory and Techniques 15.8 (Aug. 1967 [T-MTT]): 477-478.

Single-frequency measurements of both absolute phase and absolute magnitude of a complex reflection coefficient are required in determining complex permittivity by the Roberts-von Hippel method. The slotted line, although traditionally the basic tool for these measurements, suffers from several disadvantages. Among them are errors caused the perturbing influence of the probe and slot and decreased precision at short (millimeter) wavelengths and low VSWR's. Reflectometers the Engen and Beatty type and "return-loss test sets" such as used by Pomeroy yield high precision at low VSWR's but measure only magnitude and are therefore unacceptable. Some microwave bridges measure complex reflection coefficient, however, thus offering an effective alternative to the slotted line.

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Magnetodynamic Modes in Axially Magnetized Ferrite Rods Between Two Parallel Conducting Sheets (Correspondence)

H.-D. Godtmann and W. Haas. "Magnetodynamic Modes in Axially Magnetized Ferrite Rods Between Two Parallel Conducting Sheets (Correspondence)." 1967 Transactions on Microwave Theory and Techniques 15.8 (Aug. 1967 [T-MTT]): 478-480.

Open electromagnetic resonators are well-known structures for many applications in the microwave region. Assuming a lossless nonconducting medium partly surrounded by perfectly conducting metal walls, a manifold of undamped oscillations may exist provided the energy of the corresponding electromagnetic field (with finite amplitude) remains finite. In practice, high Q modes occur in open resonators built from isotropic or anisotropic dielectrics or ferrites partly enclosed by well conducting metal walls. In the case of ferrites, the resonator is tunable by a dc magnetic field which may be useful for many technical applications.

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Abstracts

Relative Humidity Effects in Microwave Resonators (Correspondence)

D.M. Smith. "Relative Humidity Effects in Microwave Resonators (Correspondence)." 1967 Transactions on Microwave Theory and Techniques 15.8 (Aug. 1967 [T-MTT]): 480-482.

Several factors affect the frequency stability of microwave resonators. One important factor is the stability of the dielectric medium which fills the resonator. It is the purpose of this correspondence to analyze the effect of the change in dielectric constant upon the resonant frequency of a sealed, air-filled resonator.



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Optimum Elliptic-Function Filters for Distributed Constant Systems (Correspondence)

L. Fraiture and J. Neiryck. "Optimum Elliptic-Function Filters for Distributed Constant Systems (Correspondence)." 1967 Transactions on Microwave Theory and Techniques 15.8 (Aug. 1967 [T-MTT]): 482-483.

It is shown from an example that the derivation of distributed constant filters from lumped-element filters through Kuroda's transformation leads to less selectivity than can be obtained with the same number of elements, when the unit elements are also made to contribute to the filtering.



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Higher Order Modes in Rectangular Coaxial Waveguides (Correspondence)

L. Gruner. "Higher Order Modes in Rectangular Coaxial Waveguides (Correspondence)." 1967 Transactions on Microwave Theory and Techniques 15.8 (Aug. 1967 [T-MTT]): 483-485.

A precise determination of the characteristic impedance of rectangular coaxial waveguides has been recently undertaken by Cruzan and Garver and it is well known that these structures have many applications in the design of shielded striplines, varactor mounts, etc. While their operation is, in general, confined to the TEM mode, there are instances when higher-order modes must be taken into account; the effect of the latter on striplines has been studied by Oliner, but there appears to be no record of a similar investigation applicable to rectangular coaxial waveguides.



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Abstracts

Numerical Solution of TEM-Line Problems Involving Inhomogeneous Media (Correspondence)

H.E. Brenner. "Numerical Solution of TEM-Line Problems Involving Inhomogeneous Media (Correspondence)." 1967 Transactions on Microwave Theory and Techniques 15.8 (Aug. 1967 [T-MTT]): 485-487.

Both empirical and analytical methods have been used in the past to evaluate the characteristic impedance of transmission lines supporting the TEM mode of wave propagation. Most of the analytical methods are rather tedious for practical use, employ approximations, or are restricted to simple configurations.



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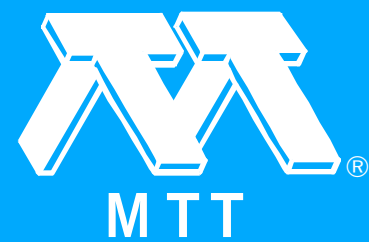
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Realizations of a Duo-Pole Branch of an Elliptic-Function Bandstop Filter (Correspondence)

B.M. Schiffman. "Realizations of a Duo-Pole Branch of an Elliptic-Function Bandstop Filter (Correspondence)." 1967 Transactions on Microwave Theory and Techniques 15.8 (Aug. 1967 [T-MTT]): 487-487.

This correspondence illustrates six realizations of the TEM line (transformed) equivalent of the LC network A of Fig. 1. Network A is here taken to represent a shunt branch of a low-pass elliptic-function ladder filter. Richards' transformation converts a lumped element low-pass filter to a transmissionline bandstop filter. Each filter element, L or C, is then replaced by a short- or open-circuited quarter-wave stub. Thus, network A is transformed to network B, with parameters as defined in Fig. 1. The six stripline and reentrant slabline networks C-H are equivalent to network B and are well suited for microwave filters. The characteristic impedances of the lines in networks C, D, E, and H are given in Fig. 1, and the coupled-line impedances of networks F and G are given in Schiffman and Matthaei and Schiffman.

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Characteristic Impedance of Multifin Transmission Lines (Correspondence)

C.R. Boyd. "Characteristic Impedance of Multifin Transmission Lines (Correspondence)." 1967 Transactions on Microwave Theory and Techniques 15.8 (Aug. 1967 [T-MTT]): 487-488.

Several years ago, the author had occasion to investigate the characteristic impedance properties of a TEM transmission line of unusual cross section. Specifically, the cross section consisted of around outer conductor with a center conductor composed of a number of thin fins symmetrically positioned about the axis of the line. Examples of this general class of cross section are illustrated in Fig. 1 for the cases of two, three, four, and six fins. Solutions for the characteristic impedances of this type of configuration were obtained by an interesting series of conformal transformations that mapped the multifin line geometry into that of a symmetric strip transmission line. Since the characteristic impedance of the latter is well known, curves can readily be generated for the multifin line impedance.

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Cylindrical Waveguides Containing Inhomogeneous Dielectric (Correspondence)

S.L. Richter, Y. Klinger and E. AhSam. "Cylindrical Waveguides Containing Inhomogeneous Dielectric (Correspondence)." 1967 Transactions on Microwave Theory and Techniques 15.8 (Aug. 1967 [T-MTT]): 488-489.

In the above correspondence, AhSam and Klinger discussed the difficulty of obtaining complete analytic solutions for propagation of electromagnetic waves in inhomogeneous media with circular cylindrical symmetry. In order to aid the search for exact solutions, they studied the special case in which the relative permittivity, independent of the azimuthal and axial coordinates, varies inversely as the square of the radius so that two of the six field equations uncouple.

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Abstracts

Contributors (Aug. 1967 [T-MTT])

J.E. Becker, P.A. Brennan, J.B. Davies, H. Guckel, R.A. Kolker, V. Mazzola, G.C. McCormick, C.A. Muilwyk, I. Palocz and Y.J. Seto. "Contributors (Aug. 1967 [T-MTT])." 1967 Transactions on Microwave Theory and Techniques 15.8 (Aug. 1967 [T-MTT]): 489-490.



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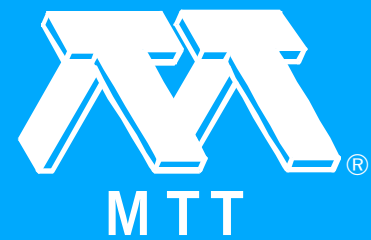
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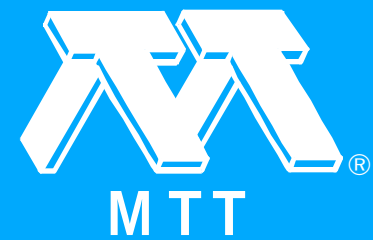
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Abstracts

Least-Weighted-Square Method for Analysis and Synthesis of Transmission Lines

N. Seshagiri. "Least-Weighted-Square Method for Analysis and Synthesis of Transmission Lines." 1967 Transactions on Microwave Theory and Techniques 15.9 (Sep. 1967 [T-MTT]): 494-503.

Analysis and synthesis of transmission lines of arbitrary geometry are not easy to realize with currently available methods. The object of this paper is to show that by introducing a new principle to be called the "least-weighted-square invariance deformation," it is possible to solve transmission line problems to desired orders of accuracy. A procedure based on this principle is given for deforming a given transmission line geometry keeping the characteristic impedance an invariant, or for synthesizing a transmission line cross-sectional geometry corresponding to the given constant parameters of the structure. The method is applied to the analysis of transmission lines having a regular polygonal outer conductor and a circular inner conductor. An application to a representative situation in synthesis is also described.



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An Analysis of the "Quarter-Wave" Technique of Reducing the Errors in UHF and Microwave Impedance Measurement

W.E. Little, D.A. Ellerbruch and G.F. Engen. "An Analysis of the "Quarter-Wave" Technique of Reducing the Errors in UHF and Microwave Impedance Measurement." 1967 Transactions on Microwave Theory and Techniques 15.9 (Sep. 1967 [T-MTT]): 504-507.

An analysis is given of the "quarter-wave" impedance measurement technique. This technique, which finds its widest potential application in conjunction with standing wave machines, permits the approximate elimination of the error due to residual reflection or VSWR. If the other sources of error are small, the potential reduction in error is in the ratio $|t_{11}/2|/|S_{11}|$, where S_{11} and t_{11} are the residual reflection coefficients of the standing wave machine and quarter-wavelength section, respectively.

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Solution of Waveguide Discontinuities by Modal Analysis

A. Wexler. "Solution of Waveguide Discontinuities by Modal Analysis." 1967 Transactions on Microwave Theory and Techniques 15.9 (Sep. 1967 [T-MTT]): 508-517.

A general method is presented for analysis of waveguide junctions and diaphragms by summing normal modes of propagation, giving solutions for the resulting scattered modes. Because interaction effects of dominant and higher-order modes between discontinuities are allowed, finite-length obstructions can be studied. Solutions are found without any prior assumption about the total fields existing at the discontinuities and, as a result, the formulation is applicable to a wide range of problems. The technique proves to be simple and is ideally suited to computers, involving mainly the solution of sets of simultaneous linear equations. Thick and thin symmetrical bifurcations of a rectangular guide are studied. Forward-scattered mode amplitudes and input admittances are calculated, the computed admittance of the thin bifurcation is compared with well-known results, and transverse field patterns on both sides of the junction are plotted, thus showing the accuracy of the match. The results of a finite-length bifurcation by a thick vane are presented for a range of lengths, the parameters of the equivalent T network being given in each case. For very short lengths, the problem corresponds to an inductive strip across the guide.

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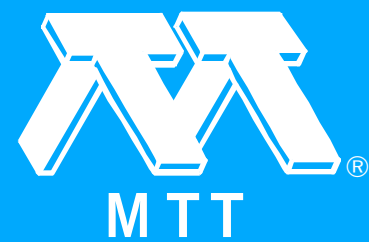
A One-GHz Ferroelectric Limiter

J.B. Horton and M.R. Donaldson. "A One-GHz Ferroelectric Limiter." 1967 Transactions on Microwave Theory and Techniques 15.9 (Sep. 1967 [T-MTT]): 517-523.

The design and analysis of a 1-GHz limiter which uses voltage variation of the dielectric constant of a ferroelectric material to achieve limiting is described. An RF electric field derived from the input power is used to change the relative dielectric constant ϵ_r of the material; the resulting nonlinear change of capacitance of a small element of the material is used to change the condition of a tuned circuit. The tuned circuit terminates a quarter-wavelength stub which shunts the main transmission line, thereby providing a power-dependent mismatch at the junction of the two transmission lines. The degree of this mismatch is controlled by the condition of the tuned circuit and, therefore, the magnitude of the input power. Theoretical analysis and experimental results for small signal and large signal operation are presented. Limiter analysis is based on the measured change of ferroelectric (nonlinear) capacitance as a function of dc electric field. The ferroelectric element is 0.011 by 0.013 by 0.020 (inches) machined from polycrystalline (Pb/sub 0.315/-Sr/sub 0.685/) TiO/sub 3/ material.

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Two Partially Filled Cavity-Resonator Techniques for the Evaluation of Scalar Permittivity and Permeability of Ferrites (Correspondence)

J.K. Sinha. "Two Partially Filled Cavity-Resonator Techniques for the Evaluation of Scalar Permittivity and Permeability of Ferrites (Correspondence)." 1967 Transactions on Microwave Theory and Techniques 15.9 (Sep. 1967 [T-MTT]): 523-525.

The two cavity-resonator techniques described earlier for measuring pure dielectrics, one using rod samples in the cylindrical cavity system, and the other using slabs in a rectangular cavity system, have been extended for measuring magnetic dielectrics such as ferrites. As there are four parameters that need to be evaluated, i.e., ϵ_r , μ_r , $\tan \delta/\epsilon_r$, and $\tan \delta/\mu_r$; four independent measurements, two of the wavelengths in the partially filled portion, and two of the Q are needed. These two sets of measurements may either be obtained by using two different samples as in Srivastava's method, or by using only one sample and obtaining the second set of measurements at a slightly different frequency (2 to 5 percent difference) and assuming that both μ and ϵ remain unaltered at this frequency. Since the cavities used in these methods are tunable, the second alternative, giving the unique advantage of using only one sample, is available.



Abstracts

Design of TEM Equal Stub Admittance Filters (Correspondence)

H.J. Hindin and J.J. Taub. "Design of TEM Equal Stub Admittance Filters (Correspondence)." 1967 Transactions on Microwave Theory and Techniques 15.9 (Sep. 1967 [T-MTT]): 525-528.

Filters formed in TEM transmission lines by short-circuited stubs that are $\lambda/4$ in length at the design center frequency and separated by the same length have useful bandpass properties in wideband (typically 10 percent to one-octave bandwidth) applications.



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Abstracts

On the Design of Stepped Transmission-Line Transformers (Correspondence)

M.A. Hamid and M.M. Yunik. "On the Design of Stepped Transmission-Line Transformers (Correspondence)." 1967 *Transactions on Microwave Theory and Techniques* 15.9 (Sep. 1967 [T-MTT]): 528-529.

The problem of matching a complex load impedance to a given transmission line using a series matching transformer is considered with a view to minimizing the transformer length and overall insertion loss. A graphical technique is presented that leads to a solution for the length and characteristic impedance of the transformer section. It is shown that this transformer reduces to the usual quarter-wave transformer for the particular case where the load is purely resistive. The performance of the transformer is also compared with the quarter-wave transformer for the case of a complex load impedance and a numerical example is given. It is shown that the design procedure is relatively simple and may lead to a significant reduction in the overall length and insertion loss of the matching section. While there is no significant improvement in the bandwidth for frequency-dependent loads, the proposed design still offers attractive features for matching transmitting antennas.



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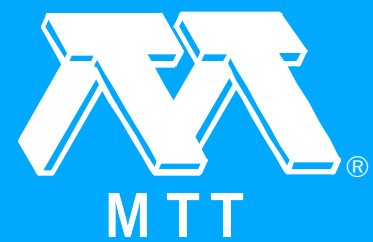
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Nonsymmetrical Coupled Lines of Reentrant Cross Section (Correspondence)

E.G. Cristal. "Nonsymmetrical Coupled Lines of Reentrant Cross Section (Correspondence)." 1967 Transactions on Microwave Theory and Techniques 15.9 (Sep. 1967 [T-MTT]): 529-530.

Frequently, UHF and microwave TEM components require tightly coupled transmission lines, directional couplers of greater than -8 dB coupling, narrow-to-moderate-bandwidth bandpass filters, moderate-to-widebandwidth stopband filters, and 90-degree phase shifters are some examples. The novel geometry of the directional coupler with reentrant cross section can result in very tightly coupled transmission lines and has been proved practical and useful. Recently, the basic geometry and the corresponding design equations for directional couplers with reentrant cross section were extended to provide a slightly more general geometry capable of even greater coupling with practical physical dimensions. However, in the afore-mentioned cases, only symmetrical geometries and their related equations were presented. In this correspondence, the basic reentrant cross-sectional geometry and associated equations are generalized to include the nonsymmetrical case which is important for nonsymmetrical directional couplers and coupled strip transmission-line filters requiring coupled non-symmetrical lines.

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Circulator Action at 140 GHz in a Semiconductor Loaded Waveguide Junction (Correspondence)

M. Brodwin and S. Kahn. "Circulator Action at 140 GHz in a Semiconductor Loaded Waveguide Junction (Correspondence)." 1967 Transactions on Microwave Theory and Techniques 15.9 (Sep. 1967 [T-MTT]): 530-531.

Circulator action has been observed in an E-plane "Y" waveguide junction having an InSb rod aligned with the principal symmetry axis of the junction. With the junction cooled to 77°K, typical isolations of 14-17 dB have been obtained at 138.5-140.1 GHz by applying a 10.5-kG magnetic field along the symmetry axis. Standing wave ratio was 1.92 at the input port but showed an unexplained decrease to 1.27 at a temperature slightly above 77°K. When the apparatus was warmed up to room temperature, only reciprocal behavior was observed.

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



Abstracts

Comparison of rho Plane with H-Plane Negative Resistance Stability Criteria Using the Smith Chart (Correspondence)

J.W. Bandler. "Comparison of rho Plane with H-Plane Negative Resistance Stability Criteria Using the Smith Chart (Correspondence)." 1967 Transactions on Microwave Theory and Techniques 15.9 (Sep. 1967 [T-MTT]): 532-533.

The Nyquist-type negative+resistance stability criterion is formulated directly in terms of a transformed reflection coefficient. It is compared with the immittance plane criterion, particular attention being paid to the "arbitrary closing loops." It is concluded that the immittance plane criterion is the least ambiguous and therefore the easiest to use.



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Abstracts

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M.E. Donaldson, D.A. Ellerbruch, G.F. Engen, J.B. Horton, W.E. Little, N. Seshagiri and A. Wexler. "Contributors (Sep. 1967 [T-MTT])." 1967 Transactions on Microwave Theory and Techniques 15.9 (Sep. 1967 [T-MTT]): 533-534.



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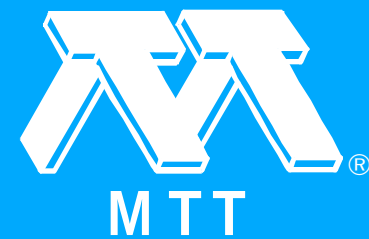
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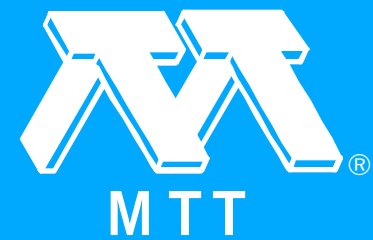
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Tunnel-Diode Low-Level Detection

W.F. Gabriel. "Tunnel-Diode Low-Level Detection." 1967 Transactions on Microwave Theory and Techniques 15.10 (Oct. 1967 [T-MTT]): 538-553.

An analysis of tunnel-diode low-level detection is presented for the purpose of explaining some of the unusual detection characteristics that occur under certain bias conditions. For example, in the vicinity of its inflection bias point, a tunnel diode exhibits a discriminator-like rectification behavior with two sensitivity peaks. When biased at one of these peaks, the diode is capable of unusually high sensitivities, at least an order of magnitude better than the sensitivity of any other known diode. It is shown that these high sensitivities are proportional to $(1 - \Gamma^2)$, where Γ^2 is the RF power gain of the detector viewed as a reflection-type amplifier. The resultant gain bandwidth (or sensitivity bandwidth) limitations of the detector are discussed. Unusually high sensitivities are also possible at the lower microwave frequencies when the tunnel diode is biased at its peak current point. A knowledge of the diode static characteristics, the reflection coefficient, and the video circuit permits an accurate analytical evaluation of the sensitivity performance of any tunnel diode, and calculations are carried out for an example diode and compared against measured data. The paper also contains a specific comparison of the relative sensitivity performance of the example tunnel diode versus a hot carrier diode.





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A Design Technique for Realizing a Microwave Tunnel-Diode Amplifier in Stripline

B.A. Miller, T.P. Miles and D.C. Cox. "A Design Technique for Realizing a Microwave Tunnel-Diode Amplifier in Stripline." 1967 Transactions on Microwave Theory and Techniques 15.10 (Oct. 1967 [T-MTT]): 554-561.

A significant problem in realizing a practical tunnel-diode amplifier is that of stabilizing the amplifier both within and outside its passband while maintaining a specified center-frequency gain and bandwidth. A new technique for realizing a moderate-bandwidth tunnel-diode amplifier that utilizes a directional filter as a bandpass structure is described. This technique was investigated analytically and an experimental S-band amplifier was built and tested. This experimental amplifier had typically the following characteristics: bandwidth, 400 MHz; center frequency, 2.9 GHz; and center-frequency gain, 12.5 dB. The technique described yields an amplifier which is reproducible and which has an analytically predictable and well-defined response. None of the experimental models have shown any tendencies toward oscillation.

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Abstracts

The Overdriven Varactor Upper Sideband Upconverter

A.I. Grayzel. "The Overdriven Varactor Upper Sideband Upconverter." 1967 Transactions on Microwave Theory and Techniques 15.10 (Oct. 1967 [T-MTT]): 561-565.

The equations for the overdriven upper sideband upconverter are derived and computer solutions are given for the abrupt junction, graded junction, and punch through varactor. The necessary design parameters are presented for the design of an upconverter. The performance of the abrupt, graded, and punch through varactors are compared.



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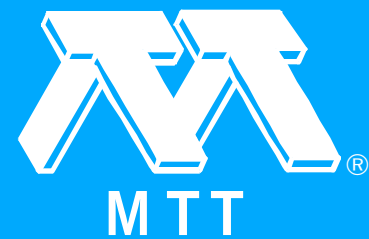
An Adjustable Narrow Band Microwave Delay Equalizer

T.A. Abele and H.-C. Wang. "An Adjustable Narrow Band Microwave Delay Equalizer." 1967 Transactions on Microwave Theory and Techniques 15.10 (Oct. 1967 [T-MTT]): 566-574.

A simple low loss microwave delay equalizer for the delay equalization of narrow band microwave bandpass filters has been explored. This equalizer is quite small and does not require the use of additional components such as circulators or hybrids. It exhibits a reflection coefficient of less than 1 percent and possesses two very valuable and convenient features: a continuous adjustment of the delay shape and of the center frequency. The structure is analyzed theoretically, an equivalent circuit is derived, and expressions for both delay and loss are given. Also presented are design data and experimental results concerning the actual delay equalization of a bandpass filter and the temperature behavior of the equalizer and the filter-equalizer combination.

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The Accuracy of Finite-Difference Solutions of Laplace's Equation

J.W. Duncan. "The Accuracy of Finite-Difference Solutions of Laplace's Equation." 1967 Transactions on Microwave Theory and Techniques 15.10 (Oct. 1967 [T-MTT]): 575-582.

The cross sections of most TEM mode transmission lines have reentrant corners or edges where the potential gradient is singular. In this paper the accuracy of the finite-difference solution for the electric field normal to the conductor boundary at a right-angle corner and at the edge of a thin plate is examined. The accuracy of the finite-difference solution is related to the mesh length h , the magnitude of the lattice point residuals, and the finite-difference operator which is used in place of the Laplacian differential operator. The computing time required to solve the mesh equations by the method of successive overrelaxation is specified. The surface charge density in the neighborhood of the boundary singularity is expressed as a truncated series of circular harmonics. As a result, the integral of the surface charge can be calculated with very good accuracy. The paper concludes by using the harmonic series treatment to determine the capacitance per unit length of a square coaxial transmission line.

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The Negative Capacitor, An Impedance Matching Element for Dielectric-Filled Transmission Line (Correspondence)

A.J. Kelly. "The Negative Capacitor, An Impedance Matching Element for Dielectric-Filled Transmission Line (Correspondence)." 1967 Transactions on Microwave Theory and Techniques 15.10 (Oct. 1967 [T-MTT]): 583-584.

The well-known problem of a capacitive dielectric window in an air-filled cylindrical transmission line can be extended to the general problem in which the transmission line is dielectric filled, as shown in Fig. 1. This leads to a unique result, When the dielectric constant of the window is less than that of the loading material, the window can be represented by a shunt negative capacitor at the reference plane $Z_{0'}$ in the uniformly filled line. This result does not contradict Foster's reactance theorem. The negative capacitor is a lumped parameter representation of a distributed-parameter network and, as such, has no accessible port. The lumped-parameter representation-even though it entails some approximations-facilitates the use of the window for impedance matching.



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High-Power S-Band Power Divider (Correspondence)

R.M. True. "High-Power S-Band Power Divider (Correspondence)." 1967 Transactions on Microwave Theory and Techniques 15.10 (Oct. 1967 [T-MTT]): 584-586.

The problem of covering the full power range from milliwatts to megawatts in laboratory experiments, with a minimum number of RF power source, and instrumentation changes, has always existed in the field of microwaves. A high-power attenuator, covering a 20 or 30 dB power range using a single RF power source, is needed so that experiments can yield more complete data. The power source used could be set to a fixed frequency and output power level, and the attenuator could be adjusted to supply discrete amounts of power, as needed, to test an experimental device. The frequency of the power source would not have to be readjusted each time the power out of the attenuator is changed.

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Controlled Wideband Differential Phase Shifters Using Varactor Diodes (Correspondence)

C.A. Liechti and G.W. Epprecht. "Controlled Wideband Differential Phase Shifters Using Varactor Diodes (Correspondence)." 1967 Transactions on Microwave Theory and Techniques 15.10 (Oct. 1967 [T-MTT]): 586-589.

For phased array transmitting systems diode step phase shifters of limited bandwidth have been developed. Thereby PIN diodes are used because they switch high peak power with low loss. In certain receiving systems and in most microwave measurements, however, a continuous phase adjustment is required. Thus, low power analog phase shifters covering broad frequency bands are desirable. This correspondence describes an electronically-controlled three-port network using varactor diodes, which produces a constant phase difference between the two output ports.

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Abstracts

Bandwidth Curves for Mumford's Maximally Flat Filter (Correspondence)

B.M. Schiffman. "Bandwidth Curves for Mumford's Maximally Flat Filter (Correspondence)." 1967 Transactions on Microwave Theory and Techniques 15.10 (Oct. 1967 [T-MTT]): 589-589.

In 1963, Mumford published design tables for a maximally flat symmetrical band-pass filter composed of six or fewer shorted quarterwave stubs separated by quarterwave lines of unit impedance. The tables were extended to ten stubs in 1965. These tables list the stub normalized admittances $k_{\text{sub } i}$ for given values of n (the number of stubs) and a band-width-related parameter ($10 \log K_{\text{sub } n}$) calculated from the $k_{\text{sub } i}$.



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Design Curves for Waveguide Absorbers (Correspondence)

H.R. Witt and E.L. Price. "Design Curves for Waveguide Absorbers (Correspondence)." 1967 Transactions on Microwave Theory and Techniques 15.10 (Oct. 1967 [T-MTT]): 590-590.

Normalized curves are presented for the design of waveguide absorbers consisting of thin uniformly spaced sheets of resistive material. An analysis of absorption in rectangular waveguides containing parallel sheets of resistive material uniformly spaced across the waveguide was carried out by Witt et al. A conclusion of this work was that when the operating frequency is in excess of about 1.5 to 2 times the cutoff frequency for the TE/sub 10/ mode in the unloaded waveguide and the number of sheets exceeds three or four, then the loaded waveguide solutions closely approach the solutions that apply to an infinite array of parallel resistive sheets. Thus, provided that these conditions are satisfied, the infinite array theory can be used to design waveguide absorbers.

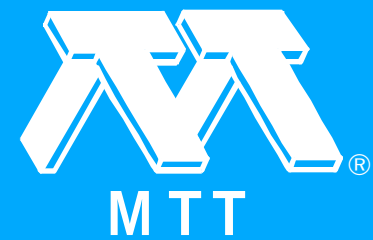
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T.A. Abele, D.C. Cox, J.W. Duncan, W.F. Gabriel, A.I. Grayzel, T.P. Miles, B.A. Miller and H.-C. Wang. "Contributors (Oct. 1967 [T-MTT])." 1967 Transactions on Microwave Theory and Techniques 15.10 (Oct. 1967 [T-MTT]): 591-592.



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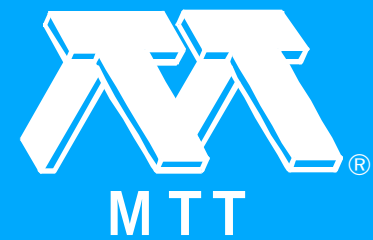
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Membership Application (Oct. 1967 [T-MTT])

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Abstracts

A Directional Coupler with a Readily Calculable Coupling Ratio

M.B. Hall and W.E. Little. "A Directional Coupler with a Readily Calculable Coupling Ratio." 1967 Transactions on Microwave Theory and Techniques 15.11 (Nov. 1967 [T-MTT]): 598-603.

A microwave (X-band) directional coupler consisting of two adjacent lengths of parallel waveguide with a common tantalum wall about for skin depths in thickness has been fabricated and studied. Coupling between the guides is effected through energy transfer via the electromagnetic fields penetrating the thin tantalum foil separating the guides. The coupling ratio of the device can be calculated by a straight-forward procedure to within experimental error (currently a few tenths of a decibel in over 70 decibels).



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An Approximate Nonlinear Analysis of Tunnel-Diode Converters

C.C.H. Tang. "An Approximate Nonlinear Analysis of Tunnel-Diode Converters." 1967 Transactions on Microwave Theory and Techniques 15.11 (Nov. 1967 [T-MTT]): 604-612.

Approximate analyses published previously on tunnel-diode converters are basically phenomenological in nature by restricting the currents flowing through the tunnel diode or (and) the voltage across it to the signal, local oscillator, and intermediate frequencies only. Because of the nonlinear nature of the tunnel diode, many higher-order frequency components corresponding to harmonics and products, sums, and differences of the above mentioned frequencies are present. By including the effects of series resistance and series inductance and restricting the operating region within the parabolic portion of the tunnel-diode characteristics, the present analysis attempts to formulate the problem in a "rigorous" manner through the derivation of a second-order nonautonomous nonlinear differential equation with time-varying coefficients. The solution to a "first-order" approximation is obtained by incorporating a variational type treatment with an expansion type perturbation method. In an effort to verify the validity of the theoretical results obtained by the nonlinear analysis, an analog simulation is carried out since the control of required parameters in actual experiments is extremely difficult, especially in the microwave frequency region. The general agreement between the theoretical results and the analog simulation is promising and, therefore, should yield enough information to facilitate the control and adjustment of the various parameters in actual experiments especially in the microwave region. Specifically, we have verified by the analog simulation the theoretical prediction that the optimized conversion gain is obtained when the source resistance is about one third of the load resistance. In addition to minimizing the converter noise, the noise due to the first IF amplifier can also be minimized by selection of the correct converter load resistance by using Figs. 4 through 8.



Abstracts

Microwave Amplifiers Employing Integrated Tunnel-Diode Devices

H.C. Okean. "Microwave Amplifiers Employing Integrated Tunnel-Diode Devices." 1967 Transactions on Microwave Theory and Techniques 15.11 (Nov. 1967 [T-MTT]): 613-622.

A series of shunt-tuned integrated microwave tunnel-diode devices utilizing unencapsulated beam lead tunnel diodes and including tuning and stabilizing circuitry have been fabricated using tantalum thin-film technology for use as the active element in microwave reflection amplifiers. The theoretical properties of such devices have been explored, and data relating to their design and measured performance are presented in detail. Finally, the successful use of these devices as the active elements in a series of absolutely stable circulator-coupled reflection amplifiers at 4 and 6 GHz has been demonstrated.



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Ring Circulator Theory, Design, and Performance

S.D. Ewing, Jr. and J.A. Weiss. "Ring Circulator Theory, Design, and Performance." 1967 Transactions on Microwave Theory and Techniques 15.11 (Nov. 1967 [T-MTT]): 623-628.

A compact, symmetrical, three-port S-band circulator composed of reciprocal T junctions and nonreciprocal phase shifters is investigated theoretically, and its experimental performance results are presented. The comparison of these results demonstrates that 1) circulators can be designed and their experimental performance described from a network model and 2) there is no theoretical limitation on the minimum amount of total differential phase shift necessary for perfect circulation. Bandwidth is investigated and techniques are discussed, including the introduction of a "backward wave" phase shifter, for achieving larger bandwidths. The stripline nonreciprocal comb-filter phase shifter used in the ring circulator is described and performance results are given.

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Noise Figure and Conversion Loss of the Schottky Barrier Mixer Diode

M.R. Barber. "Noise Figure and Conversion Loss of the Schottky Barrier Mixer Diode." 1967 Transactions on Microwave Theory and Techniques 15.11 (Nov. 1967 [T-MTT]): 629-635.

The theory of mixer operation is briefly reviewed and the results presented in graphical form convenient to the designer. In particular, the minimum noise figure, conversion loss, and the source and output impedances are plotted as functions of the pulse duty ratio of the diode current. Emphasis is placed on the pulse duty ratio as a more fundamental parameter for defining mixer operation than the magnitude of the diode voltage which is generally nonsinusoidal. It is shown that Schottky diode mixers should exhibit single sideband noise figures as low as 3 dB at X band when used in conjunction with 1.5 dB noise figure IF amplifiers, provided the diodes have cutoff frequencies higher than 500 GHz.

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Waveguides Containing Moving Dispersive Media

H. Gruenberg and P. Daly. "Waveguides Containing Moving Dispersive Media." 1967 Transactions on Microwave Theory and Techniques 15.11 (Nov. 1967 [T-MTT]): 636-642.

Perturbation formulas are derived for the changes in the dispersion curves and phase velocity for the modes in an arbitrary composite waveguide structure containing dispersive media in relative motion. The formulas are also valid when the media are fluids with arbitrary velocity distributions. It is shown that the relativistic transformation laws for the frequency and wave vector of uniform plane waves are also valid for waveguide modes provided that all moving media that make up the guide move with the same velocity. There are also difficulties when the moving media are dispersive. In general, one must therefore obtain the dispersion relation directly from the field equations or from the perturbation formulas. An example involving a simple surface wave along the interface of a moving plasma and a dielectric is worked out by both methods. As an interesting side result, it is found that plane waves in an unbounded isotropic plasma have phase velocities independent of the motion of the plasma.



Abstracts

Computation of Impedance of Partially Filled and Slotted Coaxial Line (Correspondence)

T. Hatsuda and T. Matsumoto. "Computation of Impedance of Partially Filled and Slotted Coaxial Line (Correspondence)." 1967 Transactions on Microwave Theory and Techniques 15.11 (Nov. 1967 [T-MTT]): 643-644.

The upper and lower bounds of the characteristic impedance of the slotted coaxial line has already been evaluated by means of a variational expression.



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Determination of Thermal Conductance of Dielectric-Filled Strip Transmission Line From Characteristic Impedance (Correspondence)

R.C. Levine. "Determination of Thermal Conductance of Dielectric-Filled Strip Transmission Line From Characteristic Impedance (Correspondence)." 1967 Transactions on Microwave Theory and Techniques 15.11 (Nov. 1967 [T-MTT]): 645-646.

The thermal conductance and electrical capacitance of nonmagnetic dielectric-filled TEM transmission lines are related to very close approximation by the simple formula.



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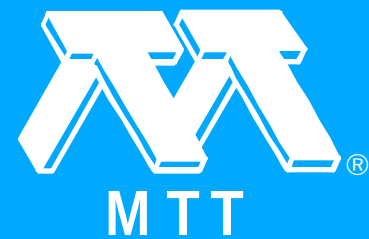
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A New Microwave Phase Equalizer Network (Correspondence)

G.F. Ross. "A New Microwave Phase Equalizer Network (Correspondence)." 1967 Transactions on Microwave Theory and Techniques 15.11 (Nov. 1967 [T-MTT]): 647-650.

This correspondence describes a new microwave allpass phase equalizer network using directly connected TEM mode transmission lines. Networks of this type have found recent application in wideband radar systems employing microwave matched filters. In the network described, transmission lines are interconnected to closely approximate a periodic repetition of the lowpass transfer function $H(p)=(p-a)/(p+a)$, where p is the complex frequency variable $p=\sigma+j\omega$. A synthesis technique is presented which permits the designer to arbitrarily locate the pole-zero pair of the transfer function in the left and right half-plane, respectively. The correspondence concludes with an illustrative filter design. A network meeting the design specifications is fabricated in the shop and its response is evaluated in the laboratory using time-domain reflectometer techniques. The experiment results are shown to be in close agreement with the theory.

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



Abstracts

Mounted Diode Equivalent Circuits (Correspondence)

W.J. Getsinger. "Mounted Diode Equivalent Circuits (Correspondence)." 1967 Transactions on Microwave Theory and Techniques 15.11 (Nov. 1967 [T-MTT]): 650-652.

The use of semiconductor diodes at microwave frequencies continues to arouse interest in practical circuit characterization for mounted diodes.



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Dual-Mode Coupler (Correspondence)

R.C. Johnson, F.L. Cain and E.N. Bone. "Dual-Mode Coupler (Correspondence)." 1967 Transactions on Microwave Theory and Techniques 15.11 (Nov. 1967 [T-MTT]): 651-652.

The dual-mode coupler discussed in this correspondence is a junction in which two rectangular waveguides excite orthogonal dominant modes (TE_{10} and TE_{01}) in a square waveguide. The coupler performs well over a relatively broad frequency band, and its simple configuration lends itself to fabrication by electroforming.

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Isolation of Lossy Transmission Line Hybrid Circuits (Comments)

B. McGough and R.M. Kurzrok. "Isolation of Lossy Transmission Line Hybrid Circuits (Comments)." 1967 Transactions on Microwave Theory and Techniques 15.11 (Nov. 1967 [T-MTT]): 652-653.

I should like to call attention to several errors appearing in the above correspondence. These errors are presumably typographical, and indeed do not affect the calculated isolation values. However, they could impair the utility of the correspondence to the reader wishing to extend the analysis to calculate the remaining properties of the two hybrid types. The errors are listed in the following.

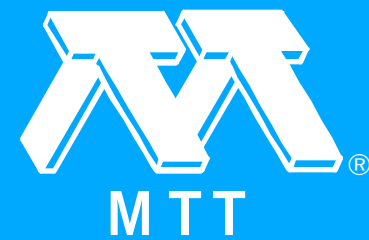
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Contributors (Nov. 1967 [T-MTT])

M.R. Barber, P. Daly, S.D. Ewing, Jr., H. Gruenberg, M.B. Hall, W.E. Little, H.C. Okean, C.C.H. Tang and J.A. Weiss. "Contributors (Nov. 1967 [T-MTT])." 1967 Transactions on Microwave Theory and Techniques 15.11 (Nov. 1967 [T-MTT]): 654-655.



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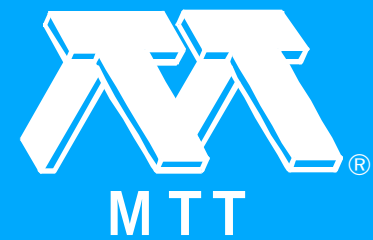
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Information for Authors (Nov. 1967 [T-MTT])

"Information for Authors (Nov. 1967 [T-MTT])." 1967 Transactions on Microwave Theory and Techniques 15.11 (Nov. 1967 [T-MTT]): 656-656.



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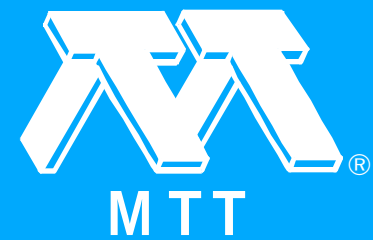
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Table of Contents (Dec. 1967 [T-MTT])

"Table of Contents (Dec. 1967 [T-MTT])." 1967 Transactions on Microwave Theory and Techniques 15.12 (Dec. 1967 [T-MTT]): 657-657.



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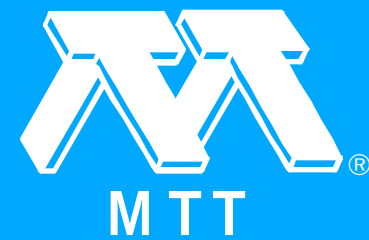
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International Microwave Symposium (Dec. 1967 [T-MTT])

"International Microwave Symposium (Dec. 1967 [T-MTT])." 1967 Transactions on Microwave Theory and Techniques 15.12 (Dec. 1967 [T-MTT]): 658-660.



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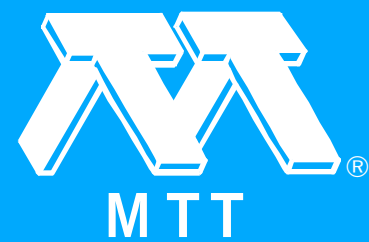
Microwave Faraday Effect and Propagation in a Circular Solid-State Plasma Waveguide

H.J. Kuno and W.D. Hershberger. "Microwave Faraday Effect and Propagation in a Circular Solid-State Plasma Waveguide." 1967 Transactions on Microwave Theory and Techniques 15.12 (Dec. 1967 [T-MTT]): 661-668.

The microwave Faraday effect in a solid-state plasma waveguide under a relatively high magnetic field ($\mu_{\text{sub } e/B/\text{sub } 0} \gg 1$) is investigated. Field configurations in the solid-state plasma waveguide are first analyzed. It is shown that two types of nondegenerate circularly polarized quasi-TE waves exist in the waveguide. The propagation constants of the quasi-TE waves are obtained by means of a variational method. The microwave Faraday effect in the solid-state plasma waveguide is formulated. It is shown that geometrical factors and reflections from the waveguide discontinuities have significant influences on the Faraday effect. Experimental results of the Faraday effect at 36 GHz through a solid-state plasma waveguide are reported. In the experiment n-type indium antimonide crystals are used. The comparison of the experimental data with the theory shows good agreement.

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Wideband High-Selectivity Diplexers Utilizing Digital Elliptic Filters

R.J. Wenzel. "Wideband High-Selectivity Diplexers Utilizing Digital Elliptic Filters." 1967 Transactions on Microwave Theory and Techniques 15.12 (Dec. 1967 [T-MTT]): 669-680.

Design techniques and element value tables are presented for the construction of compact high-selectivity diplexers using digital elliptic component filters. A brief review of an applicable diplexer theory is given and the derivation and use of the element value tables are discussed. The tables provide values for component filters with an even number of branches n for $n=4$ through $n=12$ with a prototype ripple value corresponding to maximum diplexer input VSWR of approximately 1.26 to 1. For $n=8$, 10, and 12 branch filters, additional tables with permuted transmission zero orders are given. Test results for an $n=6$ branch experimental diplexer of 2.25 to 1 bandwidth are presented. The design and construction of this diplexer is described in detail and serves to illustrate the use of the element value tables and design procedures presented. Many practical construction and alignment suggestions are given which are useful in obtaining designs with good response characteristics. The experimental diplexer has crossover frequencies at 1.5 and 3.4 GHz and provides greater than a 50 dB isolation at frequencies 0.2 GHz from crossover. The diplexer has an input VSWR $\leq$ to, 1.5 to 1 from dc to 6.0 GHz, and has package dimensions of approximately 2.0 by 2.0 by 0.75 inches.

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Radial Line Band Rejection Filters in Coaxial Waveguides (Dec. 1967 [T-MTT])

D. Varon. "Radial Line Band Rejection Filters in Coaxial Waveguides (Dec. 1967 [T-MTT])." 1967 Transactions on Microwave Theory and Techniques 15.12 (Dec. 1967 [T-MTT]): 680-687.

A coaxial waveguide with a cylindrical cavity forming a double discontinuity in the outer conductor is known to serve as a band rejection filter in the microwave region. A variational principle is applied to calculate the rejection frequency and a subsequent analysis is conducted to determine the dependence of that frequency on various parameters of the structure. Results are presented graphically and by simple analytical formulas. They demonstrate a newly discovered relationship between the rejection frequency and the width of the cavity, and provide design information which enables prediction of the rejection frequency within a 1 percent accuracy.

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Abstracts

A Computer Designed, 720 to 1 Microwave Compression Filter (Dec. 1967 [T-MTT])

H.S. Hewitt. "A Computer Designed, 720 to 1 Microwave Compression Filter (Dec. 1967 [T-MTT])." 1967 Transactions on Microwave Theory and Techniques 15.12 (Dec. 1967 [T-MTT]): 687-694.

Compression filters with bandwidths up to 1000 MHz have application in high-resolution radar system and rapid-scan receiver systems. A technique is presented for realizing a microwave linear delay (quadratic phase) versus frequency compression filter with sufficient delay accuracy to make compression ratios of up to 1000 to 1 feasible. The dispersive element in the compression filter is a silver tape with its broad side placed perpendicularly between the ground planes (instead of parallel, as in conventional stripline). The tape is folded back and forth upon itself in such a way that substantial coupling takes place between adjacent turns of the tape. A computer program has been written to determine the dimensions of the tape to achieve a linear delay versus frequency characteristic. A folded tape compression filter was constructed with a differential delay of 1.2 μs over a bandwidth of 600 MHz centered at 1350 MHz giving a compression factor of 720 to 1. This filter was constructed in four identical sections, each section of which had a differential delay of 0.3 μs over the same bandwidth as the complete filter. The entire filter (four sections) occupies a volume about 16 by 4 by 5 inches. Measurement data are presented which illustrate that the desired accurate delay characteristic was realized to within the ± 1 ns measurement uncertainty.



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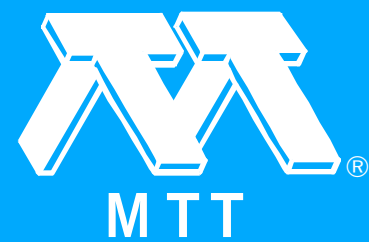
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Electromagnetic Resonances of Free Dielectric Spheres (Dec. 1967 [T-MTT])

M. Gastine, L. Courtois and J.L. Dormann. "Electromagnetic Resonances of Free Dielectric Spheres (Dec. 1967 [T-MTT])." 1967 Transactions on Microwave Theory and Techniques 15.12 (Dec. 1967 [T-MTT]): 694-700.

A systematic study is made of electromagnetic resonances of a spherical, free, and isotropic sample supposed to be without dielectric loss. The characteristic equation which is both complex and transcendant has been resolved with a computer. The results for the first modes (frequency and Q factor for epsilon varying between 1 and 100) are presented. The Q factor that is calculated represents the comparison between the energy stored by the resonance system and energy radiated per cycle; this is the theoretical maximum Q in the case of nonlossy materials. The different modes are classed in TE/sub nmr/ and TM/sub nmr/ modes which comprise exterior and interior modes. It is shown that for $n \geq r$ the energy is concentrated in all directions near the surface; these are known as surface modes. This systematic study is confirmed by experiments in which numerous modes have been observed and identified.

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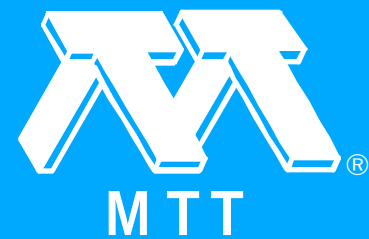
A High-Power UHF Circulator

Y. Konishi. "A High-Power UHF Circulator." 1967 Transactions on Microwave Theory and Techniques 15.12 (Dec. 1967 [T-MTT]): 700-708.

The insertion loss, the bandwidth ratio, and the nonlinearity of a high-power UHF circulator are discussed generally with regard to the characteristics, volume, and filling factor of the ferrite. Theory and experiment are made on the high-power circulator with ferrite, where either surface of the ferrite comes into contact with air. A wideband technique in improving the narrowband that is essentially the result of the filling factor of ferrite is also described. To avoid the center conductor heating effect, a circulator without a center conductor is described. Experiments have proven that, for ferrite nonlinearity, the threshold power by spinwave occurs in a polycrystal for CW power even above resonance and is changed by a external field strength, whereas the nonlinearity is not observed in a single crystal.

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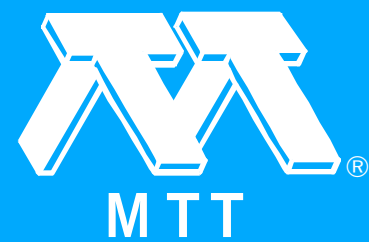
Operating Dynamics and Performance Limitations of Ferrite Digital Phase Shifters (Dec. 1967 [T-MTT])

G.P. Rodrigue, J.L. Allen, L.J. Lavedan and D.R. Taft. "Operating Dynamics and Performance Limitations of Ferrite Digital Phase Shifters (Dec. 1967 [T-MTT])." 1967 Transactions on Microwave Theory and Techniques 15.12 (Dec. 1967 [T-MTT]): 709-713.

Performance capabilities and limitations of nonreciprocal waveguide ferrite digital phase shifters are discussed. A computer-aided solution of the boundary value problem facilitates the optimization of both device geometry and material properties. Experimental results are in excellent agreement with predicted loss and phase shift values. Maximum figures of merit of the order of 1000 deg/dB have been realized. When high peak powers must be accommodated, some sacrifice in low-power performance is necessary. Operating peak power levels can be increased by lowering the saturation magnetization of the ferrite or by raising its spinwave linewidth. Peak power levels above 150 kW at X band and 350 kW at C and S bands have been attained in laboratory models with less than 1 dB loss for a 360 degree differential phase shift. When high-average power levels must be handled, various material and geometric considerations can be incorporated to minimize loss per unit length and to increase heat dissipation capabilities. Units have been successfully operated at S-band frequencies with only a five percent decrease in phase shift when carrying 900 watts average power. The various tradeoffs necessary to achieve high peak and average power performance are discussed.

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Lumped Elements in Microwave Integrated Circuits (Dec. 1967 [T-MTT])

D.A. Daly, S.P. Knight, M. Caulton and R. Ekholdt. "Lumped Elements in Microwave Integrated Circuits (Dec. 1967 [T-MTT])." 1967 Transactions on Microwave Theory and Techniques 15.12 (Dec. 1967 [T-MTT]): 713-721.

The use of lumped rather than distributed elements affords a considerable size reduction (typically a factor of 10 in area) in L- and S-band microwave integrated circuits. The electrical performance of such lumped elements is shown to be good enough to warrant their use in many applications where the size advantage or the resultant cost advantage is important. Miniature elements have been constructed which behave as true lumped reactive components up to at least 2.5 GHz. These elements have been evaluated using an impedance measurement method. Both inductors and capacitors have exhibited Qs greater than 50 at lower S band. Single-stage transistor power amplifiers at 2 GHz have been breadboarded using a simple arrangement of the lumped elements to match the measured impedances of the transistor pellet. These amplifiers have had gains as high as 4.7 dB at 2 GHz. The transistor used typically exhibits about 5 dB of gain in conventional coaxial circuitry. The loss in the lumped element matching networks has been about 0.5 dB greater than the loss in the distributed matching networks used in a microstrip amplifier built with the same type transistor. It is expected that the lumped circuit loss can be reduced as improved components are developed.





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A Multikilowatt X-Band Nanosecond Source (Dec. 1967 [T-MTT])

H. Goldie. "A Multikilowatt X-Band Nanosecond Source (Dec. 1967 [T-MTT])." 1967 Transactions on Microwave Theory and Techniques 15.12 (Dec. 1967 [T-MTT]): 722-731.

A new technique is presented which furnishes an exceptionally narrow pulse of 6 to 12 ns duration with steep skirts of 1 to 3 ns at peak power levels of tens of kilowatts. The pulse is derived by means of two sequential discharges in a nonresonant waveguide section. An analysis of the low-pressure breakdown of a gas under the action of intense microwave fields considerably higher than the threshold of breakdown field shows that under certain optimum combinations of gas parameters the aforementioned pulse is obtained. Experimental results show that a 70 kW rectangular pulse of 12 ns width with 2 ns skirts can be reliably generated on a repetitive basis with negligible jitter.

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Design Concepts for High-Power PIN Diode Limiting

N.J. Brown. "Design Concepts for High-Power PIN Diode Limiting." 1967 Transactions on Microwave Theory and Techniques 15.12 (Dec. 1967 [T-MTT]): 732-742.

Experimental data and discussion are presented which show the desirability of using thick punch-through PIN diode for high-power limiting. The slower speed of response sets an upper limit on thickness. Data are presented on the maximum thickness allowable as a function of frequency. Results are given for a high-peak-power narrow-pulsewidth receiver protector, and for a high-average-power wide-pulsewidth balanced duplexer. These devices are compared to conventional gas T-R tubes and results suggest that the use of multiple PIN diodes in limiters and duplexers can offer significant improvements in some radar applications.

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Frequency Modulation of Avalanche Transit Time Oscillators (Dec. 1967 [T-MTT])

J.W. Amoss and K.E. Gsteiger. "Frequency Modulation of Avalanche Transit Time Oscillators (Dec. 1967 [T-MTT])." 1967 Transactions on Microwave Theory and Techniques 15.12 (Dec. 1967 [T-MTT]): 742-747.

This paper presents experimental data taken to determine the frequency modulation characteristics of avalanche transit time oscillators. The active element is a diffused mesa diode with a shallow junction in epitaxial n-n⁺ silicon; the details of the construction of the diode are presented and its typical characteristics are discussed. The basic oscillator consists of the diode mounted in the capacitive portion of a radial mode cavity machined of copper with the outlines of a DO-5 diode header. The frequency of oscillation is dependent upon the diode junction capacitance and is varied between 5 and 8 GHz for the diodes tested. Microwave power levels up to 100 mW have been observed with an efficiency exceeding 3 percent. The frequency drift over the temperature range from -70 to +100°C is 2.5×10^{-5} parts/°C. The frequency modulation characteristics of these oscillators indicate their potential applications in miniature solid-state low-power communications systems.

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Microstrip Junction Circulator for Microwave Integrated Circuits (Correspondence)

B. Hershenov. "Microstrip Junction Circulator for Microwave Integrated Circuits (Correspondence)." 1967 Transactions on Microwave Theory and Techniques 15.12 (Dec. 1967 [T-MTT]): 748-750.

This author has reported recently on two forms of microstrip junction circulators. In the first type, a garnet disk was cemented into a ceramic substrate to form a composite ceramic substrate. Copper ground plane, quarterwave microstrip transmission lines, and disk were evaporated onto this substrate following a chrome flash. In the second form, the microstrip junction circulator was fabricated from a single garnet substrate. The lines, ground plane, and disk were evaporated exactly as in the first case. The results were published as preliminary feasibility test data. This all-garnet substrate circulator was identical in size with the composite ceramic substrate. The results were sufficiently promising to warrant a new smaller design size for the all-garnet microstrip junction circulator because the dielectric constant of the garnet substrate was larger than that of the ceramic.

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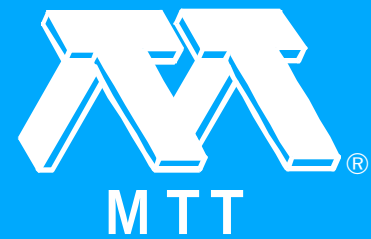


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High-Dielectric Substrates for Microwave Hybrid Integrated Circuitry (Correspondence)

G.D. Vendelin. "High-Dielectric Substrates for Microwave Hybrid Integrated Circuitry (Correspondence)." 1967 Transactions on Microwave Theory and Techniques 15.12 (Dec. 1967 [T-MTT]): 750-752.

Microstrip transmission-line parameters of temperature-compensated titanium dioxide have been measured. This material has a dielectric constant ranging from 25 to 100. The variations of microstrip wavelength, characteristic impedance, and attenuation with geometry and dielectric constant are in good agreement with the theory. This material is particularly attractive for microwave circuits because of the short guide wavelength and low attenuation.



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A Thin-Film X-Band Varactor Quadrupler (Dec. 1967 [T-MTT]) (Correspondence)

J.B. Horton. "A Thin-Film X-Band Varactor Quadrupler (Dec. 1967 [T-MTT]) (Correspondence)." 1967 Transactions on Microwave Theory and Techniques 15.12 (Dec. 1967 [T-MTT]): 752-754.

A thin-film single idler varactor quadrupler which uses microstrip transmission-line circuitry on ceramic substrate and an unpackaged beam lead varactor are described. Circuit design and the resulting microstrip pattern are discussed; experimental data are presented. Multiplier construction, including information concerning the beam lead varactor and the techniques for bonding it in the circuit pattern, is discussed.



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Cooling of Avalanche Diodes (Correspondence)

J.J. Baranowski, V.J. Higgins and F.A. Brand. "Cooling of Avalanche Diodes (Correspondence)." 1967 Transactions on Microwave Theory and Techniques 15.12 (Dec. 1967 [T-MTT]): 754-755.

This correspondence presents the experimental results of cooling reverse-biased p-n junctions operating in an avalanche transit time mode, and is an extension of previous efforts where the generation and amplification of microwave energy was obtained from conventional varactor diodes. These are commercially available epitaxial GaAs and Si varactors. The diodes were originally designed for operation as either low-noise parametric amplifiers or harmonic generators. Typically, the diodes exhibit breakdown voltages in excess of 25 volts and junction capacitances less than 1 pF at zero bias.



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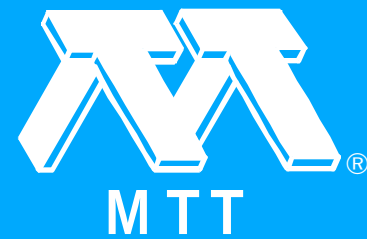


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Broadband Fixed-Tuned Acoustic Delay Lines (Correspondence)

L.R. Whicker, P.F. Carcia and G.E. Evans. "Broadband Fixed-Tuned Acoustic Delay Lines (Correspondence)." 1967 Transactions on Microwave Theory and Techniques 15.12 (Dec. 1967 [T-MTT]): 755-757.

This correspondence is concerned with the design of broadband fixed-tuned delay lines to operate at L- and S-band frequencies. These delay lines utilize layer transducers incorporating CdS thin films of the type used by deKlerk, sapphire delay media, and suitable electrical matching networks in either coaxial or in strip transmission line.



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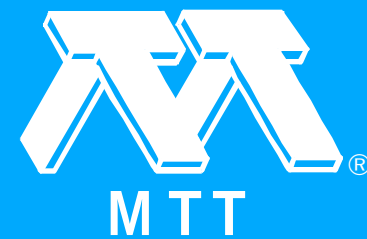
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Contributors (Dec. 1967 [T-MTT])

J.L. Allen, J.W. Amoss, N.J. Brown, M. Caulton, L. Courtois, D.A. Daly, J.L. Dormann, R. Ekholdt, M. Gastine, H. Goldie, K.E. Gsteiger, W.D. Hershberger, H. Hewitt, S.P. Knight, Y. Konishi, H.J. Kuno, L.J. Lavedan, G.P. Rodrigue, D.R. Taft, D. Varon and R.J. Wenzel.
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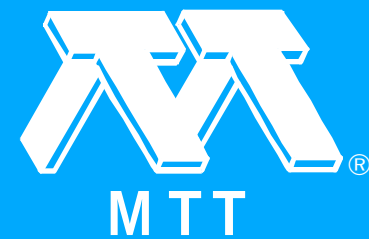
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Membership Application (Dec. 1967 [T-MTT])

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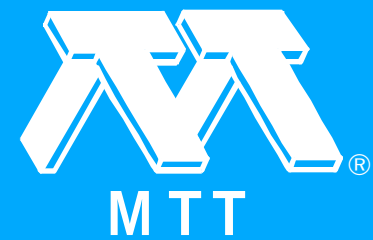
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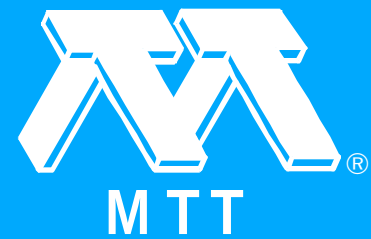
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"Copyright (1962 [MWSYM])." 1962 PGMTT National Symposium Program and Digest 62.1 (1962 [MWSYM]): i-ii.



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Foreword (1962 [MWSYM])

G.E. Schafer. "Foreword (1962 [MWSYM])." 1962 PGMTT National Symposium Program and Digest 62.1 (1962 [MWSYM]): iii-iii.

This completes ten years of existence for the Professional Group on Microwave Theory and Techniques and, as I write this foreword, it is tempting to review our history. The lack of space prohibits a true review but the names of the ten PGMTT Chairmen recall the dominant events of each year and provide a chronological checklist of our first decade: Warriner, Clavier, Mumford, Beck, Engelman, Pritchard, Saad, Oliner, Tomiyasu, and Anderson. Further, among the list of contributors to this Symposium are many who have participated throughout our history mingled with others who are relative newcomers to the field.



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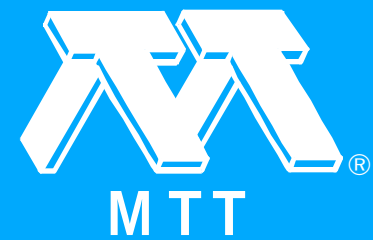
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"Index, 1962 PGMTT National Symposium." 1962 PGMTT National Symposium Program and Digest 62.1 (1962 [MWSYM]): xii-xiii.



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Millimeter Wavelength Resonant Structures (1962 [MWSYM])

R.W. Zimmerer, M.V. Anderson, G.L. Strine and Y. Beers. "Millimeter Wavelength Resonant Structures (1962 [MWSYM])." 1962 PGMTT National Symposium Program and Digest 62.1 (1962 [MWSYM]): 1-3.

At the Boulder Laboratories of the National Bureau of Standards we have been engaged in research in the millimeter wavelength region of the electromagnetic spectrum for several years. Under the direction of Dr. W. Culshaw, the Fabry-Perot interferometer was adapted for use at these wavelengths. Using a plane parallel mirror Fabry-Perot interferometer a precision study of several dielectrics was undertaken at a wavelength of 6 mm. At these wavelengths we have found that diffraction losses become significant when the mirror separation is comparable to the mirror dimensions. Following the suggestion of Fox and Li, we decided to make use of confocal mirrors in the Fabry-Perot interferometer in order to reduce diffraction losses and allow increased separation of the mirrors and consequent increased Q of the resonant structure.

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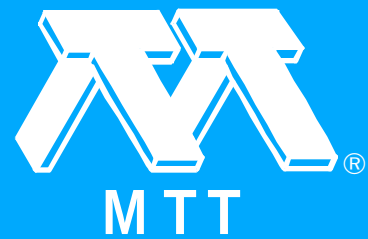


Abstracts

Superconducting Delay Line

R.J. Allen, A.J. Cummings and F.M. Kudo. "Superconducting Delay Line." 1962 PGMTT National Symposium Program and Digest 62.1 (1962 [MWSYM]): 4-5.

Advances in cryogenic engineering have made low temperature electronics feasible. A number of devices have operated successfully in cryogenic environments with considerable improvement in their characteristics.



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Ferroelectric Phase Shifters for VHF and UHF (1962 [MWSYM])

M. Cohn and A.F. Eikenberg. "Ferroelectric Phase Shifters for VHF and UHF (1962 [MWSYM])." 1962 PGMTT National Symposium Program and Digest 62.1 (1962 [MWSYM]): 6-11.

An electric field controlled ferroelectric phase shifter has been developed which provides a differential phase shift of approximately 100° per centimeter at a frequency of 200 Mc/s. The attenuation varies from 1.1 to 1.5 db per centimeter. The phase shifter, shown in Figure 1, was constructed in dielectric loaded parallel plane waveguide in which the dominant TE/sub10/ surface wave mode is excited. This transmission line is inherently suited to the construction of devices requiring control by a uniform electric field. As shown in figure 1, the surface wave is launched onto and collected from the ferroelectric loaded line by means of a coaxial line feeding through the upper plate. The center conductor traverses the space between the parallel plates and contacts the lower plate. Prior analysis has shown that this method of surface wave launching is extremely efficient and broadbanded when the dielectric constant (K) of the dielectric slab is very high. In addition it has been found that if the dielectric constant is very high, as it is in the case of ferroelectric materials ($K > 1000$), then the launching efficiency is independent of the dielectric constant. Thus changes in the dielectric constant due to electric field and temperature changes do not affect the launching efficiency. It has been analytically and experimentally determined that the impedance of the ferroelectric loaded parallel plane waveguide is very low compared to the impedance of the unloaded parallel plane regions beyond the extremities of the ferroelectric slab. Hence, very little power radiates from the ends of the slab.



Microwave Propagation in an Overdense Bounded Magnetoplasma

B. Wieder. "Microwave Propagation in an Overdense Bounded Magnetoplasma." 1962 PGMTT National Symposium Program and Digest 62.1 (1962 [MWSYM]): 12-16.

The magneto-ionic theory shows that for plane wave propagation along the direction of the magnetic field in a magnetoplasma a mode of propagation exists when the frequency of the wave is smaller than the electron gyrofrequency of the medium. Electromagnetic waves will propagate in this mode regardless of the magnitude of the plasma frequency. It requires only that the collision frequency of the electrons in the plasma be sufficiently small so that collision damping does not excessively attenuate the waves. This mode of propagation has been used to explain very low frequency "whistles" associated with lightning discharges and very low frequency emissions in the earth's exosphere. It has been called the "whistler mode" by ionosphere physicists. For propagation in the whistler mode, a dense plasma has a large refractive index, is highly dispersive, and is highly anisotropic. In this paper experiments are described which attempted to use the properties of this mode of propagation as a diagnostic tool in the hot plasma of the magnetic field stabilized pinch discharges in ZETA. The ZETA discharge tube is of toroidal shape with a 1-meter bore and a 3-meter mean diameter. Because of its large size, plane wave propagation through the plasma was considered to be feasible, and hence, the whistler mode theory applicable to the experiment.



Abstracts

Measurements of Field Strength on Resonator Boundaries by Perturbation of Radiation Field

I. Hefni. "Measurements of Field Strength on Resonator Boundaries by Perturbation of Radiation Field." 1962 PGMTT National Symposium Program and Digest 62.1 (1962 [MWSYM]): 18-19.

A new indirect method for measuring the absolute field strength at the boundaries of microwave resonators has been developed. The difference between the new method and the other indirect methods (originally developed by Hansen and Slater), is that while all the other methods are based on the perturbation of the mode-field in the resonator, the new method is based on the perturbation of the radiation-field.



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A General Power Loss Method for Attenuation of Cavities and Waveguides (1962 [MWSYM])

J.J. Gustincic and R.E. Collin. "A General Power Loss Method for Attenuation of Cavities and Waveguides (1962 [MWSYM])." 1962 PGMTT National Symposium Program and Digest 62.1 (1962 [MWSYM]): 20-21.

The usual power loss method of evaluating the damping constant of cavities and the attenuation constant of waveguides, as caused by finite wall conductivity, breaks down in the case of degenerate modes and fails to predict the coupling between degenerate modes. Papadopoulos has treated the problem by means of a perturbation method involving an expansion of the fields in terms of the modes for the ideal cavity or waveguide. In this paper a variational formulation is presented that permits the eigenvalues for the lossy case to be readily computed. This formulation turns out to be a simple extension of the usual power loss method and in addition to giving the damping constant it also shows that there is an equal shift, in the resonant frequency in the case of a cavity, and in the phase constant for a waveguide. In addition the coupling between the degenerate modes is obtained. Furthermore it is shown that the new non-degenerate sets of coupled modes form an orthogonal set. The above properties all arise from the characteristics of the matrix eigenvalue problem which arises when the Rayleigh-Ritz technique is used in conjunction with the variational formulation of the boundary value problem.

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Abstracts

Perturbation Theorems for Waveguide Junctions, with Applications (1962 [MWSYM])

D.M. Kerns and W.T. Grandy, Jr.. "Perturbation Theorems for Waveguide Junctions, with Applications (1962 [MWSYM])." 1962 PGMTT National Symposium Program and Digest 62.1 (1962 [MWSYM]): 22-26.

Our perturbation theorems are stated in the context of a theory of waveguide junctions. A waveguide junction is a linear electromagnetic system possessing ideal waveguide leads and is subject to excitation only through nonattenuated modes in these leads. The domain of the electromagnetic field is the finite region V ; the surface S , the complete boundary of V , consists of a part S_{0} , coinciding with a perfectly conducting surface, and the parts S_{1} , S_{2} , $\dots$, S_{n} , where S_{m} is the terminal surface in the m th of the n waveguide leads.



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Investigations of the Reflection from a Junction of an Ideal Rectangular Waveguide with One Having Rounded Inside Corners

W.J. Anson, R.W. Beatty, D.M. Kerns and W.T. Grandy, Jr.. "Investigations of the Reflection from a Junction of an Ideal Rectangular Waveguide with One Having Rounded Inside Corners." 1962 PGMTT National Symposium Program and Digest 62.1 (1962 [MWSYM]): 27-31.

The magnitude of the reflection coefficient of a simulated joint between a rectangular waveguide having a cross-section with sharp inside corners and one with rounded corners was determined both experimentally and theoretically,



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Electromagnetic Diffraction by a Planar Array of Circular Disks (1962 [MWSYM])

W.H. Eggimann and R.E. Collin. "Electromagnetic Diffraction by a Planar Array of Circular Disks (1962 [MWSYM])." 1962 PGMTT National Symposium Program and Digest 62.1 (1962 [MWSYM]): 32-34.

In a recent paper the electromagnetic diffraction by a perfectly conducting circular disk was calculated. The induced surface current density was obtained as a power series in (ka) , with $k = 2\pi/\lambda = \text{wave number}$ and $a = \text{disk radius}$. These results are now used to calculate the diffraction by a planar rectangular array of disks. Problems of this sort are important in the studies of artificial dielectrics where the molecular dipoles of real dielectrics are replaced by conductors distributed regularly or at random in a supporting medium. For many cases, good approximate solutions have been found usually for conductors with dimensions very small compared to the wavelength or for some very simple geometrical configurations. The case of an array of disks has been the object of early investigations. In a first approximation, the disks are replaced by the induced electric and magnetic dipole moments which Bethe obtained during his studies of the diffraction by small holes. Later, the so-called static interaction, where phase differences between the oscillating dipoles are neglected, was taken into account.

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Abstracts

The Representation of Waveguides Containing Small Ferrimagnetic Ellipsoids

L.K. Anderson and H.J. Shaw. "The Representation of Waveguides Containing Small Ferrimagnetic Ellipsoids." 1962 PGMTT National Symposium Program and Digest 62.1 (1962 [MWSYM]): 36-40.

As ferrimagnetic materials having lower and lower intrinsic losses have become available, it has become feasible to build microwave devices in which small ellipsoidal samples are placed in uniform propagating structures. In many such applications, the sample, although small physically, presents a large electrical discontinuity, so that the usual perturbation procedures are no longer adequate to describe the interaction between the sample and the microwave circuit, and a more complete analysis must be made.



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Abstracts

Interdigital, Band-Pass Filters

G.L. Matthaei. "Interdigital, Band-Pass Filters." 1962 PGMTT National Symposium Program and Digest 62.1 (1962 [MWSYM]): 41-45.

The filters discussed in this paper consist of arrays of TEM-mode transmission line resonators between parallel ground planes. Each resonator line is a quarter-wavelength long at mid-band and is short-circuited at one end and open-circuited at the other--the resonator elements being arranged in a parallel array with the positions of the short-circuited ends alternating. Figure 1 shows a strip-line interdigital filter with its upper ground plane removed.



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Microwave Bandstop Filters with Narrow Stop Bands (1962 [MWSYM])

L. Young, G.L. Matthaei and E.M.T. Jones. "Microwave Bandstop Filters with Narrow Stop Bands (1962 [MWSYM])." 1962 PGMTT National Symposium Program and Digest 62.1 (1962 [MWSYM]): 46-51.

In most microwave systems the signal frequency has to be transmitted and guided from one place to another with the minimum of attenuation, while guarding against unwanted frequencies by keeping them out with bandpass filters, which pass only the signal frequency. While the common types of bandpass filters do an adequate job for most applications, they suffer from some disadvantages in particular situations. It may, for instance, happen that some one interfering frequency is particularly strong and special measures have to be taken to suppress it; or that a limited number of frequencies are being generated in a frequency generator system, but these frequencies have to be kept apart and pure. In those cases, a bandpass filter, which discriminates against all frequencies outside the passband, will not be as efficient as one or more bandstop filters which discriminate especially against the strongest unwanted frequencies.

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Abstracts

The Design of Branch-Guide Couplers, with Applications to the Suppression of Spurious Frequencies

L. Young. "The Design of Branch-Guide Couplers, with Applications to the Suppression of Spurious Frequencies." 1962 PGMTT National Symposium Program and Digest 62.1 (1962 [MWSYM]): 52-57.

This investigation was the result of a program to suppress the harmonic frequency output from high-power transmitters without causing undue reflection of the attenuated frequencies. The attenuation is produced by a rejection filter (which took the form of a waveguide, lowpass, "waffle-iron" filter). To protect the transmitter, a "harmonic pad" is placed between it and the rejection filter to absorb most of the power in the reflected harmonics (in this case, up to the tenth harmonic), while introducing negligible insertion loss in the transmitter fundamental band.



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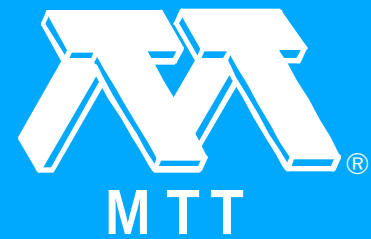


Abstracts

An Electronically Tunable Band Pass Microwave Filter

I. Kaufman and W.H. Steier. "An Electronically Tunable Band Pass Microwave Filter." 1962 PGMTT National Symposium Program and Digest 62.1 (1962 [MWSYM]): 58-63.

A new type of tunable band pass microwave filter using the dipole resonance of a plasma column has been investigated. The center frequency of the pass band can be electronically tuned over a large portion of the S band. Over this range the insertion loss at the center frequency is less than 2 db and the isolation for frequencies outside the pass band is at least 12 db. The typical 3 db bandwidth of the filter is 150 Mc/s at S band.



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Abstracts

A New Technique for Multimode Power Measurement (1962 [MWSYM])

J.J. Taub and J. Goldberg. "A New Technique for Multimode Power Measurement (1962 [MWSYM])." 1962 PGMTT National Symposium Program and Digest 62.1 (1962 [MWSYM]): 64-69.

A new and simple technique is described for measuring the total power flow in an overmoded waveguide. A problem arises when measuring spurious emissions of microwave transmitters and low-loss transmission in the millimeter and submillimeter regions. In many instances, the power is split between two and ten modes. Conventional power-measuring devices are based on one propagating mode. By converting the overmoded wave to an approximate plane wave, the total power flow in an overmoded waveguide can be determined by averaging the squared magnitudes of electric field along the waveguide perimeter. The electric field is sampled by a set of fixed probes. Unlike an earlier fixed-probe technique, this technique does not require a digital computer to reduce the data and can operate at higher peak-power levels. It is applicable to all uniform transmission lines. However, this paper discusses in detail only the rectangular waveguide.



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A Novel High Power Harmonic Suppressor (1962 [MWSYM])

E. Wantuch and R.M. Maines. "A Novel High Power Harmonic Suppressor (1962 [MWSYM])." 1962 PGMTT National Symposium Program and Digest 62.1 (1962 [MWSYM]): 70-71.

The use of high power harmonic suppressors, or low-pass filters, is becoming an accepted technique in the microwave state-of-the-art. Such filters are required to absorb spurious frequencies generated by high power microwave sources. Radiation of such frequencies may cause serious interference problems with neighboring radar equipment. It is further desired that these harmonic frequencies not only be prevented from reaching the antenna, but should also be terminated resistively to prevent multiple reflections between the rejection filter and the microwave source.



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Layered Media as High Power Microwave Absorbers

S.R. Steele and R.J. Briggs. "Layered Media as High Power Microwave Absorbers." 1962 PGMTT National Symposium Program and Digest 62.1 (1962 [MWSYM]): 72-77.

Materials for high power attenuator or matched load applications should present a wave impedance of several hundred ohms for maximum absorption and at the same time should be capable of large heat dissipation. These requirements are generally mutually exclusive, since for conductors thermal conductivity is proportional to electrical conductivity. One way to circumvent this is to use an anisotropic material which can conduct heat easily in the direction perpendicular to the electric field orientation.

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Abstracts

Fine Grain Spectrum Analysis of Pulsed Microwave Amplifiers (1962 [MWSYM])

R.F. Koontz. "Fine Grain Spectrum Analysis of Pulsed Microwave Amplifiers (1962 [MWSYM])." 1962 PGMTT National Symposium Program and Digest 62.1 (1962 [MWSYM]): 78-84.

In the design, construction, and evaluation of high power microwave amplifiers and their associated transmitter systems, a high degree of emphasis is currently being placed on the development of microwave amplifier systems which can amplify complex microwave pulse spectra without introducing noise or spurious modulation into the spectrum. In the usual microwave pulse spectrum, the energy as a function of frequency takes the familiar $\text{Sin } x/x$ distribution as shown in Figure 1.



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Abstracts

Subtle Differences in System Noise Measurements and Calibration of Noise Standards (1962 [MWSYM])

T. Mukaihata, B.L. Walsh, Jr., M.F. Bottjer and E.B. Roberts. "Subtle Differences in System Noise Measurements and Calibration of Noise Standards (1962 [MWSYM])." 1962 PGMTT National Symposium Program and Digest 62.1 (1962 [MWSYM]): 85-87.

There is an increasing need for precise, accurate, and reliable noise measurements especially with the advent of parametric amplifiers (abbreviated as paramps) and other low noise devices. Important applications of such devices, primarily due to their extreme sensitivity to low level signals, are in deep space probe, radar, and communication systems.



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An Accurate Millimeter Wave Loss and Delay Measurement Set (1962 [MWSYM])

M.B. Chasek. "An Accurate Millimeter Wave Loss and Delay Measurement Set (1962 [MWSYM])." 1962 PGMTT National Symposium Program and Digest 62.1 (1962 [MWSYM]): 89-93.

A point-by-point millimeter wave loss and delay measurement system has been built which combines large dynamic range with high accuracy. Up to 80 db loss and 100 nanoseconds envelope delay can be measured in the 50-60 Gc/s range. The accuracy for 0-40 db loss measurements is ± 0.05 db, while beyond that accuracy is progressively diminished to ± 0.8 db at 80 db. Delay accuracy for low loss devices (0-20 db) is ± 0.2 μ sec over the entire 100 μ sec range. High accuracy and large range are attained with a substitution heterodyne measurement scheme using rapid RF and IF comparison switching along with calibrated IF loss and delay standards. In addition, high gain, narrow band, IF amplification and differential null detection is employed. Both measurement functions are incorporated into one system with manual waveguide switching and preset IF programs to facilitate conversion from loss to delay.

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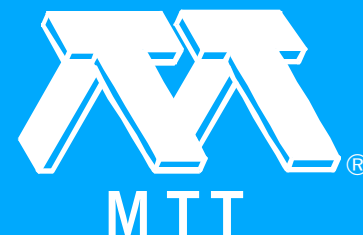


Abstracts

Microwave Phase Comparator

J.A. Kaiser, H.B. Smith, Jr., W.H. Pepper and J.H. Little. "Microwave Phase Comparator." 1962 PGMTT National Symposium Program and Digest 62.1 (1962 [MWSYM]): 94-98.

This paper presents a circuit for measuring relative phase between two microwave signals of the same frequency. The principle of phase comparison described presents no ambiguities throughout 360 degrees and is independent of relative signal amplitudes. There are no moving parts or variable phase shifters. Phase angle can be indicated automatically and instantaneously.



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Waveguide Perturbation Techniques in Microwave Semi-Conductor Diagnostics (1962 [MWSYM])

K.S. Champlin and D.B. Armstrong. "Waveguide Perturbation Techniques in Microwave Semi-Conductor Diagnostics (1962 [MWSYM])." 1962 PGMTT National Symposium Program and Digest 62.1 (1962 [MWSYM]): 99-106.

DC transport properties (e. g., conductivity, Hall effect, magneto-conductivity) are proportional to various averages of the electron-lattice relaxation time ($\langle T \rangle$, $\langle T^2 \rangle$, $\langle T^3 \rangle$, etc.) and hence give indirect information about the scattering mechanisms affecting the conduction process. With microwaves, the observation frequency can frequently be of the order of the scattering frequency $1/(2\pi \langle T \rangle)$. Under these conditions, microwave transport properties are complex and contain potentially more information concerning detailed scattering mechanisms than the analogous dc properties.

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Further Developments in Dielectric Waveguide Devices for Millimeter Wavelengths

C.E. Barnes. "Further Developments in Dielectric Waveguide Devices for Millimeter Wavelengths." 1962 PGMTT National Symposium Program and Digest 62.1 (1962 [MWSYM]): 107-111.

An isolator and a variable attenuator having flat responses over the 50 to 60 Gc/s band were reported at the 1961 PGMTT Symposium. These devices utilized a broadband Faraday rotator which consisted of a solid rod of ferrite of sufficient diameter to function as a dielectric waveguide with characteristics approximating those of an infinite ferrite. Further development of this type of device has produced isolators with significant improvements in bandwidth and loss characteristics and a three-port circulator with broadband characteristics similar to the isolator. The characteristics of the isolator as functions of power and temperature have been studied in order to determine the limitations on the isolator's use.

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Phase Shift Characteristics of Dielectric Loaded Waveguide

G.F. Bland and A.G. Franco. "Phase Shift Characteristics of Dielectric Loaded Waveguide." 1962 PGMTT National Symposium Program and Digest 62.1 (1962 [MWSYM]): 112-118.

An investigation of waveguide phase shifting techniques was conducted recently for the purpose of establishing the design criteria of a device capable of meeting the following electrical specifications: a phase shift variable over minimum range of 360° and a maximum phase slope (or deviation) of 5° at any phase setting over at least a 10 per cent frequency band width. Mechanical simplicity, low insertion loss, rugged construction and small size are also essential characteristics.

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Abstracts

Ferrite Switches in Coaxial or Strip Transmission Line (1962 [MWSYM])

C.E. Fay. "Ferrite Switches in Coaxial or Strip Transmission Line (1962 [MWSYM])." 1962 PGMTT National Symposium Program and Digest 62.1 (1962 [MWSYM]): 119-125.

In many microwave systems there is need for a fast-acting switch which has negligible insertion loss in its "On" condition and substantial attenuation in its "Off" condition. Ferrite switches can in general be made fast-acting by thinning waveguide walls to a few skin depths, using low inductance coils and applying pulse circuitry techniques. Switches in rectangular or circular waveguide have been either of the Faraday rotation or the waveguide-beyond-cutoff variety. Some coaxial or stripline structures have been described which show interesting properties. Early work at Bell Telephone Laboratories on ferrite loaded coaxial lines indicated that large amounts of attenuation could be obtained with axial magnetic fields. The high attenuation is the result of a cutoff condition in the ferrite loaded line, and/or ferromagnetic resonance in the ferrite. The applied field may be switched to bring the line into a propagating and low loss condition.



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A 6 kw Peak Power Varactor Duplexer (1962 [MWSYM])

J.C. Hoover. "A 6 kw Peak Power Varactor Duplexer (1962 [MWSYM])." 1962 PGMTT National Symposium Program and Digest 62.1 (1962 [MWSYM]): 126-130.

The varactor diode, due to its voltage dependent capacity, exhibits a nonlinearity in impedance with changes in RF power level. This change in impedance is sufficient to provide switching action. In addition to this switching action, the varactor junction has an erg burn out level on the order of a thousand times that of a mixer diode. Because of these two properties, the varactor is very applicable in solid state duplexers and limiters for mixer diode protection.



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Bandwidth of TEM Diode Limiters

R.V. Garver and J.A. Rosado. "Bandwidth of TEM Diode Limiters." 1962 PGMTT National Symposium Program and Digest 62.1 (1962 [MWSYM]): 131-137.

To date diode limiters are either parametric frequent devices or simply diodes shunting a transmission line. The parametric limiters are narrow band because they must be made using cavities. Future techniques might improve their bandwidth but it is felt that in the limit their bandwidth would approach that of the techniques discussed here.

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Frequency-Selective Limiting (1962 [MWSYM])

K.L. Kotzebue. "Frequency-Selective Limiting (1962 [MWSYM])." 1962 PGMTT National Symposium Program and Digest 62.1 (1962 [MWSYM]): 138-141.

In the usual microwave limiter the presence of a large signal above a certain threshold power level produces a change in gain or attenuation of the device so that the output power level of this signal remains approximately constant as the input level is varied. This characteristic is desirable in many applications to provide crystal burnout protection in a receiver, act as a power leveler, etc. When more than one signal is present, however, such a limiter will have the undesirable property of increasing the attenuation of a small signal which is also within the passband of the limiter. Thus, while a receiver may be protected from permanent damage by such a limiter, it would be rendered inoperative whenever a strong signal is present.

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Operation of a Microwave Garnet Limiter

R.L. Comstock and L.J. Varnerin. "Operation of a Microwave Garnet Limiter." 1962 PGMTT National Symposium Program and Digest 62.1 (1962 [MWSYM]): 142-145.

It is now possible to design a class of low level, milliwatt range ferrimagnetic microwave limiters which exhibit distinctive characteristics and important advantages over previously reported ferrimagnetic limiters. The limiter characteristically consists of a microwave transmission cavity containing as a nonlinear element a large single crystal spherical sample of yttrium iron garnet (YIG) biased to the subsidiary absorption by a dc magnetic field perpendicular to the rf magnetic field. Garnet losses increase with power above the subsidiary absorption threshold and result in a nonlinear decline in cavity Q which limits the output power. Large filling factors are needed for a significant limiting range and the large YIG single crystals now available make this limiter practical. At a given frequency the limiting threshold can be varied with the bias magnetic field, in contrast to gyromagnetic coupler limiters.

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Abstracts

A Coincidence Region Power Limiter Using Monocrystal Lithium Ferrite at 6500 Mc/s

S. Okwit. "A Coincidence Region Power Limiter Using Monocrystal Lithium Ferrite at 6500 Mc/s." 1962 PGMTT National Symposium Program and Digest 62.1 (1962 [MWSYM]): 146-150.

Passive Microwave power limiters that use narrow linewidth ferrimagnetic materials such as YIG and gallium-substituted YIG operating in the coincidence region have been previously reported. However, these limiters have been restricted to operating in the L- and S-band ranges because of the low ferrite saturation magnetization ($4\pi M/\text{sub s/}$). Recently, monocrystal lithium ferrite having a $4\pi M/\text{sub s/}$ of 3900 and exhibiting relatively narrow linewidth properties has become available. We have used this material in the development of a coincidence power limiter that operates in the 6500-Mc/s frequency range. (Independent work on coincidence limiting using lithium at 5200 Mc/s, has recently been reported by Rossol.)



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Multiple Pumped Parametric Amplifiers

G.C. Spacek. "Multiple Pumped Parametric Amplifiers." 1962 PGMTT National Symposium Program and Digest 62.1 (1962 [MWSYM]): 151-153.

A new concept in the field of parametric amplifiers has been evolved which provides significant increase in the gain-bandwidth product and stability of such devices. The concept involves the use of two independent pump sources of different frequencies. In this paper, the basic idea of multiple pumping is described and the analysis of double pumped parametric amplifiers is given. The experimental results obtained with such devices at VHF and microwave frequencies are reported.



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Broadband Parametric Amplifiers

R. Pettai and B.B. Bossard. "Broadband Parametric Amplifiers." 1962 PGMTT National Symposium Program and Digest 62.1 (1962 [MWSYM]): 154-157.

A criterion has been found for developing broadband parametric amplifiers of either reflection or upconverter type which are capable of large bandwidths with a minimum of external circuitry. The method to be described depends on the maximum utilization of the parasitic elements ($R/\text{sub } s$, L , $C/\text{sub } o$, $C/\text{sub } c$) of the varactor diode itself, plus certain simple experimental techniques which are easily applied.

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Abstracts

Large Signal Properties of Non-Degenerate Varactor Parametric Amplifiers

D. Jackson. "Large Signal Properties of Non-Degenerate Varactor Parametric Amplifiers." 1962 PGMTT National Symposium Program and Digest 62.1 (1962 [MWSYM]): 159-164.

Parametric amplifiers, in common with many other non-linear devices, exhibit peculiar and perhaps useful properties when operated at high signal levels. For example, abrupt switching between various modes of operation is sometimes observed, and simultaneous oscillation at two different frequencies may occur under certain conditions. A satisfactory quantitative description of many of these phenomena is obtainable through the use of the simplified circuit model shown in Figure 1.



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Abstracts

Design of a Wideband Tunnel Diode Preamplifier for Phased Array Radars

D.W. MacGlashan. "Design of a Wideband Tunnel Diode Preamplifier for Phased Array Radars." 1962 PGMTT National Symposium Program and Digest 62.1 (1962 [MWSYM]): 166-170.

The developement of the phased array radar has generated the requirement for a simple, inexpensive, low noise preamplifier which will have at least a 12 percent 1 db bandwidth, less than a 4 db noise figure and which will phase and amplitude track over the pass-band.



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Masers and Millimeter Waves

F.S. Barnes. "Masers and Millimeter Waves." 1962 PGMTT National Symposium Program and Digest 62.1 (1962 [MWSYM]): 172-175.

This paper examines the characteristics of several types of proposed masers to see what characteristics they can be expected to have in the region between one and a tenth millimeter. In particular, estimates are given for the maximum power output and efficiency of a number of maser systems operating as oscillators or power sources. Additionally, the expected noise temperature for maser systems in this frequency region are compared with those at lower frequencies.

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Abstracts

Microwaves and Solid State (Abstract)

B. Lax. "Microwaves and Solid State (Abstract)." 1962 PGMTT National Symposium Program and Digest 62.1 (1962 [MWSYM]): 176-176.

The interaction between solid state research and microwaves has been a mutually beneficial one. The current developments in this marriage between these fields is opening new vistas for the microwave scientist in the millimeter and submillimeter regions as well. However, important innovations in the microwave region are taking place also in the form of acoustical excitation in solids.



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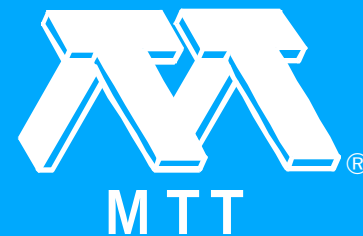


Abstracts

Coherent Wave Optics, New Frontier of the Microwave Art (Abstract)

A.G. Fox. "Coherent Wave Optics, New Frontier of the Microwave Art (Abstract)." 1962 PGMTT National Symposium Program and Digest 62.1 (1962 [MWSYM]): 177-177.

The present state of the art will be described and the importance of coherence discussed. It appears possible that coherent light will prove useful in communication systems. The role of the microwave engineer in the future development of this field will be suggested.



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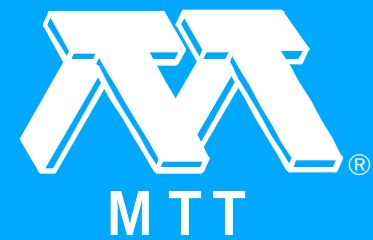
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General Information (1962 [MWSYM])

"General Information (1962 [MWSYM])." 1962 PGMTT National Symposium Program and Digest 62.1 (1962 [MWSYM]): 178-179.



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Front Cover (1963 [MWSYM])

"Front Cover (1963 [MWSYM])." 1963 PTGMTT National Symposium Program and Digest 63.1 (1963 [MWSYM]): f1-f2.



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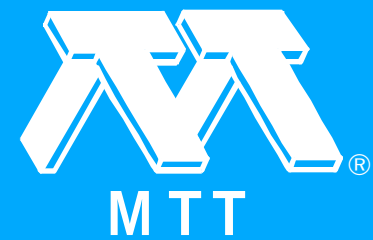
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"Copyright (1963 [MWSYM])." 1963 PTGMTT National Symposium Program and Digest 63.1 (1963 [MWSYM]): i-ii.



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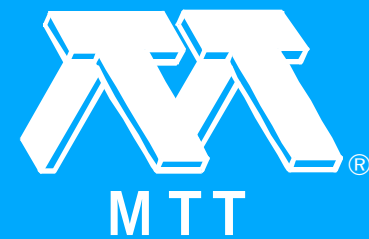


Abstracts

Foreword (1963 [MWSYM])

D.B. Anderson. "Foreword (1963 [MWSYM])." 1963 PTGMTT National Symposium Program and Digest 63.1 (1963 [MWSYM]): 1-1.

Your Symposium Steering Committee and the Los Angeles, Santa Ana, and Orange-Belt Chapters of the IEEE Professional Technical Group on Microwave Theory and Techniques extend to you a cordial welcome.



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Program (1963 [MWSYM])

"Program (1963 [MWSYM])." 1963 PTGMTT National Symposium Program and Digest 63.1 (1963 [MWSYM]): 2-16.



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Modern Radar Systems (Abstract)

H.G. Weiss. "Modern Radar Systems (Abstract)." 1963 PTGMTT National Symposium Program and Digest 63.1 (1963 [MWSYM]): 17-18.

The sensitivity of radar detection systems has increased about 35 db during each of the past two decades. Although there has been no specific indication that this sensitivity vs. time trend has leveled off, practical considerations of cost and complexity will undoubtedly influence this trend. The increases in sensitivity that have been achieved to date result from the use of larger antennas, higher powered transmitters, improved receivers and sophisticated data processing techniques. During the next decade electronically steered, multi-element array systems offer promise of providing additional increases in system sensitivity. These new systems, by the adaptive use of optimum scanning patterns and modulation waveforms, offer possibilities for more efficient utilization of power and time. The characteristics of several contemporary radar systems will be described.

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Abstracts

TRADEX - The Second Generation of Super Power Transmitters

R. Graham, Jr.. "TRADEX - The Second Generation of Super Power Transmitters." 1963 PTGMTT National Symposium Program and Digest 63.1 (1963 [MWSYM]): 19-30.

The very successful performance attained by the TRADEX UHF Transmitter in the TRADEX radar represents a significant step forward in transmitter capability over previous super-power efforts. Prior to the TRADEX application, UHF super-power was limited to brute-force installations, where long range was of prime importance and relatively coarse target data were perfectly acceptable. The TRADEX radar, in addition to maintaining a requirement for operation at extremely long ranges, incorporates several unique, highly sophisticated concepts.



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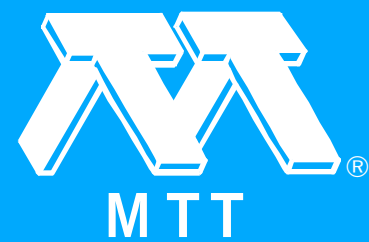
Plasmas and Microwaves (Abstract)

T. Morita. "Plasmas and Microwaves (Abstract)." 1963 PTGMTT National Symposium Program and Digest 63.1 (1963 [MWSYM]): 31-32.

Since the inception of modern plasma research, microwaves have played an important role. It has first served as a diagnostic tool to determine such properties of the plasma as electron density, collision frequency and electron temperature. Second the plasma with an applied magnetic field has served as a medium with interesting propagation properties, which may be exploited for various microwave devices.

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Propagation of Linearly Polarized Electromagnetic Waves in Dense Magneto-Plasmas

J.T. Verdeyen. "Propagation of Linearly Polarized Electromagnetic Waves in Dense Magneto-Plasmas." 1963 PTGMTT National Symposium Program and Digest 63.1 (1963 [MWSYM]): 33-38.

The theoretical problem discussed here is best illustrated by Figure 1. We wish to find the propagation constant of electromagnetic waves down a parallel-plane waveguide filled with a plasma magnetized parallel to the conducting planes and perpendicular to the direction of propagation. The geometry of this problem is shown in this figure along with the relationship of the components of the dielectric constant K , K_x , and K_y to the plasma parameters. If the boundary value problem for this case is solved under the assumption of no variation of the fields in the "x" direction, three solutions are obtained. Two of these solutions can be shown to be related to the well known "ordinary" and "extraordinary" waves in an infinite plasma. The third solution has no counterpart in an infinite medium.

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Microwave Breakdown Near a Hot Surface (1963 [MWSYM])

M. Gilden and J. Pergola. "Microwave Breakdown Near a Hot Surface (1963 [MWSYM])." 1963 PTGMTT National Symposium Program and Digest 63.1 (1963 [MWSYM]): 39-44.

Breakdown below the normal threshold can be induced in a waveguide system by the presence of a hot surface because the adjacent layer of heated gas is more readily ionized. Under uniform conditions the breakdown electric field strength is inversely proportional to absolute gas temperature. However, if the layer of hot gas is sufficiently thin, the rate of electron diffusion out of the region of ionization tends to restore the breakdown threshold. Thus breakdown can be controlled because the thickness of the film of hot gas is a function of the velocity of the gas across the hot surface. To take advantage of this effect cool gas may be forced across the hot surface with the added benefit of cooling the hot surface.

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Synthesis of Microwave Filters and Directional Couplers

H.J. Riblet. "Synthesis of Microwave Filters and Directional Couplers." 1963 PTGMTT National Symposium Program and Digest 63.1 (1963 [MWSYM]): 45-50.

E.M.T. Jones has considered the general synthesis of transmission line filters consisting of short-circuited, quarter-wave stubs spaced a quarter-wavelength apart on sections of transmission line, each of undetermined characteristic impedance. He has shown that the insertion loss function, $P_{\text{sub } L}$, of a symmetrical filter of this type will take the form $P_{\text{sub } L} = 1 + Q^2_{\text{sub } n+1}(w)/(1+w^2)^{\text{sup } n}$, where $Q_{\text{sub } n+1}(w)$ is an even or odd polynomial of degree, $n + 1$, in w with real coefficients, and n is the number of quarter-wavelength series-sections of transmission line. He has also pointed out how equiripple performance can be achieved for arbitrary bandwidth and tolerance by means of an ingenious potential analogy suggested by V.H. Grinich. The Grinich transformation is rather involved, with the result that Jones limited his calculations to the coefficients of $Q_{\text{sub } n+1}(w)$ for only a single bandwidth.

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General Synthesis of Optimum Multi-Element Coupled-Transmission-Line Directional Couplers

R. Levy. "General Synthesis of Optimum Multi-Element Coupled-Transmission-Line Directional Couplers." 1963 PTGMTT National Symposium Program and Digest 63.1 (1963 [MWSYM]): 51-56.

Coupled-transmission-line directional couplers of the simple quarter-wavelength type have theoretically perfect isolation and input match. The coupling varies sinusoidally with frequency, giving a useful bandwidth of approximately 2:1, but much greater bandwidths may be obtained by cascading sections. Thus for example a coupling of $3 \text{ db} \pm 0.4 \text{ db}$ over a 5:1 band may be obtained using a symmetrical three-quarter wavelength coupler. However this is not optimum in the sense of having maximum bandwidth for a given coupling tolerance, owing to the restriction placed on the coupling function by making the two outer elements equal. When the three elements are allowed to be all unequal, then it is possible to obtain an optimum Tchebycheff coupling characteristic with two ripples.

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Abstracts

An Exact Design Technique for a Type of Maximally-Flat Quarter-Wave-Coupled Band Pass Filter

W.W. Mumford. "An Exact Design Technique for a Type of Maximally-Flat Quarter-Wave-Coupled Band Pass Filter." 1963 PTGMTT National Symposium Program and Digest 63.1 (1963 [MWSYM]): 57-62.

Consider the filter configuration consisting of a number of shorted quarter wave stubs spaced a quarter wavelength apart on an otherwise uniform transmission line. What tapering of the characteristic impedances of the stubs will yield a maximally-flat transmission characteristic?



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Abstracts

Evaluation of a Coupling Hole Between Two Resonant Cavities

H.A. Wheeler. "Evaluation of a Coupling Hole Between Two Resonant Cavities." 1963 PTGMTT National Symposium Program and Digest 63.1 (1963 [MWSYM]): 63-68.

In microwave technology, resonant cavities may be coupled through a hole in a common wall. The general principles of such coupling are well known.



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Abstracts

Exact Design of Band-Stop Microwave Filters (1963 [MWSYM])

B.M. Schiffman and G.L. Matthaei. "Exact Design of Band-Stop Microwave Filters (1963 [MWSYM])." 1963 PTGMTT National Symposium Program and Digest 63.1 (1963 [MWSYM]): 69-74.

Approximate techniques accurate only for filters with narrow stop-bands have previously been used for the design of band-stop filters. In this paper, exact synthesis techniques due to Ozaki and Ishii are adapted for the straight-forward design of band-stop filters having stop-bands of any desired width.



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Minimum Insertion Loss Microwave Filters

J.J. Taub and H.J. Hindin. "Minimum Insertion Loss Microwave Filters." 1963 PTGMTT National Symposium Program and Digest 63.1 (1963 [MWSYM]): 75-82.

Equal-element band-pass filters provide the lowest midband insertion loss possible with a given number of resonators and a specified rejection bandwidth or skirt response. Losses can often be reduced by 1 to 2 db. A technique applicable to narrow-band equal-element filters has been developed that holds for both large and small dissipation factors. Using this technique, circuit constants can be determined for filters having from two to eight coupled resonators. Formulas are given for lumped-constant and strip-transmission-line circuits.

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Abstracts

Microwave Diodes and Transistors (Abstract)

L.D. Armstrong. "Microwave Diodes and Transistors (Abstract)." 1963 PTGMTT National Symposium Program and Digest 63.1 (1963 [MWSYM]): 83-83.

This paper will review the microwave areas in which semiconductor diodes of various types and transistors are currently being used. Included will be such areas as amplifiers, harmonic generators, switches, detectors and mixers, limiters and duplexers, attenuators and phase shifters. The extent of importance of contributions to the entire microwave field will be discussed.



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Abstracts

A New Microwave Measurement Technique to Characterize Diodes and an 800 Gc Cutoff Frequency Varactor at Zero Volts Bias (1963 [MWSYM])

B.C. De Loach, Jr.. "A New Microwave Measurement Technique to Characterize Diodes and an 800 Gc Cutoff Frequency Varactor at Zero Volts Bias (1963 [MWSYM])." 1963 PTGMTT National Symposium Program and Digest 63.1 (1963 [MWSYM]): 85-92.

The equivalent circuit of a diode in a waveguide is difficult to determine because it is embedded in the circuit of supporting devices such as dielectric spacers and posts. The influence of these supporting devices can be eliminated by fabricating the diode directly in reduced height waveguide. Diodes in cartridges can also be made to approximate this situation.



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Low Noise II GC Parametric Amplifier Using Refrigerated Silver Bonded Germantum Diode

S. Kita, K. Tahara and T. Masuda. "Low Noise II GC Parametric Amplifier Using Refrigerated Silver Bonded Germantum Diode." 1963 PTGMTT National Symposium Program and Digest 63.1 (1963 [MWSYM]): 93-98.

The authors had previously reported that the silver bonded germanium diode was suitable for a parametric amplifier and we have succeeded in parametric amplification at 11GC using this type of diode, and obtained a noise figure of 3.5 dB at room temperature.

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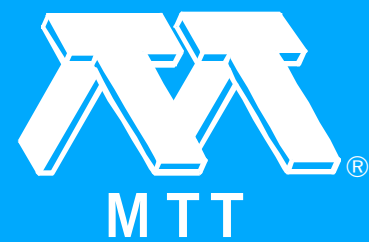
A High Power Protector Using PIN Diodes

M.R. Barber. "A High Power Protector Using PIN Diodes." 1963 PTG/MTT National Symposium Program and Digest 63.1 (1963 [MWSYM]): 99-104.

PIN diodes are useful in high power switching applications because their microwave impedance is essentially a controllable conductance in shunt with a nearly constant capacitance. The diodes are made by diffusing heavily doped N+ and P+ layers into a pi-type body. When reverse biased the R. F. impedance is determined by the pi-region capacitance in series with a small resistance. If a forward bias current is applied, the pi-region is progressively filled with carriers and the device becomes a conductance increasing to a maximum value of about 10 mhos. It is this high conductance which accounts for the high power rating of PIN diodes.

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Optimum Design of Fast Acting Broadband Multithrow Diode Switches

P.L. Clar. "Optimum Design of Fast Acting Broadband Multithrow Diode Switches." 1963 PTGMTT National Symposium Program and Digest 63.1 (1963 [MWSYM]): 105-112.

This paper utilizes wideband matching theory to derive the maximum bandwidth capabilities of fast-acting, broadband multithrow diode switches, and filter techniques to closely realize them. Using these filter matching techniques, a 1:16 multithrow switch was constructed and evaluated. It achieves less than 1 db insertion loss, 1.3:1 input VSWR and 27 db isolation from dc to 750 mc which agrees closely with the theory. Switching times as small as 40 nsec have been observed. These results represent a significant advancement in the design of fast-acting diode multithrow switches.

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Abstracts

A Versatile C-Band Cryogenic Parametric Amplifier

C.T. Rucker, B.R. Savage and E.S. Grimes, Jr.. "A Versatile C-Band Cryogenic Parametric Amplifier." 1963 PTGMTT National Symposium Program and Digest 63.1 (1963 [MWSYM]): 113-118.

The parametric amplifier described has met several conditions which, to the writers knowledge, have not been realized heretofore in an integrated amplifier assembly suitable for system application.



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Abstracts

Integrated Electronics at UHF

G. Schaffner, P. Clar and F. Gleason. "Integrated Electronics at UHF." 1963 PTGMMT National Symposium Program and Digest 63.1 (1963 [MWSYM]): 119-124.

The development of microwave microcircuit utilizing uncased semiconductor chips and thin films promises a revolution in the design and construction of microwave circuits. The more intimate contact between the semiconductor device and circuit, without constraints of the package, will allow the attainment of device performance never before achieved. The construction of rf circuitry in a standardized micromodule form will allow rf circuitry to be compatible with standard microelectronic packaging techniques and similar in cost to low frequency circuits.



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Abstracts

Harmonic Generation, Mixing and Detection of Millimeter and Submillimeter Waves Using Parametric or Tunnel Diodes (Abstract)

K.K.N. Chang. "Harmonic Generation, Mixing and Detection of Millimeter and Submillimeter Waves Using Parametric or Tunnel Diodes (Abstract)." 1963 PTGMTT National Symposium Program and Digest 63.1 (1963 [MWSYM]): 125-128.

A general discussion of harmonic generation, mixing and detection through use of parametric or tunnel diodes is given. The efficiency, noise factor and sensitivity of such devices are presented. In particular, the circuit design and its associated diode fabrication, together with recent experimental results at millimeter wave frequencies are described. Based on the general considerations, similar experimental results can be anticipated in the submillimeter wave region.



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Pumped Tunnel Diode Frequency Converters with Idlers

P.L. Fleming. "Pumped Tunnel Diode Frequency Converters with Idlers." 1963 PTGMTT National Symposium Program and Digest 63.1 (1963 [MWSYM]): 129-136.

This paper is concerned with analytical and experimental results for pumped tunnel diode frequency converters with idlers. The notation used in analyzing pumped varactors is appropriate for this analysis since idling circuits are utilized in conjunction with a pump or local oscillator. Pumped tunnel diode converters with idlers do not perform circuit functions that could not conceivably be performed by pumped varactor circuits with idlers. Tunnel diode converters with idlers are capable of performing similar circuit functions with simpler circuitry (being a pumped conductance device) and with considerable savings in pump power. An experimental tunnel diode converter with idler has been operated in the 2000 Mc region to obtain total power gains greater than 30 db with a pump power requirement of 100 microwatt. Comparable varactor converters would require at least an order of magnitude more pump power.

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Octave Bandwidth Tunnel Diode Amplifier (Abstract)

G.J. Wheeler and J.H. Lepoff. "Octave Bandwidth Tunnel Diode Amplifier (Abstract)." 1963 PTGMTT National Symposium Program and Digest 63.1 (1963 [MWSYM]): 137-138.

Two tunnel diodes amplifiers were built, one covering 2-3 kmc and the other 3-4 kmc. In each case, the limit on bandwidth was the frequency band of the circulator used with the amplifier. As shown in the photograph below, the amplifiers were combined in a diplexing circuit to make a single two-port amplifier with better than 12 db gain over the octave 2-4 kmc.

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Abstracts

Practical Design Techniques for Solid State Microwave Generators

D.O. Fairley. "Practical Design Techniques for Solid State Microwave Generators." 1963 PTGMTT National Symposium Program and Digest 63.1 (1963 [MWSYM]): 139-146.

In a harmonic generator, the following principles constitute desirable design criteria: 1) Provide an impedance match at the input; 2) provide an impedance match at the output; 3) prevent the output from reaching the generator; 4) prevent the input from reaching the load; 5) prevent other harmonic currents from flowing except in reactive idler terminations; and 6) operate the diode at the optimum point on its capacitance-voltage characteristic.



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Abstracts

Analysis of a Microwave Radiometer for Precise Standardization of Noise Sources

G. Ward and J. Richardson. "Analysis of a Microwave Radiometer for Precise Standardization of Noise Sources." 1963 PTGMTT National Symposium Program and Digest 63.1 (1963 [MWSYM]): 147-150.

It is possible to derive a very general expression for the voltage wave emergent from one part of a multiport microwave junction, which itself contains sources, and to the arms of which are connected general microwave two-ports themselves terminated by active sources. This expression may be specialized to a class of microwave radiometers, consisting of a three-port junction, to the arms of which are connected, through general microwave two-ports used for measurement, respectively a microwave source to be measured, a standard source in terms of which the measurement is made, and a receiver. The analysis is sufficiently complete to identify clearly many conditions which bear on the accuracy of measurement of the unknown source, and to quantitatively evaluate them, or to keep them below some tolerable contribution.



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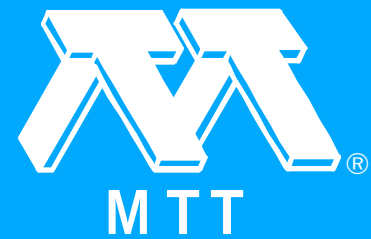


Abstracts

A High Power Rotary Waveguide Joint

P.H. Smith and G.H. Mongold. "A High Power Rotary Waveguide Joint." 1963 PTGMTT National Symposium Program and Digest 63.1 (1963 [MWSYM]): 151-156.

A new radio frequency rotary joint with high-power capability which lends itself to stacking for multichannel service has been developed. Many present designs are either limited in power handling capability, or are plagued with electrical resonance, and higher order waveguide mode problems.



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The Focused Fabry-Perot Resonator and its Application To Plasma Diagnostics

R.I. Primich and R.A. Hayami. "The Focused Fabry-Perot Resonator and its Application To Plasma Diagnostics." 1963 PTGMTT National Symposium Program and Digest 63.1 (1963 [MWSYM]): 157-162.

The planar Fabry-Perot resonator is a well-known device, both in the optical region and at millimeter wavelengths. Culshaw has demonstrated the excellent performance that may be obtained in the millimeter wavelength band and has indicated that such resonators would be very attractive at even shorter wavelengths. Several years ago one of the authors proposed a focused Fabry-Perot resonator in which the plate would be spherical in shape and would be located along constant phase contours in the field of a focused antenna. Attempts to operate such a device failed, probably due to the fact that the very high mechanical and control requirements were not met. Culshaw quite independently, has discussed a similar focused resonator, but apart from indicating that it might resonate, no estimated performance figures were given. More recently, he has published a detailed theoretical analysis of the planar resonator and has shown that it is exactly equivalent to the focused resonator. The authors have recently successfully operated a focused resonator, and the details of this work will be described in this paper.

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Abstracts

Electro-Optic Interference Filter Light Modulator

X. De Angelis and W. Niblack. "Electro-Optic Interference Filter Light Modulator." 1963 PTGMTT National Symposium Program and Digest 63.1 (1963 [MWSYM]): 163-166.

Electro-optic light modulation utilizing the Pockels effect in potassium dihydrogen phosphate (KDP) or similar materials usually requires either a high modulating voltage or a long crystal structure depending upon the particular modulation technique utilized. An electro-optic interference filter modulator has been developed which operates at greatly reduced voltages and power having a compact structure and the potential of high modulation rates.



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A Review of Microwave Ferrite Devices

K.J. Button. "A Review of Microwave Ferrite Devices." 1963 PTGMTT National Symposium Program and Digest 63.1 (1963 [MWSYM]): 167-170.

Ferrites are used at frequencies between 100 Mc and 300,000 Mc in nonreciprocal attenuators (isolators), circulators, nonreciprocal phase shifters, power limiters, microwave switches, modulators, frequency multipliers, parametric amplifiers, sideband generators and variable attenuators and phase shifters. These applications fall into two categories: (1) unique functions such as those performed by the ferrite isolator and circulator where other types of devices are clearly inferior; (2) marginal functions such as the ferrite limiter or switch where a gas or semiconductor device would ordinarily provide superior performance. Ferrite devices of both categories have been improved recently. Those that perform the unique functions have been made to operate in new kinds of microwave systems or at higher power levels or at ultra-high frequencies or at millimeter wavelengths. Those that perform marginal functions have been adapted to work in specialized systems where they have provided higher power-handling capacity or longer lifetime or lower cost or smaller size or shorter recovery time or smaller insertion loss, but rarely more than one of these in each case.

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



4-Port Crossed-Junction Waveguide Circulators

L.E. Davis, M.D. Coleman and J.J. Cotter. "4-Port Crossed-Junction Waveguide Circulators." 1963 PTGMTT National Symposium Program and Digest 63.1 (1963 [MWSYM]): 171-176.

Circulator action can be obtained with a symmetrical 4-port H-plane waveguide junction containing a central composite post of ferrite and a conducting material, e.g. brass, and this paper gives some details of the experimental investigation which has led to completed devices in three frequency ranges, 3 Gc/s, 9 Gc/s and 20 Gc/s.



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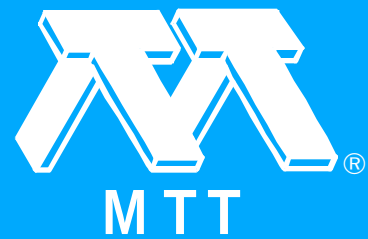


Abstracts

Superconducting Solenoid Traveling Wave Maser System

S. Okwit, K. Siegel and J.G. Smith. "Superconducting Solenoid Traveling Wave Maser System." 1963 PTGMTT National Symposium Program and Digest 63.1 (1963 [MWSYM]): 177-182.

This paper describes a traveling-wave-maser (TWM) system that obtains its magnetic field from a superconducting air-core solenoid.



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The Investigation of an Electron Resonance Spectrometer Utilizing a Generalized Feedback Microwave Oscillator (1963 [MWSYM])

J.B. Payne, III. "The Investigation of an Electron Resonance Spectrometer Utilizing a Generalized Feedback Microwave Oscillator (1963 [MWSYM])." 1963 PTGMTT National Symposium Program and Digest 63.1 (1963 [MWSYM]): 183-188.

The purpose of this investigation was to determine the technical feasibility and the attainable sensitivity of a "self-stabilized" oscillator-spectrometer system in terms of a generalized sample-carrying feedback element to replace the conventional spectrometer systems. This new "self-stabilized" oscillator-spectrometer has a microwave amplifier with a generalized network element in the positive feedback loop causing oscillation to occur at the network's central resonant frequency, with essentially instantaneous frequency stability. This eliminates the need for electronic frequency stabilizing equipment. With the paramagnetic test sample located in the H field of the generalized feedback element, the network's attenuation and phase characteristics are altered when paramagnetic resonance occurs. The resultant problem is to determine the effect this change has on the oscillator's amplitude and frequency of oscillation. From this, the system's ultimate sensitivity is determined from a consideration of the noise within the oscillator loop.

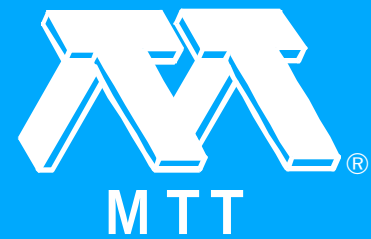


Abstracts

The Importance of Phase in Systems Design (Abstract)

J. Develet. "The Importance of Phase in Systems Design (Abstract)." 1963 PTGMTT National Symposium Program and Digest 63.1 (1963 [MWSYM]): 189-190.

This paper attempts to illustrate the need for controlling phase shift introduced by components in large systems. The author will draw heavily on recent experience in the communication system field; specifically, the control of phase in the design of long haul microwave relays utilizing frequency modulation, such as the Telstar and Relay satellite systems.



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Abstracts

Microwave Phase Measurement Techniques (Abstract)

G.E. Schafer. "Microwave Phase Measurement Techniques (Abstract)." 1963 PTGMTT National Symposium Program and Digest 63.1 (1963 [MWSYM]): 191-192.

A survey of selected developments in microwave phase measurement techniques is presented. General characteristics such as precision, accuracy, and versatility are compared briefly. Particular attention is given to errors inherent in the different techniques. The general problem of loss of accuracy due to mismatches when a component is moved from one system to another is also treated. Some comments are made on problems associated with swept-frequency techniques.



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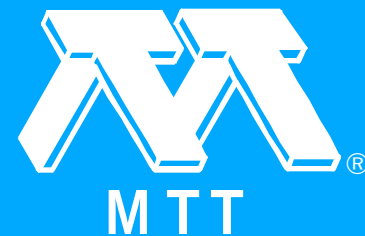


Abstracts

Lasers (Abstract)

R.H. Kingston. "Lasers (Abstract)." 1963 PTGMTT National Symposium Program and Digest 63.1 (1963 [MWSYM]): 193-194.

Recent significant developments in lasers will be discussed. Such new devices as the Raman and semiconductor laser will be described with a brief review of new techniques in the gas and crystalline types of devices. Work in non-linear optical effects will be reviewed with emphasis on the similarity in techniques between microwave and optical theory and experiment.



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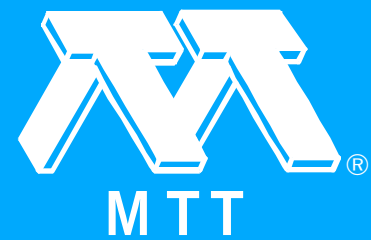


Abstracts

Optical Modulation and Detection (Abstract)

D.A. Chisholm. "Optical Modulation and Detection (Abstract)." 1963 PTGMTT National Symposium Program and Digest 63.1 (1963 [MWSYM]): 195-196.

This paper will discuss latest techniques for optical modulation and demodulation.



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Abstracts

Microwave Ultrasonics (Abstract)

R.T. Denton. "Microwave Ultrasonics (Abstract)." 1963 PTGMTT National Symposium Program and Digest 63.1 (1963 [MWSYM]): 197-198.

Recent activity in the study of high frequency elastic waves (ultrasonic waves) has resulted in an expanded knowledge of the elastic properties of materials at high frequencies and in new types of ultrasonic devices utilizing these properties.



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Amplification of Ultrasonic Waves in Piezoelectric Semiconductors (Abstract)

D.L. White. "Amplification of Ultrasonic Waves in Piezoelectric Semiconductors (Abstract)." 1963 PTGMTT National Symposium Program and Digest 63.1 (1963 [MWSYM]): 199-200.

Ultrasonic waves traveling in certain directions in piezoelectric semiconductors can be amplified by application of an electric field. The conditions for amplification are that the average drift velocity of the charge carriers exceed the velocity of sound and that the carriers travel in the same direction as the sound. Ultrasonic amplification has been observed in single crystal CdS, CdSe and ZnO from frequencies of 10mc/sec to over 1000 mc/sec. The gain is large enough (up to 0.3db per wavelength) to stimulate effort on devices like electrical amplifiers, long loss-less ultrasonic delay lines, etc., especially in the VHF, UHF region. Characteristics of ultrasonic amplifier devices, such as frequency limitations, power requirements, stability, and noise, will be discussed.

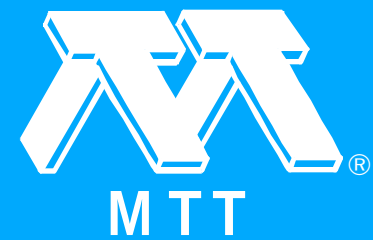
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Abstracts

Overview (1963 [MWSYM])

C.L. Cuccia. "Overview (1963 [MWSYM])." 1963 PTGMTT National Symposium Program and Digest 63.1 (1963 [MWSYM]): 201-202.



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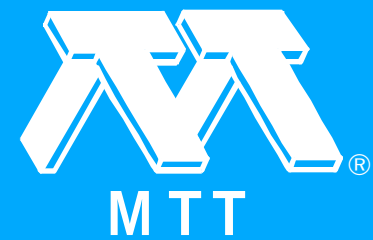
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"General Information (1963 [MWSYM])." 1963 PTGMTT National Symposium Program and Digest 63.1 (1963 [MWSYM]): 203-205.



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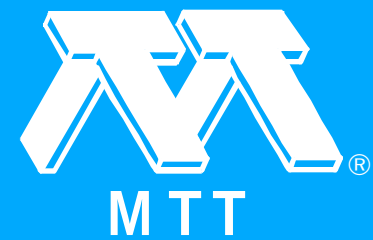
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"Committees (1963 [MWSYM])." 1963 PTGMTT National Symposium Program and Digest 63.1 (1963 [MWSYM]): 206-207.



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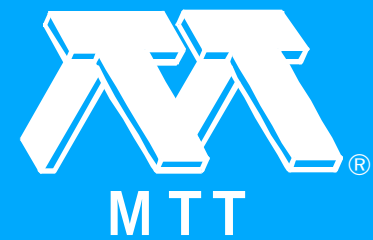
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Abstracts

Index to Institutional Listings (1963 [MWSYM])

"Index to Institutional Listings (1963 [MWSYM])." 1963 PTGMTT National Symposium Program and Digest 63.1 (1963 [MWSYM]): 208-210.



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"Front Cover (1964 [MWSYM])." 1964 PTGMTT International Symposium Program and Digest 64.1 (1964 [MWSYM]): f1-f2.



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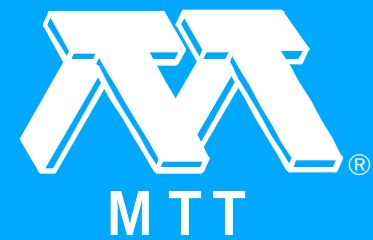
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*"Program (1964 [MWSYM])." 1964 PTGMTT International Symposium Program and Digest
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Characteristics of Log-Periodic Transmission Line Circuits

R.H. DuHamel and M.E. Armstrong. "Characteristics of Log-Periodic Transmission Line Circuits." 1964 PTGMTT International Symposium Program and Digest 64.1 (1964 [MWSYM]): 9-12.

The objectives of this and the companion papers following are to introduce and explain new concepts for the design of transmission line circuits which will theoretically provide frequency-independent performance. All of the circuits are constructed according to log-periodic design principles. As with the corresponding log-periodic antennas, these circuits may be designed to give essentially frequency-independent performance over any desired finite bandwidth. Particularly useful circuits to be described are three-port constant phase difference circuits and four-port hybrids.

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



Log-Periodic Phase Difference Circuits

R.H. DuHamel and M.E. Armstrong. "Log-Periodic Phase Difference Circuits." 1964 PTGMTT International Symposium Program and Digest 64.1 (1964 [MWSYM]): 13-17.

A schematic diagram of the constant phase difference circuits to be discussed is given in Fig. 1. It consists of two similar two-port log-periodic circuits with their inputs connected in parallel.

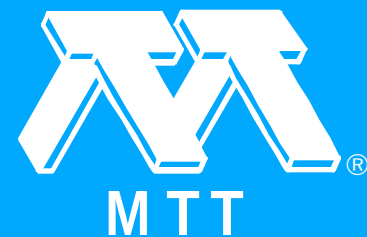


Abstracts

Log-Periodic Octaline Hybrid Junctions

R.H. DuHamel, M.E. Armstrong and M.A. Meyer. "Log-Periodic Octaline Hybrid Junctions." 1964 PTGMTT International Symposium Program and Digest 64.1 (1964 [MWSYM]): 18-21.

The four-port circuits to be discussed are actually eight-port circuits with pairs of ports connected in a balanced manner. Thus, it may be necessary in some applications to use frequency-independent baluns, such as those described in the preceding paper, to feed the hybrid. Since the coupled outputs of the log-periodic octaline junctions are equal in magnitude and either in phase or out of phase, the circuit behaves as a magic T. Log-periodic quadra line hybrid junctions, for which the coupled outputs are 90° out of phase, will be the subject of a future paper. The log-periodic hybrids should find wide application in wideband search, ECM and monopulse tracking systems. As will be discussed, these circuits are best suited for the frequency ranges from 50 Mc to 10 Gc.



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Bandpass Filters with Steep Skirt Selectivity

E.N. Torgow and P.D. Lubell. "Bandpass Filters with Steep Skirt Selectivity." 1964 PTGMMT International Symposium Program and Digest 64.1 (1964 [MWSYM]): 22-26.

Low-pass constant-k filters and exact insertion-loss filters of the Butterworth or Tchebycheff types have long been used as prototype sections for bandpass filters in the microwave region. Such filters having LC ladder structures can be readily transformed into coupled-cavity bandpass microwave filters. Such basic low-pass prototypes having monotonically increasing rejection characteristics will contain many circuit elements when sharp cutoff characteristics are required. The introduction of m-derived sections, or the synthesis of prototype filters exhibiting Tchebycheff ripple characteristics in the stop band, reduces the number of elements. These filters are no longer simple ladder networks and, when transformed to yield bandpass or band-reject characteristics, contain complex arrangements of circuit elements which cannot be readily realized as a microwave structure.

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



Abstracts

Application of Exact Synthesis Methods to Multichannel Filter Design (1964 [MWSYM])

R.J. Wenzel. "Application of Exact Synthesis Methods to Multichannel Filter Design (1964 [MWSYM])." 1964 PTGMTT International Symposium Program and Digest 64.1 (1964 [MWSYM]): 27-32.

The major problem in the design of multichannel filters is that of obtaining a network that separates a given frequency band into n-channels with minimum insertion loss and a low VSWR at the input port. The complexity of the structure is determined by the allowable width of the crossover regions between frequency bands and the required isolation between bands.



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Circular Waveguide Loaded with Dielectric Discs for Increased Usable Bandwidth

P.J. Meier, M.A. Balfour and H.A. Wheeler. "Circular Waveguide Loaded with Dielectric Discs for Increased Usable Bandwidth." 1964 PTGMTT International Symposium Program and Digest 64.1 (1964 [MWSYM]): 33-37.

For each mode of propagation in waveguide, there is a critical (cutoff) frequency below which waves do not propagate. In practice, it is preferable to restrict the propagation to a single mode. If the dominant (TE-11) mode in circular waveguide is to be utilized, other modes may be excluded by operating at frequencies below the cutoff of the next mode (usually the TM-01). Thus the ratio of the TM-01 cutoff frequency over the TE-11 limits the waveguide's useful bandwidth. This ratio is 1.31 for uniform filling, and may be increased to 1.41 by a dielectric lining in the waveguide. A much greater ratio can be achieved by periodically loading the waveguide with discs of high dielectric constant, as shown in Fig. 1. The waveguide diameter is decreased to raise the cutoff frequency of the TM-01 mode, and the dielectric discs are inserted to lower the TE-11 cutoff frequency. As will be shown, the discs have relatively little effect on the TM-01 mode.





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Properties and Applications of the TM/sub 11/ Mode in Cylindrical Disk-Loaded Waveguide

O.H. Altenmueller, R.R. Larsen and G.A. Loew. "Properties and Applications of the TM/sub 11/ Mode in Cylindrical Disk-Loaded Waveguide." 1964 PTGMTT International Symposium Program and Digest 64.1 (1964 [MWSYM]): 38-41.

Several laboratories in Europe and the United States have recently become interested in the TM/sub 11/ mode in cylindrical disk-loaded waveguide. This interest has been stimulated by the realization that the TM/sub 11/ mode exhibits interesting and useful properties when made to interact with charged particle beams. Whereas the TM/sub 01/ mode in cylindrical disk-loaded waveguide has been used for years to give cumulative longitudinal interaction with an electron beam, as, for example, in traveling-wave tubes or linear accelerators, the TM/sub 11/ mode is found to exert a transverse force on particles traveling along the direction of propagation.

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



Abstracts

Periodic Waveguide Structures Containing Ferrimagnetic Material

P.J.B. Clarricoats and M.I. Sobhy. "Periodic Waveguide Structures Containing Ferrimagnetic Material." 1964 PTGMTT International Symposium Program and Digest 64.1 (1964 [MWSYM]): 42-48.

This paper describes some results of a theoretical study of the propagation characteristics of a number of periodic circularly cylindrical structures loaded with axially magnetized ferrimagnetic material, as shown in Fig. 1.



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A Theory for the Operation of the Tetrahedral Junction Ferrite Switch

I. Bardash. "A Theory for the Operation of the Tetrahedral Junction Ferrite Switch." 1964 PTGMTT International Symposium Program and Digest 64.1 (1964 [MWSYM]): 49-53.

In January 1960, a ferrite switch was described which had very attractive characteristics. These included an "off" insertion loss of 60 decibels and an "on" insertion loss of under 0.1 decibels. The name given to the switch was the tetrahedral junction ferrite switch. Figure 1 is a sketch of the switch. The ferrite rod is centrally located along the longitudinal axis of the junction. The switch is turned "on" and "off" by the application and removal of a magnetic field which is generated by a magnetizing coil. The length of the rod is the same as that of the junction with one-inch tapers extending into the input and output waveguides for matching purposes.

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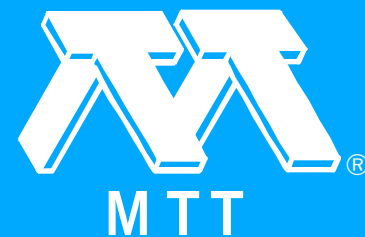


Abstracts

On the Theory of the Ferrite Junction Circulator

C.E. Fay and R.L. Comstock. "On the Theory of the Ferrite Junction Circulator." 1964 PTGMTT International Symposium Program and Digest 64.1 (1964 [MWSYM]): 54-59.

Among the several papers which have appeared in the literature pertaining to the ferrite junction circulator, those of Auld, Bosma and Butterweck have seemed to us to be the most helpful in obtaining an understanding of the device. There have, however, been some points needing clarification, which we shall attempt to cover in this paper.



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Abstracts

Circulator Synthesis (1964 [MWSYM])

J.A. Weiss. "Circulator Synthesis (1964 [MWSYM])." 1964 PTGMTT International Symposium Program and Digest 64.1 (1964 [MWSYM]): 60-64.

Theoretical consideration of the junction circulator has taken the form of group-theoretical treatment of the characteristic modes of symmetrical junctions and analysis of the spatial configurations of the modes under certain simplifying assumptions regarding the structure of the junction. Although a considerable advance in the quality of Y-junction circulators has taken place during the same period, it has not been possible to apply the results of the theory to the design effort. The mechanical improvements, which include the shaping of the ferrite, use of composite dielectric-ferrite elements, addition of tuning elements at the ports and, in stripline versions, shaping of the center conductor, have increased the complexity of the device to the point where existing simplified theoretical models can serve at most only as a qualitative guide.



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A Symmetrical, Distributed Constant Circulator

R.W. Roberts. "A Symmetrical, Distributed Constant Circulator." 1964 PTG/MTT International Symposium Program and Digest 64.1 (1964 [MWSYM]): 65-68.

Ferrite circulators that have been built in the past fall into two categories: non-symmetrical, distributed-parameter type, such as the Faraday rotation and differential phase shift circulators; and the symmetrical, abrupt discontinuity type, such as the "Wye" junction circulator. This paper describes a third type, which has both the properties of symmetry and a distributed interaction region. As such, it is believed that this type of circulator has potential for quite large bandwidths.

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Phonon Generation at 70 kMcps

J.B. Thaxter and P.E. Tannenwald. "Phonon Generation at 70 kMcps." 1964 PTGMTT International Symposium Program and Digest 64.1 (1964 [MWSYM]): 69-72.

Phonons have been generated and detected at 70 kMcps using piezoelectric surface excitation in single-crystal quartz. Echoes are observed from multiple reflections of acoustic waves in a quartz rod excited by a microwave pulse. The temperature dependence of the relative attenuation of several acoustic modes has been measured from 4.2° to 25°K. Previously, experiments using the surface excitation of acoustic waves in solids have been carried out up to 24 kMcps.

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Abstracts

Properties and Excitation of Spin Waves--A New Microwave Time Delay Medium

I. Kaufman and R.F. Soohoo. "Properties and Excitation of Spin Waves--A New Microwave Time Delay Medium." 1964 PTGMTT International Symposium Program and Digest 64.1 (1964 [MWSYM]): 73-79.

Since the proposal of a method of coherent spin wave excitation by Schlomann and its verification by Eshbach, an interest in the use of coherent spin waves has arisen.



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A Two-Port Microwave Variable Delay Line

F.A. Olson and L.D. Buchmiller. "A Two-Port Microwave Variable Delay Line." 1964 PTGMMT International Symposium Program and Digest 64.1 (1964 [MWSYM]): 80-84.

The ability to delay microwave signals and, in particular, to electronically control the delay, is exceedingly important in certain electronic systems. There has been considerable activity in this field recently, much of it centered about fixed-delay techniques using acoustic waves, and variable-delay techniques using combinations of acoustic waves and spin waves, in various single-crystal materials. This paper describes the operation of a new kind of delay device--a two-port electronically variable delay line utilizing pure spin-wave propagation in single-crystal yttrium iron garnet. Particular advantages of this device are transmission-type (two-port) operation, delay continuously variable from zero to several microseconds by means of the magnetic field, and no critical dimensions or surface finishes.

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Abstracts

A YIG Delay Line for Use at Microwave Frequencies

R.A. Sparks, G.R. Gourley and E.L. Higgins. "A YIG Delay Line for Use at Microwave Frequencies." 1964 PTGMTT International Symposium Program and Digest 64.1 (1964 [MWSYM]): 85-89.

The application of yttrium iron garnet in microwave devices has been associated with electronic tuneable filters and low-level power limiters. The characteristics of YIG exploited in these components is the extremely narrow linewidth of the material in the region of ferromagnetic resonance.



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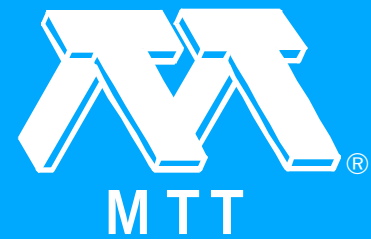


Abstracts

A Novel Solid-State Modulator for Millimeter Waves

A. Saeki, Y. Horiguchi and H. Tsuru. "A Novel Solid-State Modulator for Millimeter Waves." 1964 PTG/MTT International Symposium Program and Digest 64.1 (1964 [MWSYM]): 90-93.

This paper concerns a solid-state modulator that uses both a crystal diode and a ferrite, which is particularly useful as a high-speed pulse modulator for millimeter waves.



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A Technique for Measuring Phase Modulation or Rapid Phase Changes of a Microwave Signal (1964 [MWSYM])

W.P. Ernst. "A Technique for Measuring Phase Modulation or Rapid Phase Changes of a Microwave Signal (1964 [MWSYM])." 1964 PTGMTT International Symposium Program and Digest 64.1 (1964 [MWSYM]): 94-97.

There have been many schemes devised to detect phase shift at microwave frequencies. Most of them are capable of high accuracy when measuring a steady state phase change. The problem becomes a little more complex when one desires to monitor phase when it is varying with time, where the time intervals may be in the order of a few microseconds. The double probe method has been adapted to measure phase modulation, but falls short in two instances: a) the range of phase change is limited, i.e., up to 90°; b) the technique is difficult to adapt to measurements at millimeter wavelengths. The "zebra-stripe" Wharton microwave interferometer is capable of handling wide dynamic phase shifts, but here again we find a disadvantage in that a large number of fringe shifts, caused by very large phase changes, make it cumbersome to resolve the phase vs time contour. Another scheme by Osborne presents the phase vs time as a polar plot, where timing pulses appear as dots on the display. Multiradian phase shifts are again difficult to resolve.



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Quasioptical Waveguide Filters

J.J. Taub, H.J. Hindin and G.P. Kurpis. "Quasioptical Waveguide Filters." 1964 PTGMTT International Symposium Program and Digest 64.1 (1964 [MWSYM]): 98-102.

Oversize waveguide has recently been used successfully to develop a variable attenuator, directional coupler, phase shifter, and a duplexer at 330 Gc. Use of oversize waveguide results in lower loss components at millimeter and submillimeter wavelengths. Filter structures using quasioptical techniques in oversize waveguides are described in this paper.

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Multiple Quantum Frequency Conversion in Extended Interaction Structures

D.J. Scalapino, A. Vassiliadis and R.N. Wilson. "Multiple Quantum Frequency Conversion in Extended Interaction Structures." 1964 PTGMTT International Symposium Program and Digest 64.1 (1964 [MWSYM]): 103-106.

In 1959, E.T. Jaynes suggested that resonant, multiquantum processes could provide an efficient method of frequency conversion at high frequency and high powers. This conversion is mediated by a gas or solid composed of molecules having a strong electric-dipole absorption at a frequency Ω . Such a system can resonantly absorb energy from an electromagnetic field at all odd subharmonic of Ω . The ω/Ω subharmonic absorption is said to correspond to a $2n + 1$ quantum process. The excited (driven) molecular system has electric dipole moments at all odd harmonics of the drive ω . The resonant dipole moment at a frequency $(2n + 1)\omega$ generates an electromagnetic field resulting in the frequency conversion process proposed by Jaynes. Here we report theoretical calculations and experimental observation of this multiquantum frequency conversion in a traveling-wave structure.

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Abstracts

Detection and Demodulation of Laser Beams (Abstract)

A.E. Siegman. "Detection and Demodulation of Laser Beams (Abstract)." 1964 PTGMTT International Symposium Program and Digest 64.1 (1964 [MWSYM]): 107-107.

This talk will review some of the important devices and techniques available for optical reception, particularly in possible future optical communications systems. An exhaustive survey of all the existing or proposed photo-devices will not be attempted. Rather, some hopefully instructive comments will be offered on such key topics as: optical heterodyning; optical heterodyne receivers vs laser amplifier receivers; synthesis of special optical networks; and linear or coherent detection vs quantum counting.



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Abstracts

Demodulation of Microwave Frequency-Modulated Light Using Birefringent Crystals

E.O. Ammann and S.E. Harris. "Demodulation of Microwave Frequency-Modulated Light Using Birefringent Crystals." 1964 PTGMTT International Symposium Program and Digest 64.1 (1964 [MWSYM]): 108-111.

At present, the most promising technique for demodulating frequency-modulated (FM) light is to convert the FM signal to an AM signal; the AM signal can then be demodulated by a microwave photo tube, photodiode, or other means. This paper deals with the discrimination process, i.e., the conversion of FM light to AM light. In particular, we describe several discriminators composed of birefringent crystals and polarizers.



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Analysis of Negative-Resistance Photodiodes

M. Wright. "Analysis of Negative-Resistance Photodiodes." 1964 PTGMTT International Symposium Program and Digest 64.1 (1964 [MWSYM]): 112-114.

Photodetectors for the detection of microwave-modulated optical radiation have recently received increasing attention. Passive microwave photodiodes (containing no negative resistance or other gain-producing mechanism) have been recently developed and some experimental work has been presented on active parametric photodiodes. An active photodetector is one in which a gain-producing mechanism, such as a negative resistance, appears.

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Abstracts

Macroscopic Single-Mode Waveguide for the Construction of Optical Components

D.W. Wilmot. "Macroscopic Single-Mode Waveguide for the Construction of Optical Components." 1964 PTGMTT International Symposium Program and Digest 64.1 (1964 [MWSYM]): 115-120.

The contemplated application of laser radiation include optical systems which are similar to present microwave radar and communication systems. However, to provide the degree of sophistication presently obtainable at microwave frequencies, it is necessary to have high-performance optical components. One approach to the design of laser systems is to employ waveguide-type components, analogous to those presently available at microwave frequencies. This paper discusses single-mode, macroscopic, optical wave guide which is proposed as a construction medium for the fabrication of optical components. The term "macroscopic" implies that the waveguide dimensions are at least an order of magnitude greater than the wavelength of light, which is considered sufficiently large to permit fabrication with reasonable tolerances.



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High-Power Limitations of Microwave Control Circuits (Abstract)

L. Gould. "High-Power Limitations of Microwave Control Circuits (Abstract)." 1964 PTGMTT International Symposium Program and Digest 64.1 (1964 [MWSYM]): 121-121.

Present and future high-power microwave systems impose stringent performance requirements on circuits for switching, duplexing, attenuating, and phase shifting of transmitted power. These control functions are achieved either with purely mechanical microwave circuits, or by utilizing the interaction between microwave circuits and nonlinear materials such as plasmas, ferrites and semiconductors. The high-power limitations of such control circuits will be reviewed with particular emphasis on their relative performance characteristics and on anticipated improvements in performance in the near future.

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



Abstracts

High-Power Filters for the Suppression of Spurious Frequencies

L. Young, B.M. Schiffman, E.G. Cristal and O. Allen. "High-Power Filters for the Suppression of Spurious Frequencies." 1964 PTGMTT International Symposium Program and Digest 64.1 (1964 [MWSYM]): 122-126.

The rapidly increasing number of high-power transmitters are creating a serious problem in radio frequency interference. A large part of this problem is the emission of harmonic and other spurious frequencies, which can be eliminated without affecting the signal bandwidth of the transmitter. Various types of filter have been investigated both analytically and experimentally; this paper will review some of this work. The intention is to compare different situations and different filters, rather than to treat any one filter in detail.



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A DC Triggered High-Speed High-Power Microwave Spark Gap Switch (1964 [MWSYM])

H. Farber, M. Klinger, M. Sucher and E. Malloy. "A DC Triggered High-Speed High-Power Microwave Spark Gap Switch (1964 [MWSYM])." 1964 PTGMTT International Symposium Program and Digest 64.1 (1964 [MWSYM]): 127-132.

A previously reported high-speed microwave spark gap switch is triggered with a flash of intense ultraviolet light, but requires the applied rf power level to be close to the self-breakdown value of the gap. For this reason, the reliable use of the u-v triggered switch is restricted to rf pulse widths which are less than the formative time for an rf discharge (0.25-0.50 microseconds).



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Generation of High-Power Nanosecond Pulses of Microwave Energy

M. Gilden and F.A. Jellison. "Generation of High-Power Nanosecond Pulses of Microwave Energy." 1964 PTGMTT International Symposium Program and Digest 64.1 (1964 [MWSYM]): 133-137.

The subject of this paper is the generation and measurement of high-power nanosecond pulses of microwave energy. The technique involves the sudden release of energy stored in a standing wave in a linear resonator with a resultant gain in peak power over that used to charge the resonator. Alternative techniques using traveling-wave resonators and other circuits have not achieved equivalent power levels, and are inherently limited by greater losses, complex circuitry, and lack of power gain. The key to this technique is the ability to switch in less than a nanosecond by using a triggered high-pressure gas discharge gap. The apparatus was constructed for use at X-band frequencies to study breakdown of gases on a nanosecond time scale.

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E and H-Plane Bends for High-Power Oversized Rectangular Waveguide (1964 [MWSYM])

J.P. Quine. "E and H-Plane Bends for High-Power Oversized Rectangular Waveguide (1964 [MWSYM])." 1964 PTGMTT International Symposium Program and Digest 64.1 (1964 [MWSYM]): 138-143.

This paper presents the results of a study of bends for oversized rectangular waveguide having cross-sectional dimensions in the range between 1.5 and 2.5 free-space wavelengths. It is expected that waveguide having these dimensions will be able to transmit 50 to 100 kw of average power at X-band without water cooling. The transmission of at least 5.0 megawatts of peak power at X-band without pressurization is also a design objective.

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



A High-Power Ferroelectric Limiter (1964 [MWSYM])

M. Cohn and A.F. Eikenberg. "A High-Power Ferroelectric Limiter (1964 [MWSYM])." 1964 PTGMTT International Symposium Program and Digest 64.1 (1964 [MWSYM]): 144-149.

A new type of solid state high-power limiter, which utilizes the large-signal nonlinear characteristics of ferroelectric materials, has been developed. Experimental 218 Mc units have handled peak input power levels in excess of 25 kw while yielding saturated output power levels of about 300 watts and a small-signal insertion loss of 0.5 db. The limiter consists of a symmetrical, loop-coupled, capacity-loaded, coaxial line cavity as shown in Fig. 1. A large portion of the capacity loading is provided by the ferroelectric pellet. Due to the large amount of capacitive loading yielded by the very high dielectric constant ferroelectric material, the cavity length is well under a quarter wavelength. An electric heater is located outside the cavity, but near the ferroelectric pellet, in order to bring the pellet temperature within a few degrees of its Curie temperature. Figure 1 also contains an expanded drawing of the region near the ferroelectric pellet. The power handling capability, saturated power output level, and small-signal insertion loss are determined by the radius ($r/\text{sub } f/$) and height ($d/\text{sub } f/$) of the ferroelectric pellet. High-voltage breakdown in this region is retarded by coating the lateral surfaces of the ferroelectric pellet and its supporting brass posts with corona dope. The entire assembly is also filled with sulfur hexafluoride gas ($\text{SF}/\text{sub } 6/$) as a further precaution against high-voltage breakdown.



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Phase Stability of Varactor Frequency Multipliers

R.A. McConnell. "Phase Stability of Varactor Frequency Multipliers." 1964 PTGMTT International Symposium Program and Digest 64.1 (1964 [MWSYM]): 150-152.

In the Stanford Linear Accelerator, power at 476 Mc is transmitted by a two-mile coaxial line parallel to the accelerator structure. At 30 points along the length of this coaxial line, separated by 333-1/3 feet, a few watts of power are coupled out and multiplied by varactor diode sextuples to the accelerator operating frequency of 2856 Mc. This power is then amplified and transmitted to the accelerator structure to provide acceleration to the electron beam.

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An X-Band Parametric Amplifier with Closed-Cycle Cooling (1964 [MWSYM])

C.T. Rucker, W. Morrow and E.S. Grimes, Jr.. "An X-Band Parametric Amplifier with Closed-Cycle Cooling (1964 [MWSYM])." 1964 PTGMTT International Symposium Program and Digest 64.1 (1964 [MWSYM]): 153-156.

The objective of the work described here was to develop a system-oriented closed-cycle cooled parametric amplifier using a commercially available cooler. The desired characteristics were: tuning range, 7.0 to 8.0 Gc; instantaneous bandwidth, 20 to 30 megacycles; effective noise temperature, about 70° Kelvin including the uncooled X-Band four port circulator. The compatibility for use, at a later date, of more complex multistage coolers to allow cooling of the circulator and parametric amplifier combination, was also an important consideration.

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The Versatile Tunnel-Diode Video Detector

W.F. Gabriel. "The Versatile Tunnel-Diode Video Detector." 1964 PTGMTT International Symposium Program and Digest 64.1 (1964 [MWSYM]): 157-162.

The tunnel-diode video detector to be discussed is shown in Fig. 1; it consists of a diode mount and a ferrite isolator. The isolator is necessary because the tunnel diode is biased into its negative resistance region. The diode mount was designed for operation at the C-band frequency range of 5.4 to 5.9 Gc. This mount is tunable in order to accommodate diode replacement, and its rf bandwidth is adjustable between the limits of roughly 30 Mc to 700 Mc for selected diodes.

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Abstracts

Solid State V-Band Local Oscillator and Mixer

X.A. De Angelis. "Solid State V-Band Local Oscillator and Mixer." 1964 PTG/MTT International Symposium Program and Digest 64.1 (1964 [MWSYM]): 163-164.

The technique used to obtain an all-solid-state local oscillator at 68.5 Gc consisted of driving a varactor harmonic generator chain with a transistor-power amplifier. The source was a crystal-controlled transistor oscillator in a temperature-compensated oven yielding a stability of three parts in 10^6 at a frequency of 44.596 Mc. Alternatively, an external stable source with a 4 milliwatt, 50 ohm output may be used to drive the exciter-power amplifier. The exciter-power amplifier contains a buffer amplifier, a tripler and appropriate power amplification to yield 14 watts at 133.789 Mc from two 2N2876 transistors.



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Design of Stable Broadband Tunnel-Diode Amplifiers

J.H. Lepoff. "Design of Stable Broadband Tunnel-Diode Amplifiers." 1964 PTGMTT International Symposium Program and Digest 64.1 (1964 [MWSYM]): 165-168.

The design method described here establishes the desired gain at band edges and relies on the symmetry of the circuit reactance characteristic to maintain the gain over the entire band. A design for the 4 Gc to 5 Gc band resulted in a theoretical peak gain of 13 db when the gain at band edges was set at 11 db. Another design for the 5 Gc to 6 Gc range had a peak gain of 15 db.

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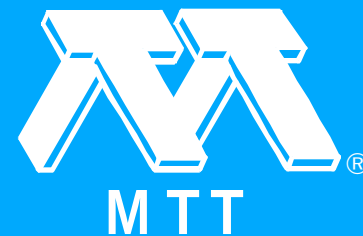


Abstracts

New Device Principles Used in Microwave Diodes (Abstract)

R.M. Ryder. "New Device Principles Used in Microwave Diodes (Abstract)." 1964 PTGMTT International Symposium Program and Digest 64.1 (1964 [MWSYM]): 169-169.

Modern microwave diodes owe much to transistor techniques, materials, and understanding. In contrast to the older point-contact diodes, still universally used in microwave receivers, the new units operate by means of a variety of new principles which were not available until transistor techniques were applied.



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Integrated Circulator Design for Parametric Amplifier Application

C.E. Barnes. "Integrated Circulator Design for Parametric Amplifier Application." 1964 PTGMTT International Symposium Program and Digest 64.1 (1964 [MWSYM]): 170-175.

A paper accepted for presentation at the 1964 International Solid State Circuits Conference describes a two-stage, L-band parametric amplifier with a gain of 19 ± 0.25 db over a 20% band, and a 1.5 db noise figure in the 15% band of interest. The achievement of maximum performance in a parametric amplifier of this type depends critically upon the characteristics of the associated circulators. It is felt that a discussion of the techniques used in the design of the circulator package for this amplifier might prove helpful to other designers in the field.

Click on title for a complete paper.



Microwave Applications of the Step Recovery Diode

R.B. Mouw and F.S. Coale. "Microwave Applications of the Step Recovery Diode." 1964 PTGMTT International Symposium Program and Digest 64.1 (1964 [MWSYM]): 176-180.

There has been increasing interest in the past few years in methods for obtaining microwave power derived for vhf sources by means of single-stage multipliers of higher harmonic order. While such a method is less efficient than a cascade of varactor doublers and triplers, the reduced complexity and increased versatility will often mitigate the additional vhf drive power required. A single-stage high-harmonic-order multiplier usually consists of an input matching network and output cavity or bandpass filter. The input and output of single-stage multipliers are usually terminated with linear loads, whereas varactor chains are often difficult to align due to the nonlinear interaction between stages. An additional advantage of the single-stage multiplier is the possibility of employing prime harmonic numbers.



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A Diode Phase Shifter for Array Antennas

J.F. White. "A Diode Phase Shifter for Array Antennas." 1964 PTG/MTT International Symposium Program and Digest 64.1 (1964 [MWSYM]): 181-185.

The appeal of a phased array antenna is well recognized in the search for a radiator whose power is not limited by the finite capacity of its component subradiators--only their number--and whose beam may be steered at high speeds and even subdivided into multibeam. Numerous methods are proposed to control the phase of the coherently energized subradiators and thus steer their resultant beam. Microwave, two-port, electronically switchable phase shifters used in series with one or more radiator elements and using PIN switching diodes for control are frequently recommended. Previously, the problems in implementing such a device have been the achievement of high power capability and low insertion loss.

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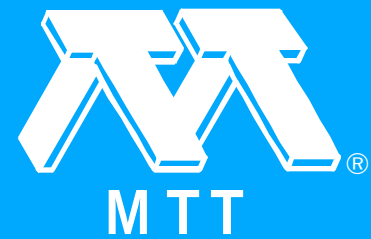


Abstracts

Advances in Solid State Microwave Devices (Abstract)

W. Matthei. "Advances in Solid State Microwave Devices (Abstract)." 1964 PTGMTT International Symposium Program and Digest 64.1 (1964 [MWSYM]): 186-186.

This paper reviews the latest solid state techniques in terms of oscillators, amplifiers, detectors, switches, and limiters.



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Abstracts

Improvements in Reflex Klystron Linearity with the Use of Varactor Diodes

V. Possenti and A. Pistilli. "Improvements in Reflex Klystron Linearity with the Use of Varactor Diodes." 1964 PTGMTT International Symposium Program and Digest 64.1 (1964 [MWSYM]): 187-192.

The reflex klystron oscillator is very widely used as a frequency-modulated oscillator in modern microwave radio links for telephone and television communication systems.



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Abstracts

A 7 Gc Narrow-Band Waveguide Switch Using PIN Junction Diodes

H.J. Peppiatt, A.V. McDaniel, Jr. and J.B. Linker, Jr.. "A 7 Gc Narrow-Band Waveguide Switch Using PIN Junction Diodes." 1964 PTGMTT International Symposium Program and Digest 64.1 (1964 [MWSYM]): 193-198.

A narrow-band waveguide switch has been designed in WR-137 waveguide which will handle a power level in excess of 8 watts. When passing a signal, this switch has an insertion loss of less than 0.5 db, but when it is "turned off" it has an insertion loss of greater than 80 db over a minimum bandwidth of 10 Mc. The switch is designed using PIN junction diodes in band elimination filter sections.



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Abstracts

Broadband Binary 180° Diode Phase Modulator (1964 [MWSYM])

R.V. Garver. "Broadband Binary 180° Diode Phase Modulator (1964 [MWSYM])." 1964 PTGMTT International Symposium Program and Digest 64.1 (1964 [MWSYM]): 199-203.

The recent emergence of diode phase modulators makes certain systems realizable which were previously impossible or impractical because of the high modulation power required to obtain high-speed phase control. Systems benefiting from this new diode phase shifter technology include high-speed electronic antenna scanners and phase modulation radars. It was as part of an effort to develop a video frequency phase modulated radar that the task reported here was undertaken. The system requires a phase shifter that can be switched between 0° and 180° phase shift in 20 nanoseconds or less. The amplitudes in each phase state must be equal and the switching transient should be small. Additional flexibility is allowed the system if the phase shifter is broadband. Other requirements on the phase shifter such as power limitations depend on the diode, and are not considered here. The purpose of this task is to find a suitable technique to satisfy the system requirements using presently available diodes. The new technique reported here has application to variable phase control as well as binary phase control.



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A Mono-Control Microwave Semiconductor Switch

J.C. Hoover. "A Mono-Control Microwave Semiconductor Switch." 1964 PTGMTT International Symposium Program and Digest 64.1 (1964 [MWSYM]): 204-208.

The circuit shown in Fig. 1 has the useful property that the impedance looking into the input remains matched if the two outputs are terminated in matched loads regardless of the value of Z , whether it be reactive, real or even negative. This statement is conditional on the requirement that the value of Z be identical in two locations. The division of power to the two outputs is not independent of Z but is controlled by it. Obviously, if Z is reduced to zero, output #1 will be shorted out and no power will appear at that port. In the converse, if Z is infinite, output #2 is shorted out by the open-circuited quarter-wavelength stub.



Abstracts

Improved Duplexing Techniques Employing Gas TR and Semiconductor Limiter Devices

R. Tennenholtz and P. Basken. "Improved Duplexing Techniques Employing Gas TR and Semiconductor Limiter Devices." 1964 PTGMTT International Symposium Program and Digest 64.1 (1964 [MWSYM]): 209-213.

The TR Tube Dilemma. The present-day TR tube, through constant improvements, has approached a point where basically all parameters, with the exception of one or two, can be optimized. The designer, at best, can satisfy a specific rigid requirement only at the expense of another. This typically involves a "trade off" in performance with respect to such characteristics as crystal protection, life, recovery time or power handling capability.



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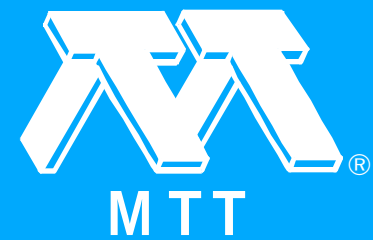
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Index, 1964 PTGMTT International Symposium

"Index, 1964 PTGMTT International Symposium." 1964 PTGMTT International Symposium Program and Digest 64.1 (1964 [MWSYM]): 214-215.



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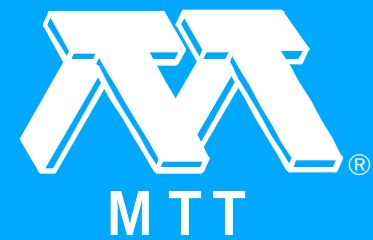
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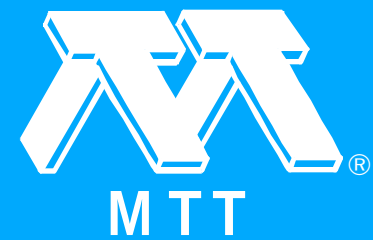
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"Copyright (1965 [MWSYM])." 1965 G-MTT Symposium Program and Digest 65.1 (1965 [MWSYM]): I-ii.



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Theory of a Thermal-Gradient Gas Lens (1965 [MWSYM])

D. Marcuse. "Theory of a Thermal-Gradient Gas Lens (1965 [MWSYM])." 1965 G-MTT Symposium Program and Digest 65.1 (1965 [MWSYM]): 1-6.

A communications system using a carrier at light frequencies requires a guiding medium to assure light propagation from transmitter to receiver. A periodic sequence of lenses can act as a waveguide if the lenses are properly spaced. Lenses made of a solid dielectric such as glass not only absorb some of the light in the dielectric medium itself but also inevitably scatter some of the light out of the beam at the interface between air and dielectric. Since many closely spaced lenses are required to guide the beam around intentional and accidental bends of the transmission path the loss of a lens-waveguide can become quite high. These losses can be avoided if instead of solid dielectrics gasses are used as lens material.

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Measurements on a Thermal Gradient Gas Lens (1965 [MWSYM])

W.H. Steier. "Measurements on a Thermal Gradient Gas Lens (1965 [MWSYM])." 1965 G-MTT Symposium Program and Digest 65.1 (1965 [MWSYM]): 7-10.

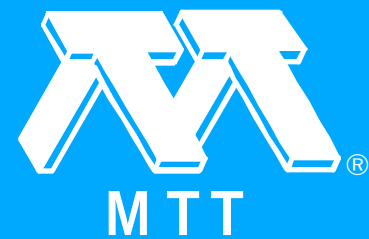
A thermal gradient gas lens has been investigated experimentally for a variety of conditions and gases. The results in general show good agreement with the theory and indicate that these lenses may be useful in long distance optical transmission lines.



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Light Beam Propagation in Curved Schlieren Guides

H.G. Unger. "Light Beam Propagation in Curved Schlieren Guides." 1965 G-MTT Symposium Program and Digest 65.1 (1965 [MWSYM]): 11-16.

Schlieren guides consisting of a suitable transverse profile of optical density in a gas may not only be used to continuously focus light beams of Hermite-Gaussian field distribution but also to guide such beams around bends.

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Modes in Radial Wavebeam Resonators (1965 [MWSYM])

G. Goubau and F. Schwering. "Modes in Radial Wavebeam Resonators (1965 [MWSYM])." 1965 G-MTT Symposium Program and Digest 65.1 (1965 [MWSYM]): 17-20.

The electromagnetic fields in beam waveguides and Fabry-Perot resonators can be described in terms of axially propagating reiterative beam modes having a cross-sectional field distribution which can be reconstituted at periodoc intervals. In the resonator case, the period of iteration is one round trip of the beam between the two reflectors. The iteration is accomplished either by diffraction effected by limiting the beam cross-section or by transformation of the cross-sectional phase distribution of the beam. The first case applies to the iris-type beam waveguides and to Fabry-Perot resonators with plane reflectors and the second to lens-type beam waveguides and to resonators with spherical reflectors.

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Ray Theory of Resonators and Beam Waveguides with an Inhomogeneous Medium

W.K. Kahn. "Ray Theory of Resonators and Beam Waveguides with an Inhomogeneous Medium." 1965 G-MTT Symposium Program and Digest 65.1 (1965 [MWSYM]): 21-26.

Important characteristics of optical resonators and beam waveguides can be inferred from simple ray-optical considerations. The ray theory is susceptible to an extremely convenient algebraic formulation from which a formal analogy in terms of electrical networks is evident. Most of the available results for optical resonators and beam waveguides assume the medium within the structure to be homogeneous and isotropic. In laser applications of optical resonators the medium is certainly inhomogeneous and, furthermore, dispersive. A ray analysis is carried through for these complex cases, and yields some very interesting and general conclusions. In particular, the stability of the ray systems, i.e., discrimination between high and low-loss configurations, is discussed in terms of a generalization of Pierce's criterion. For simplicity, two-dimensional systems are considered; the extension to three dimensions follows directly.

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Abstracts

Rayleigh Distance as a Normalizing Range for Beam Power Transmission

J.F. Ramsay. "Rayleigh Distance as a Normalizing Range for Beam Power Transmission." 1965 G-MTT Symposium Program and Digest 65.1 (1965 [MWSYM]): 27-32.

Rayleigh distance is the axial distance from a radiating aperture to a point at which the path difference between the axial ray and an edge ray is $\lambda/4$. To a good approximation, $R/\text{sub } r/ = D^2 / 2\lambda$.



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Wideband Interdigital Filters with Capacitively Loaded Resonators

L.A. Robinson. "Wideband Interdigital Filters with Capacitively Loaded Resonators." 1965 G-MTT Symposium Program and Digest 65.1 (1965 [MWSYM]): 33-38.

The interdigital filters described by Matthaei consist of resonators formed by coupled-line elements that are $\lambda/4$ long at midband, with alternate ends of the coupled-line elements grounded, and the opposite ends open-circuited. It will be shown in this paper that the coupled-line elements can be made shorter than $\lambda/4$ at midband provided that loading capacitances are added at the open-circuited element ends. In addition to making the filter more compact in one dimension, capacitive loading has the advantage of moving the second pass band (that is, the first spurious pass band) even farther from the first pass band. The shorter the resonators are at midband, the wider the upper stop band, since the second pass band cannot occur until the resonators are somewhat greater than $\lambda/2$ long. The capacitively loaded version retains the other advantages of the version without loading, that is, the relatively large spacings between coupled-line elements permit relatively relaxed manufacturing tolerances, the rates of cutoff and strength of the stop bands are enhanced by multiple-order poles at zero frequency and between the pass bands, and they can be fabricated using little or no dielectric. The wide separation between first and second pass bands should make this filter type useful in parametric amplifiers and in frequency multipliers, the latter application has been demonstrated by Cuccia.

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Equalization of Waveguide Delay Distortion (1965 [MWSYM])

E.N. Torgow. "Equalization of Waveguide Delay Distortion (1965 [MWSYM])." 1965 G-MTT Symposium Program and Digest 65.1 (1965 [MWSYM]): 39-44.

All-pass microwave networks can be realized by terminating the conjugate pair of arms of a wideband 3-db coupler in identical reactive networks. For transmission in one direction, an ideal circulator can be used with one arm terminated in the reactive network. When the reactive network is a length of waveguide, tapered so that the cutoff wavelength decreases with distance from the input port, characteristics well suited for the equalization of the dispersive characteristics of waveguide sections result. A single linear tapered guide, in particular, is shown to be capable of reducing the time delay variation a length of waveguide to less than 2 percent over the full operating frequency band of the waveguide. A family of design curves is presented giving the slope of the taper for a prescribed degree of equalization over a specified frequency range.

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Circular TE/sub 011/-Mode, Trapped-Mode Bandpass Filters (1965 [MWSYM])

G.L. Matthaei and D.B. Weller. "Circular TE/sub 011/-Mode, Trapped-Mode Bandpass Filters (1965 [MWSYM])." 1965 G-MTT Symposium Program and Digest 65.1 (1965 [MWSYM]): 45-48.

The filters to be described are called "trapped-mode filters" because for their desired resonator mode the energy is trapped within the resonator structure to give a high-Q resonance. However, the side walls of the resonator are partially open so unwanted modes will radiate out the side walls of the structure so as to completely kill or at least greatly dampen unwanted resonances. Thus one of the main objectives in using this type of resonator is to obtain bandpass filters which will give a low-loss pass band, with no other pass bands. Though the principles to be described can also be used with other forms of resonators, in this paper, the resonators described employ the circular TE/sub 011/-mode which has the advantage of providing a higher unloaded Q than would rectangular TE/sub 101/-mode resonators.

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Abstracts

Microwave Filters Containing High-Q Dielectric Resonators

S.B. Cohn. "Microwave Filters Containing High-Q Dielectric Resonators." 1965 G-MTT Symposium Program and Digest 65.1 (1965 [MWSYM]): 49-54.

Dielectric objects with free-space boundaries have for many years been known to exhibit resonances in various modes. Since practical applications of this phenomenon in microwave filters have not been made, a study program was instituted to explore the feasibility of dielectric resonators as filter elements, and to derive formulas and obtain experimental data useful for filter design.



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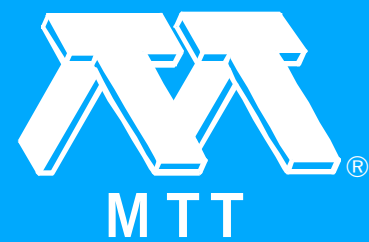
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Optimum Multipole Quarter-Wave TEM Filters

M.C. Horton and R.J. Wenzel. "Optimum Multipole Quarter-Wave TEM Filters." 1965 G-MTT Symposium Program and Digest 65.1 (1965 [MWSYM]): 55-60.

Most microwave TEM filters use stub loading of a transmission line or coupled resonant elements to achieve the desired bandpass or band stop characteristics. In many cases the stubs or resonant elements are of equal line length, and are spaced equally along a transmission line at quarter-wave intervals. The spacing between filter elements in these designs provides isolation from interaction with the fields of adjacent elements but otherwise does not contribute to the filtering characteristics. A theory is presented herein which includes the quarter-wave transmission line spacers, called "unit elements," in an exact design of maximally flat and equal ripple bandpass or bandstop response filters. The theory is applicable to all microwave filter forms consisting entirely of a cascade of quarter-wave lines, quarter-wave stubs, and coupled quarter-wave lines. Each line length element characterized in the theory may be used to create a complex plane pole to augment the filter skirt response. Thus, the new theory is termed "optimum multipole."

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Wideband Varactor Harmonic Multipliers

R.J. Wenzel. "Wideband Varactor Harmonic Multipliers." 1965 G-MTT Symposium Program and Digest 65.1 (1965 [MWSYM]): 61-66.

The basic circuit criteria for designing efficient narrowband harmonic multipliers are well established. For the case of the shunt-connected diode, ideal filters are usually specified that pass desired harmonics, reject others by having an infinite input impedance, and provide zero impedance paths for idler harmonics. As the bandwidth of allowable input frequencies is increased, it is desirable to maintain these ideal conditions. The stopband input impedance of most filters is entirely reactive and must change continuously with frequency. Since the ideal filter conditions call for the input impedance to be either infinite or zero, the optimum conditions can be obtained only at discrete frequencies. As in any practical situation, the ideal conditions can be approximated but, in general, bandwidths in excess of 10 percent become difficult to achieve. A common procedure for obtaining wider bandwidths is to use bandpass filters that have sharp cutoff characteristics. This guarantees that the real part of the stopband input impedance is small, but does not provide the ideal input conditions required. In fact, for most designs, interaction between the filter input impedances results in undesirable loading of the varactor and is a bandwidth-limiting factor.

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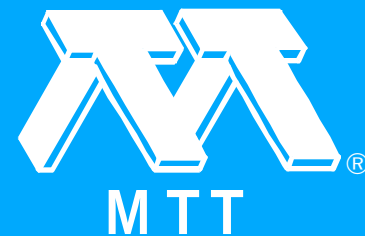


Abstracts

Filter-Diode Integration

F.S. Coale and P.M. LaTourrette. "Filter-Diode Integration." 1965 G-MTT Symposium Program and Digest 65.1 (1965 [MWSYM]): 67-73.

Integration of a semiconductor diode within a microwave filter circuit may result in superior performance over separate components. This paper will consider several classes of devices which yield electrical and mechanical characteristics impossible to obtain by the separate treatment of individual components.



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Wideband Polarizer in Circular Waveguide Loaded with Dielectric Discs

P.J. Meier and S. Arnow. "Wideband Polarizer in Circular Waveguide Loaded with Dielectric Discs." 1965 G-MTT Symposium Program and Digest 65.1 (1965 [MWSYM]): 73-78.

At last year's Symposium, it was shown that dielectric-disc loading could greatly increase the useful bandwidth of circular waveguide. Figure 1 is a sketch of a circular waveguide containing spaced high-k dielectric discs which strongly load the TE-11 (dominant) mode, but have little effect on the TM-01 mode which normally limits the single-mode bandwidth. Figure 2 shows the frequency range over which modes can propagate for disc loading and for uniform loading. Disc loading offers a much greater ratio of single-mode bandwidth, whose upper limit is then determined by the TE-21 cutoff. This wider frequency band is useful in the design of various components, particularly the polarization converter to be described.

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Abstracts

Progress in Solid State Microwave Power Sources (Abstract)

F. Sterzer. "Progress in Solid State Microwave Power Sources (Abstract)." 1965 G-MTT Symposium Program and Digest 65.1 (1965 [MWSYM]): 79-80.

The state-of-the art of cw microwave solid state power sources is still rapidly advancing. Progress during the past year to be discussed includes: transistor amplifiers delivering more than 10w at 400 mc and more than 1w at 1 gc, transistor amplifier-multipliers and transistor oscillator-multipliers producing several watts at L-band frequencies (in these devices the transistor acts as both an amplifier or an oscillator, and as a frequency converter), transistor driven varactor harmonic generator chains producing over 1 watt at X-band frequencies and several watts at C- and S-band frequencies, varactor multipliers with efficiencies of 80 percent, compact and rugged sources capable of operating in missile and outer space environments, and electronically tuned sources with tuning characteristics superior to that of reflex klystrons.



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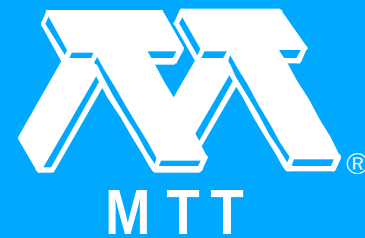


Abstracts

Microwave Transistor Amplifier Design

B.T. Vincent, Jr.. "Microwave Transistor Amplifier Design." 1965 G-MTT Symposium Program and Digest 65.1 (1965 [MWSYM]): 81-86.

The high frequency transistor equivalent circuit applicable for our consideration is shown in Figure 1. Typical values of the parameters for a state-of-the-art silicon npn microwave transistor are given below.



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Frequency Multiplication with the Step Recovery Diode

R.D. Hall. "Frequency Multiplication with the Step Recovery Diode." 1965 G-MTT Symposium Program and Digest 65.1 (1965 [MWSYM]): 87-88.

The step recovery diode has been discussed in several papers. Recently, diodes have become available with attractive combinations of short transition time, long lifetime, low series resistance, and high breakdown voltage. These parameters are all related to the efficiency and power handling capability of frequency multipliers using these diodes. Special frequency multipliers were constructed to explore the relations among the diode characteristics and the performance of multipliers. To make multipliers suitable for such study, the circuits were constructed to eliminate resonances except at the input and the output frequency even for high order multiplication. Diode current was measured by budding into the multiplier a current sampling resistor immediately adjacent to the diode. The value of the resistance is kept small, and the voltage developed across it is observed with a Hewlett-Packard sampling oscilloscope having a bandwidth of 5 gc. The output circuits of these multipliers were tunable cavities coupled to the diode so that operation could be observed at many different multiples of the input frequency.

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Abstracts

Low-Level Limiting Utilizing Impact Ionization in Bulk Germanium at 4.2°K

W.W. Heinz and S. Okwit. "Low-Level Limiting Utilizing Impact Ionization in Bulk Germanium at 4.2°K." 1965 G-MTT Symposium Program and Digest 65.1 (1965 [MWSYM]): 89-92.

Low-level garnet limiters operating in the coincidence region have previously been reported at 4.2°K. These devices, however, operate only within an octave frequency range, which is a function of the $4\pi/M/\text{sub s/}$. For YIG at 4.2°K, for example, this frequency range is 2.3 to 4.6 gc. This paper describes the application of impact ionization in bulk semiconductors to obtain low-level limiting, for which no such frequency limit exists in the microwave range.



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A New Millimeter Mixer Using Bulk Semiconductor (and its Radio Frequency Bolometric Prototype)

F. Arams, E. Sard, C. Allen and B. Peyton. "A New Millimeter Mixer Using Bulk Semiconductor (and its Radio Frequency Bolometric Prototype)." 1965 G-MTT Symposium Program and Digest 65.1 (1965 [MWSYM]): 93-94.

We have carried out an analysis and demonstrated experimentally mixing in the 8-millimeter region using non-linear effects in a bulk semiconductor. In a manner analogous to optical heterodyne mixers, it is not required that the element have instantaneous response to the individual RF cycle, but merely that the time constant be sufficiently short for the intermediate frequency output. The barrier capacitance, and small size inherent to point-contact and similar diodes is eliminated, so that this type of mixer will inherently operate at frequencies well into the submillimeter region. Furthermore, It can be easily matched over broad bandwidths.



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A Low Noise Figure 94 Gc Gallium Arsenide Mixer Diode

R.J. Bauer. "A Low Noise Figure 94 Gc Gallium Arsenide Mixer Diode." 1965 G-MTT Symposium Program and Digest 65.1 (1965 [MWSYM]): 95-100.

Until recently low noise figure mixer diodes for operation above 80 gc were very difficult to achieve and had short life times. This paper describes the procedures and results that evolved from a development program that eliminated these disadvantages. The three major areas to be investigated in developing a low noise figure diode were selection of an intermediate frequency for minimum crystal noise ratio, selection of a semiconductor material that gave low conversion loss, and mounting the diode such that package parasitics have a minimal effect. (The term low noise figure in this discussion infers crystal noise figure, i.e., the product of the conversion loss (Lc) and the noise ratio. It is assumed that the noise figure of the IF amplifier, whether it be transistor, tunnel diode or TWT, will remain relatively constant through the low microwave frequencies.)

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An Electrically-Tuned Parametric Amplifier

K.L. Kotzebue and L.B. Fletcher. "An Electrically-Tuned Parametric Amplifier." 1965 G-MTT Symposium Program and Digest 65.1 (1965 [MWSYM]): 101-104.

A parametric amplifier is a device which normally can be tuned only over relatively restricted frequency ranges. One of the basic reasons for this tuning difficulty is the fact that more than one frequency range is of importance: In addition to the signal frequency, a pump frequency and one or more sum or difference frequencies must be considered. For example, one could construct a tunable parametric amplifier by using a fixed-tuned broadband signal circuit, a tunable pump source, and a fixed-tuned difference or sum frequency circuit. Or, one could use a fixed-tuned broadband signal circuit, a fixed-tuned pump source, and a tunable difference or sum frequency circuit. A third approach would be to use tunable signal and sum or difference frequency circuits, together with a fixed frequency pump source.

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Abstracts

Microstrip Transmission on Semiconductor Dielectrics (1965 [MWSYM])

T.M. Hyltin. "Microstrip Transmission on Semiconductor Dielectrics (1965 [MWSYM])." 1965 G-MTT Symposium Program and Digest 65.1 (1965 [MWSYM]): 105-108.

As a result of both a larger number of microwave functions performed by semiconductor devices and a larger number of functions required in modern systems, it has become highly desirable from both the system and the device standpoint, to fabricate multiple microwave semiconductor devices on a common substrate. The use of multiple devices in a single package has system and reliability advantages, but there is also offered the possibility of improved performance of the microwave components. This results from the elimination of packaging of each individual element and the ability to place the package interface in a more advantageous position in the circuit.



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Abstracts

Trends in Phased Arrays

J.L. Allen. "Trends in Phased Arrays." 1965 G-MTT Symposium Program and Digest 65.1 (1965 [MWSYM]): 109-110.

The advent of the ballistic missile threat has promoted interest in a complex form of radar commonly called a "phased array." These radars, instead of using a single electrically large antenna such as a parabolic reflector, and mechanically moving it to point the beam, make use of many electrically small antennas (typically hundreds or thousands) and move the beam by varying the relative phasing of these antennas.



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Abstracts

A Digital Latching Ferrite Strip Transmission Line Phase Shifter (1965 [MWSYM])

L.R. Whicker and R.R. Jones. "A Digital Latching Ferrite Strip Transmission Line Phase Shifter (1965 [MWSYM])." 1965 G-MTT Symposium Program and Digest 65.1 (1965 [MWSYM]): 111-114.

This paper is concerned with the development of a new non-reciprocal, digital phase shifter which combines the rapid switching speeds offered by latching devices and the compactness of a strip transmission line structure. A four-bit, C-band model is described which offers a maximum of 3 percent phase deviation across an 8 percent frequency band with a corresponding figure of merit (degrees of phase shift/db loss) in excess of 500. In addition, the new phase shifter is much smaller than its waveguide counterpart, and is better suited for integration into a compact matrix which may contain many identical phase shifters.



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Ferrite Digital Phase Shifters

D.R. Taft, J.W. Simon and J.D. Sweeney. "Ferrite Digital Phase Shifters." 1965 G-MTT Symposium Program and Digest 65.1 (1965 [MWSYM]): 115-118.

Recent phased array system requirements for fast switching, latching type phase shifters have prompted considerable interest in the non-reciprocal ferrite phase shifter using a toroidal geometry. The use of the toroidal geometry permits the ferrite to be permanently magnetized in the circumferential direction by passing a current pulse through the toroid. The basic ferrite and driving configuration are shown in Figure 1.

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A Four-Bit Latching Ferrite Switch (1965 [MWSYM])

D.H. Landry and W.C. Passaro. "A Four-Bit Latching Ferrite Switch (1965 [MWSYM])." 1965 G-MTT Symposium Program and Digest 65.1 (1965 [MWSYM]): 119-122.

Latching ferrites are rapidly advancing a new era of solid state devices. Fast switching, light weight, minimal drive requirements, no bulky external magnets are some of the significant characteristics of these devices. This paper deals with the application of latching ferrites to a novel approach for combining polarized input signals. Vertical, horizontal, right circularly polarized or left circularly polarized input signals are combined at a common output by selectively choosing the bit states of a four-bit latching ferrite switch. The heart of the device is a fast switching, low insertion loss, phase stable, temperature controlled, 90 degree latching bit shown in Figure 1.

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A Latching Ferrite Junction Circulator for Phased Array Switching Applications

P.C. Goodman. "A Latching Ferrite Junction Circulator for Phased Array Switching Applications." 1965 G-MTT Symposium Program and Digest 65.1 (1965 [MWSYM]): 123-126.

This paper describes an X-band latching three-port junction circulator with switching time less than one microsecond, wide bandwidth, and small size. It is particularly well suited for use as the switching element in differential time delay networks and other switching networks required in phased array antennas.



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A High-Power Phase Shifter for Phased Array Systems

W.P. Clark. "A High-Power Phase Shifter for Phased Array Systems." 1965 G-MTT Symposium Program and Digest 65.1 (1965 [MWSYM]): 127-132.

In many large phase-phase array systems It is desirable to provide RF phase shifting at the input to rows, columns, or sub-arrays of element phase shifters in order to drastically reduce the complexity of the phase control system. The phase shifting may be provided by a high power phase shifter which must necessarily handle all the power that the row, column or sub-array radiates. To provide this high power phase shifting capability, a 115 kw peak, 600 watt average power C-band phase shifter has been developed. The unit is a Reggia-Spencer type of phase shifter capable of 360 degrees of continuous reciprocal phase shift. It is 2.4 by 2.1 by 8.2 inches, and weighs less than 1.5 pounds. This paper covers the design and development of the unit.

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Abstracts

Application of the Butler Matrix to High-Power Multichannel Switching

R.S. Davis and H.E. Schrank. "Application of the Butler Matrix to High-Power Multichannel Switching." 1965 G-MTT Symposium Program and Digest 65.1 (1965 [MWSYM]): 133-138.

This paper describes a technique for multichannel switching of high microwave power levels, based on an application of waveguide hybrid circuits such as the well known Butler matrix. It operates on the basic principle of dividing the high power input into a number of lower-power parts, then phase shifting these lower-power components to cause them to recombine into any one of the multiple output channels. The number of channels is any binary number, $N=2^{\sup n/}$, and the total power which can be switched is equal to N times the power handling capability of the phasing components used.



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Theoretical Analysis of Twin Slab Phase Shifters in Rectangular Waveguide (1965 [MWSYM])

E. Schlomann. "Theoretical Analysis of Twin Slab Phase Shifters in Rectangular Waveguide (1965 [MWSYM])." 1965 G-MTT Symposium Program and Digest 65.1 (1965 [MWSYM]): 139-142.

One of the more promising device configurations for digital ferrite phase shifters is that of a rectangular waveguide containing circumferentially magnetized ferrite toroids of suitable length. Such a structure is shown in Figure 1. A very similar structure, which is more readily amenable to theoretical analysis is shown in Figure 2. Here the ferrite toroid has been replaced by two oppositely magnetized slabs which extend over the complete height of the waveguide. The propagation of electromagnetic waves through waveguides of the type shown in Figure 2 has previously been analyzed by Lax et al, and by Von Aulock.

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Broadband Strip Transmission Line UHF Circulators

J.W. Simon. "Broadband Strip Transmission Line UHF Circulators." 1965 G-MTT Symposium Program and Digest 65.1 (1965 [MWSYM]): 143-146.

The recent need for compact nonreciprocal devices in the UHF region has focused much attention on the three-port junction circulator. This device when polarized above the resonant magnetic field, can be constructed into a compact configuration capable of an electrical performance and size advantage heretofore unattainable with ferrite isolators, duplexers, etc.

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New Design Techniques for Miniature VHF Circulators

V.E. Dunn and R.W. Roberts. "New Design Techniques for Miniature VHF Circulators." 1965 G-MTT Symposium Program and Digest 65.1 (1965 [MWSYM]): 147-152.

Since the feasibility of Y junction circulators was first reported in 1959, such circulators have been built to operate in frequency bands from 100 mc to the millimeter wavelength range. All of these circulators appear to operate on essentially the same principle. Using this approach the ferrite disc diameter is proportional to the wavelength. While junction circulators have been useful at microwave frequencies because of their simplicity and small size, such circulators at UHF and VHF frequencies have been expensive and inconveniently large because of the large ferrite volume required. This paper reports the development of a new type of circulator for the VHF and UHF bands. The approach utilizes the lumped element techniques which are natural and convenient for this frequency range and as a result the size of the circulator, and ferrite volume, do not increase with the wavelength. Lumped element circulators have also been developed recently in Japan by Konishi. Figure 1 illustrates the size reduction which has been obtained with the new technique.

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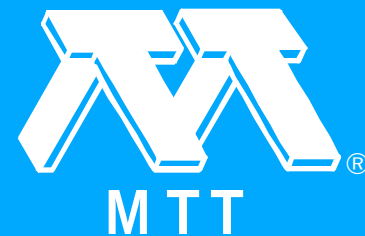


Abstracts

Advanced Ferrite Duplexing-Limiting Techniques

J.E. Andrews, J.L. Brediger and D.H. Landry. "Advanced Ferrite Duplexing-Limiting Techniques." 1965 G-MTT Symposium Program and Digest 65.1 (1965 [MWSYM]): 153-158.

Recent advances in the field of high power ferrite devices have permitted the use of microwave duplexing techniques providing reliability and fail-safe protection previously impractical or impossible.



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Abstracts

A High-Power X-Band Limiter

E. Wantuch and M. King. "A High-Power X-Band Limiter." 1965 G-MTT Symposium Program and Digest 65.1 (1965 [MWSYM]): 159-162.

The narrow ferrimagnetic linewidth exhibited by single crystal yttrium iron garnet forms the basis for several novel microwave devices. These may be divided into two main categories, namely, magnetically tunable filters and microwave limiters. Single crystal YIG spheres may be associated with additional microwave resonators to enhance one of these desired characteristics and to suppress the other.



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Oversize Waveguide Quasioptical Ferrite Devices

H.J. Hindin and J.J. Taub. "Oversize Waveguide Quasioptical Ferrite Devices." 1965 G-MTT Symposium Program and Digest 65.1 (1965 [MWSYM]): 163-168.

Oversize waveguide quasioptical techniques, which have been used in the past to develop many components have not been used to design nonreciprocal ferrite devices at wavelengths as low as 1 mm. These Faraday rotation devices include an isolator, four-port circulator, and modulator. Initial experiments have demonstrated the rotation phenomena and yielded information on ferrite properties at these small wavelengths. In this paper, devices will be described and experimental data will be given. Previous work on millimeter Faraday rotation devices has been at longer wavelengths and used standard sized waveguide.

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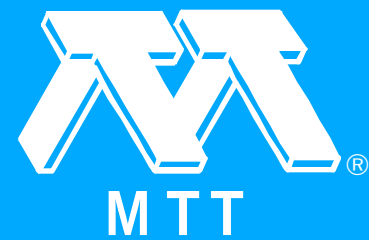


Abstracts

A Ferroelectric Microwave Switch (1965 [MWSYM])

J.W. Amoss, L.J. Lavedan, M.R. Donaldson and A.L. Stanford. "A Ferroelectric Microwave Switch (1965 [MWSYM])." 1965 G-MTT Symposium Program and Digest 65.1 (1965 [MWSYM]): 169-174.

The rapid variation of an impedance shunting a transmission line is a well known technique for switching microwave power. The application of a switching voltage to a ferroelectric material provides a convenient means for rapidly varying an impedance between significantly different states. A multistub transmission-reflection type switch actuated by a switching voltage of 1000 volts has been studied. The operation of the switch depends upon the ability of a ferroelectric variable capacitor to change its capacitance upon application of a switching voltage. A change in capacitance represented by a ratio of two to one results in substantial change in the input admittance ($Y_{\text{sub } n/}$) of the prototype network shunting the transmission line.



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Design Considerations for Microwave Acoustic Delay Devices

J.R. Yaeger and F.A. Olson. "Design Considerations for Microwave Acoustic Delay Devices." 1965 G-MTT Symposium Program and Digest 65.1 (1965 [MWSYM]): 175-178.

Recent developments in the field of microwave acoustics have led to the realization of miniature solid state delay devices operating at microwave frequencies. These devices, capable of new functions in terms of length of delay and signal storage time, are finding numerous uses in altimeters, radar, and similar electronic systems. The units are particularly attractive in situations where size and weight are of prime importance.



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Suppression of Multiple Pass Signals from Microwave Acoustic Delay Lines

H.A. Willing and G.P. Rodrigue. "Suppression of Multiple Pass Signals from Microwave Acoustic Delay Lines." 1965 G-MTT Symposium Program and Digest 65.1 (1965 [MWSYM]): 179-180.

Microwave acoustic delay lines normally exhibit an output that shows a series of delayed pulses corresponding to a succession of passes through the delay medium. Such a train of multiple pass pulses can be used to advantage in many test equipment applications. In some applications, however, they are highly undesirable. In cw applications they are, of course, prohibited. While complete suppression of multiple passes is practically impossible, effective suppression of multiple pass signals, 30 db suppression, can be achieved in a number of ways.



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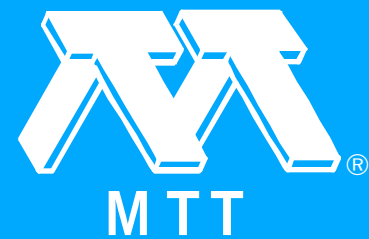
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UHF Magnetoacoustic Delay Line

W. Skudera, R. Sproat, I. Bady and E. Gikow. "UHF Magnetoacoustic Delay Line." 1965 G-MTT Symposium Program and Digest 65.1 (1965 [MWSYM]): 181-186.

The feasibility of exploiting the relatively slow velocity of propagation of acoustic waves in order to delay an electromagnetic signal in the microwave frequency range has been clearly established. Several different approaches in the conversion of the electromagnetic energy to acoustic energy have been shown to be practical. One of these involves the use of a rod of single crystal yttrium iron garnet (YIG) which serves both as the delay medium and also as the transducer to convert the electromagnetic energy to acoustic energy, and vice-versa. A basic advantage of this type of delay line is the ability to vary delay time continuously over a large range by means of a magnetic biasing field. Though considerable progress has been reported in the field of magnetoacoustic delay lines of this type further advances are required in the reduction of insertion loss, increase in the delay time, and a more precise understanding of the phenomena involved. In pursuance of these objectives, experiments have been performed on a magnetoacoustic delay line intended for operation over the range of 200 to 1000 mc. Comprehensive data on insertion loss and VSWR is presented and analyzed. Also, results of bonding two single crystal YIG rods to achieve a longer delay are given.

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Abstracts

Monopulse Comparator Networks for Multioctave Operation

R. Van Wagoner and P. Shelton. "Monopulse Comparator Networks for Multioctave Operation." 1965 G-MTT Symposium Program and Digest 65.1 (1965 [MWSYM]): 187-192.

Antennas with wide bandwidths have been exploited for many applications. Log-periodic and spiral radiators are examples of structures that can be designed to cover any desired bandwidth. One of the most important uses for these antennas is as feed systems for focusing objectives, typified by the parabolic reflector.



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Abstracts

Techniques for Providing TWM's with Wide Instantaneous Bandwidths

J.A. DeGruyl, S. Okwit and J.G. Smith. "Techniques for Providing TWM's with Wide Instantaneous Bandwidths." 1965 G-MTT Symposium Program and Digest 65.1 (1965 [MWSYM]): 193-198.

The paramagnetic material in a conventional TWM is uniformly distributed in a slow-wave structure located in a homogeneous DC magnetic field. The spin distribution-function has a Lorentzian shape which constitutes a fixed relationship between Gain (db) and 3 db bandwidth, namely, $B/\text{sub } 3/ = B/\text{sub } m/ / \text{spl radic/ } 3/G/\text{sub db/}-3//$. By applying an inhomogeneous DC magnetic field, we can overcome this limitation and make gain and bandwidth both independent variables.



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Abstracts

Impedance and Attenuation of Transmission Lines Supporting TEM-Modes

M.V. Schneider. "Impedance and Attenuation of Transmission Lines Supporting TEM-Modes." 1965 G-MTT Symposium Program and Digest 65.1 (1965 [MWSYM]): 199-204.

The characteristic impedance and the attenuation of transmission lines supporting a TEM mode can be determined by the following methods: 1 Resistive thin film method (analog computation). 2 Finite difference methods combined with relaxation technique (digital computation).



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Abstracts

The Arc Loss of Multimegawatt Gas Discharge Duplexers (1965 [MWSYM])

C.S. Ward. "The Arc Loss of Multimegawatt Gas Discharge Duplexers (1965 [MWSYM])." 1965 G-MTT Symposium Program and Digest 65.1 (1965 [MWSYM]): 205-210.

The arc loss of multimegawatt microwave gas discharge duplexers is the subject of this paper. It is shown that the discharge at these power levels can be considered as a lossy conductor of freed surface area and varying thickness, given by the skin depth which varies with peak incident power. Since the skin depth is always smaller than the discharge container dimensions, the analysis is greatly simplified as compared with other treatments. These small skin depths are always realized in multimegawatt switching applications.



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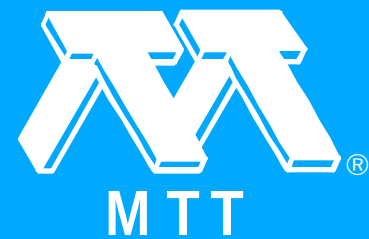
A Superheterodyne 600 Gc Radiometer Receiver

R.F. Packard. "A Superheterodyne 600 Gc Radiometer Receiver." 1965 G-MTT Symposium Program and Digest 65.1 (1965 [MWSYM]): 211-216.

A radiometer receiver using a superheterodyne circuit has been designed and constructed which detects thermal energy at 600 gc. The design is an extension to submillimeter wavelengths of principles used previously by workers at this laboratory in the design of millimeter wave radiometers. The radiometer was built on contract with U.S. Army Munitions Command, Frankford Arsenal, for field evaluation as a possible means for detection of ground military targets. This paper described the design and performance of the radiometer in viewing a thermal calibrator. Field experiments with the radiometer will be reported at a later time by personnel of the contracting agency.

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Prediction and Measurement of Oscillator Frequency Modulation under Random Vibration

J.R. Ashley and C.B. Searles. "Prediction and Measurement of Oscillator Frequency Modulation under Random Vibration." 1965 G-MTT Symposium Program and Digest 65.1 (1965 [MWSYM]): 217-221.

Many microwave oscillators operate in a vibrating environment and the effect of this vibration on performance must be known. Test data have shown the vibration in missiles and jet aircraft is not sinusoidal; indeed, the spectrum analysis of vibration shown in Figure 1 indicates that the vibration is better simulated by band limited random noise than by sinusoidal vibration. Diagnosis of trouble is easier to perform and understand if sinusoidal vibration is used. Therefore, it is desirable to predict the frequency modulation of an oscillator operating under random vibration, on the basis of tests made with sinusoidal vibration.

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Abstracts

Interpretation of Interaction of Fabry-Perot Resonator Fields with Plasmas

D.H. Auston, R.I. Primich and R.A. Hayami. "Interpretation of Interaction of Fabry-Perot Resonator Fields with Plasmas." 1965 G-MTT Symposium Program and Digest 65.1 (1965 [MWSYM]): 223-226.

Fabry-Perot, or open resonators are extremely useful in plasma diagnostics because of the excellent spatial resolution and sensitivity to small changes in electron density and collision frequency which can be achieved with them. Their application to diagnostics has been considered in detail.



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Abstracts

A Simple Method for Precise Phase Shift Measurement

C.F. Augustine. "A Simple Method for Precise Phase Shift Measurement." 1965 G-MTT Symposium Program and Digest 65.1 (1965 [MWSYM]): 227-231.

This paper discusses a simple method of measuring the phase shift of circuit components with very high accuracy. The method is substantially independent of loss in the circuit component. This is accomplished by using a systematic technique that eliminates errors due to the usual measuring system imperfections. The method uses a hybrid junction, a dual channel null detector circuit, and a high quality phase shift standard whose design is presented in some detail. Phase shift measurement accuracies of 1 degree have been reliably obtained on components with loss up to 40 db.



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Abstracts

The Automatic Phasing System for the Stanford Two-Mile Linear Electron Accelerator (1965 [MWSYM])

C.B. Williams, A.R. Wilmunder, J. Dobson, H.A. Hogg, M.J. Lee and G.A. Loew. "The Automatic Phasing System for the Stanford Two-Mile Linear Electron Accelerator (1965 [MWSYM])." 1965 G-MTT Symposium Program and Digest 65.1 (1965 [MWSYM]): 233-236.

The Stanford 2 mile linear electron accelerator, now under construction, will consist of a straight line array of two hundred and forty 24-megawatt klystron amplifiers, operating at 2856 mc, each feeding four 10-foot accelerator sections made of disk-loaded waveguide. A relativistic bunched electron beam injected at the beginning of the machine will be accelerated to energies up to 20 billion electron volts. The acceleration is achieved through the process of energy transfer from the electromagnetic waves launched by the klystrons in the accelerator sections to the electrons riding on this wave.



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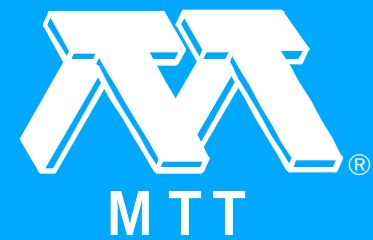
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Abstracts

Copyright (1966 [MWSYM])

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Abstracts

Foreword (1966 [MWSYM])

P. Lacy. "Foreword (1966 [MWSYM])." 1966 G-MTT International Microwave Symposium Digest 66.1 (1966 [MWSYM]): iii-iii.

A hearty welcome is extended to all of you attending the 1966 G-MTT International Microwave Symposium. With considerable effort on the part of the Program Committee, a full and exciting four day program is presented. Invited speakers and guests will give a truly international breath and technical depth to the coverage. However, the true core of a scientific symposium lies in the new and unpublished work to be presented in the contributed papers.



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GaAs Post-Threshold Microwave Amplifier, Mixer, and Oscillator

B.W. Hakki. "GaAs Post-Threshold Microwave Amplifier, Mixer, and Oscillator." 1966 G-MTT International Microwave Symposium Digest 66.1 (1966 [MWSYM]): 1-6.

Bulk GaAs was operated simultaneously as a microwave amplifier, mixer, and oscillator under cw conditions. This was achieved by biasing the sample at post-threshold conditions, i.e., beyond the bias at which the sample broke into Gunn-type oscillations. It was found that even under these post-threshold conditions, wherein the device was oscillating at a certain frequency, the device simultaneously had the properties of a linear active element capable of mixing and amplification at other frequencies. The frequencies at which the device exhibited simultaneous amplification, mixing, and oscillation were not harmonically related. These frequencies were determined jointly by semiconductor and microwave circuits.

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Abstracts

Quantitative Comparison of Solid-State Microwave Detectors (1966 [MWSYM])

M. Cowley and H.O. Sorensen. "Quantitative Comparison of Solid-State Microwave Detectors (1966 [MWSYM])." 1966 G-MTT International Microwave Symposium Digest 66.1 (1966 [MWSYM]): 7-12.

Six classes of solid-state microwave detectors are compared in this paper. The primary criteria for comparison are sensitivity, frequency response, and dynamic range. Other performance criteria which are less easily characterized by a single numerical quantity, are also considered; examples of these are burnout and ease of impedance match.



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Ultimate Noise Figure and Conversion Loss of the Schottky Barrier Mixer Diode

M.R. Barber and R.M. Ryder. "Ultimate Noise Figure and Conversion Loss of the Schottky Barrier Mixer Diode." 1966 G-MTT International Microwave Symposium Digest 66.1 (1966 [MWSYM]): 13-18.

Considerable interest has recently been shown in the use of the epitaxial Schottky barrier (ESBAR) diode as a microwave frequency down-converter. For the first time it has become possible to surpass the performance of the redoubtable point-contact diodes, through the use of photo resist techniques to achieve small areas and epitaxial material to achieve low series resistance. The new diodes are also more reproducible, have much lower reverse current leakage, lower $1/f$ noise, and can be designed for much higher dynamic range. Herein we calculate that they should exhibit overall calculated noise figures as low as 3 dB at X-band when the image is short-circuited and the following i-f amplifier has a 2 db noise figure.

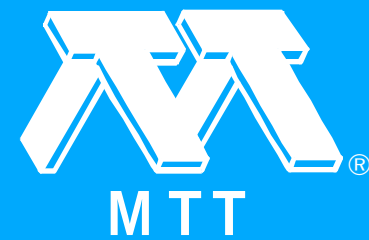
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Some Selected Topics in British Solid-State Research

L. Lewin. "Some Selected Topics in British Solid-State Research." 1966 G-MTT International Microwave Symposium Digest 66.1 (1966 [MWSYM]): 18-18.



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Abstracts

Improved Intermodulation Rejection in Mixers (1966 [MWSYM])

J.H. Lepoff and M. Cowley. "Improved Intermodulation Rejection in Mixers (1966 [MWSYM])." 1966 G-MTT International Microwave Symposium Digest 66.1 (1966 [MWSYM]): 19-22.

Intermodulation is one of the most serious forms of spurious response in superheterodyne receivers. This type of interference cannot be completely eliminated by narrow band filters. Major improvements in receiver performance can be made only by improving and making more effective use of the mixing element.



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Performance Characteristics of CW Silicon and GaAs Avalanche Diode Oscillators

F.A. Brand, V.J. Higgins and J.J. Baranowski. "Performance Characteristics of CW Silicon and GaAs Avalanche Diode Oscillators." 1966 G-MTT International Microwave Symposium Digest 66.1 (1966 [MWSYM]): 23-27.

Recently there have been numerous reports of coherent microwave generation from p-n junction structures when biased into the avalanche region and situated in a suitable circuit environment. However, little quantitative data on the performance of these devices in various circuit configurations have been available. Further, nothing has been presented concerning their application to specific system problems; nor has any data regarding their reliability been documented to date.

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Abstracts

Microwave Solid-State Sources

B.C. De Loach, Jr. and B.C. De Loach. "Microwave Solid-State Sources." 1966 G-MTT International Microwave Symposium Digest 66.1 (1966 [MWSYM]): 28-29.

This paper has a three-fold purpose: (1) to present a simple physical description and the basic operating principles of the solid state devices currently capable of generating coherent microwave power, including transistors, harmonic generators, tunnel diodes, avalanche transit time (IMPATT) diodes, and Gunn diodes; (2) to summarize the present state of the art for each device; and (3) to ascertain the limitations imposed on each device by device physics, and to compare their potentialities.



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Abstracts

Instabilities in Varactor Multipliers

D.B. Leeson. "Instabilities in Varactor Multipliers." 1966 G-MTT International Microwave Symposium Digest 66.1 (1966 [MWSYM]): 30-34.

Operating instability and spurious oscillations are principal factors preventing widespread success with varactor frequency multipliers. This paper outlines a theory of multiplier instability which relates universal characteristics of non-linear resonant circuits to the observed behavior of varactor multipliers and multiplier chains. Design criteria and test methods for stable multipliers are developed; their validity is supported by data on multipliers shown to be stable over wide variations in environment, drive level and load.



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Theory and Measurements of Noise in Varactor Harmonic Generator Sources

M.E. Hines and J.G. Ondria. "Theory and Measurements of Noise in Varactor Harmonic Generator Sources." 1966 G-MTT International Microwave Symposium Digest 66.1 (1966 [MWSYM]): 35-40.

Oscillators and harmonic generators are inherently nonlinear. Their responses to noisy perturbations are more characteristic of the modulation process than of linear superposition. It is commonly found that noise is present as modulation sidebands with strong correlation between noise components on opposite sides of the carrier.



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Practical Application of a Positive Resistance Up-Converter for Ultra-Low-Noise Amplification

E. Sard, B. Peyton and S. Okwit. "Practical Application of a Positive Resistance Up-Converter for Ultra-Low-Noise Amplification." 1966 G-MTT International Microwave Symposium Digest 66.1 (1966 [MWSYM]): 41-45.

An ultra-low-noise, tunable S-band amplifier which uses a travelling-wave maser (TWM) as the second stage has been developed. The amplifier is made up of a cooled, tunable low-noise S-band varactor up-converter, a fixed-tuned, high-gain, C-band TWM, and an uncooled, tunable varactor down-converter connected in cascade. This receiver configuration has the advantage of combining the large tuning range capability of a parametric up-converter with the ultra-low noise temperature and unconditional stability of a maser.

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Abstracts

A 1200 Megabits/Sec, Gray Code, Analog to Digital Converter

R.E. Fisher. "A 1200 Megabits/Sec, Gray Code, Analog to Digital Converter." 1966 G-MTT International Microwave Symposium Digest 66.1 (1966 [MWSYM]): 46-51.

This paper considers a novel 9 GHz microwave carrier system which can sample a baseband analog input signal at a 200 MHz rate and encode into Gray Code 6-bit words (64 levels), giving a bit rate of 1200 megabits/second. This performance is obtained through the use of a system employing the microwave counterpart of a serial type gray coder first described by B. D. Smith. In this new system the baseband analog signal amplitude is replaced by microwave carrier amplitude, while base-band analog signal polarity is replaced by microwave carrier phase.



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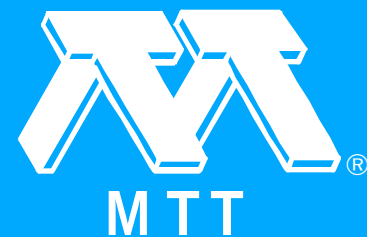


Abstracts

Broadband Frequency Translators

F.S. Coale, H.M. Weil and P.M. LaTourrette. "Broadband Frequency Translators." 1966 G-MTT International Microwave Symposium Digest 66.1 (1966 [MWSYM]): 52-59.

In most microwave systems signals are converted from one frequency to another -- usually from microwave to conventional intermediate frequencies from 30 - 200 MHz. However, there is a large class of systems which employ microwave translators which convert from one microwave frequency to another. This paper will deal with microwave frequency translators in which the bandwidth of these signals is large--usually greater than an octave and up to a decade.



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Injection-Locked Oscillators as Amplifiers for Angle-Modulated Signals

H.L. Stover and R.C. Shaw. "Injection-Locked Oscillators as Amplifiers for Angle-Modulated Signals." 1966 G-MTT International Microwave Symposium Digest 66.1 (1966 [MWSYM]): 60-66.

Under certain conditions an oscillator can lock to and track an external driving signal whose frequency is near the free-running frequency of the oscillator and whose amplitude is considerably less than the oscillator output amplitude; this property has led to speculation whether the locked oscillator can serve as an amplifier for angle-modulated signals. We have conducted experimental and theoretical investigations in order to clearly define what the conditions are which would allow such an application. The investigations have included steady-state locking performance, dynamic amplifier response, and noise behavior of the locked oscillators. The experiments were performed on tunnel-diode oscillators at X-band. The theory is valid for a wide number of oscillator types.

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Abstracts

The RF Drive System for the Stanford Two-Mile Linear Accelerator

G.A. Loew. "The RF Drive System for the Stanford Two-Mile Linear Accelerator." 1966 G-MTT International Microwave Symposium Digest 66.1 (1966 [MWSYM]): 67-68.

The function of the rf drive system for the Stanford Two-Mile Linear Accelerator is to supply rf drive power at 2856 MHz to an array of 240 high power (24 mw) klystron amplifiers and to assure that the correct phase relationship between each of these drive signals and the electron bunches in the accelerator is preserved over a tuning range of ± 0.1 mhz. This paper gives an overall description of the system which fulfills these requirements, and discusses some of the microwave engineering and measurement problems encountered in its design.



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Abstracts

Microwave Applications of Superconductivity

P.B. Wilson. "Microwave Applications of Superconductivity." 1966 G-MTT International Microwave Symposium Digest 66.1 (1966 [MWSYM]): 69-75.

For many years after the discovery of superconductivity in 1911, the phenomenon remained largely a laboratory curiosity. For over 40 years physicists worked with only moderate success to gain a theoretical understanding of superconductivity. In recent years, however, the situation has changed rapidly. An adequate theory has now been developed (the BCS theory), and superconductivity has become a useful tool in many fields of pure and applied research. As an outstanding example, super-conducting magnets are now available commercially which can generate dc fields up to 100 kilogauss.



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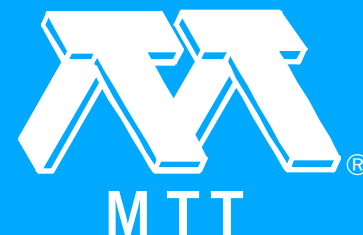


Abstracts

Accurate Phase Length Measurements of Large Microwave Networks (1966 [MWSYM])

J.N. Weaver and R. Alvarez. "Accurate Phase Length Measurements of Large Microwave Networks (1966 [MWSYM])." 1966 G-MTT International Microwave Symposium Digest 66.1 (1966 [MWSYM]): 76-82.

Electrical phase length measurements and adjustments on long wave guide or coaxial feed lines are necessary sometimes in antenna arrays and particle accelerators. Most of the commonly used phase length measurements schemes are of a transmission or reflection type and may use a modulated signal. Transmission methods usually require a precision reference length to reach both ends of the network, while reflection methods require only a stable reflector, but inherently cannot resolve 180° /spl oslash/ differences.



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Synthesis of Distributed Elliptic-Function Filters from Lumped-Constant Prototypes (1966 [MWSYM])

R. Levy and I. Whiteley. "Synthesis of Distributed Elliptic-Function Filters from Lumped-Constant Prototypes (1966 [MWSYM])." 1966 G-MTT International Microwave Symposium Digest 66.1 (1966 [MWSYM]): 83-89.

Filters based on the elliptic-function or Cauer-parameter type of response give rapid cut-off compared with filter responses of Chebychev or Butterworth types which have no attenuation poles at finite frequencies. The response of a distributed band-stop filter consisting of commensurate lengths of transmission line, based on a two-pole lumped element prototype, is shown in Fig. 1 as an example of the type of response desired.

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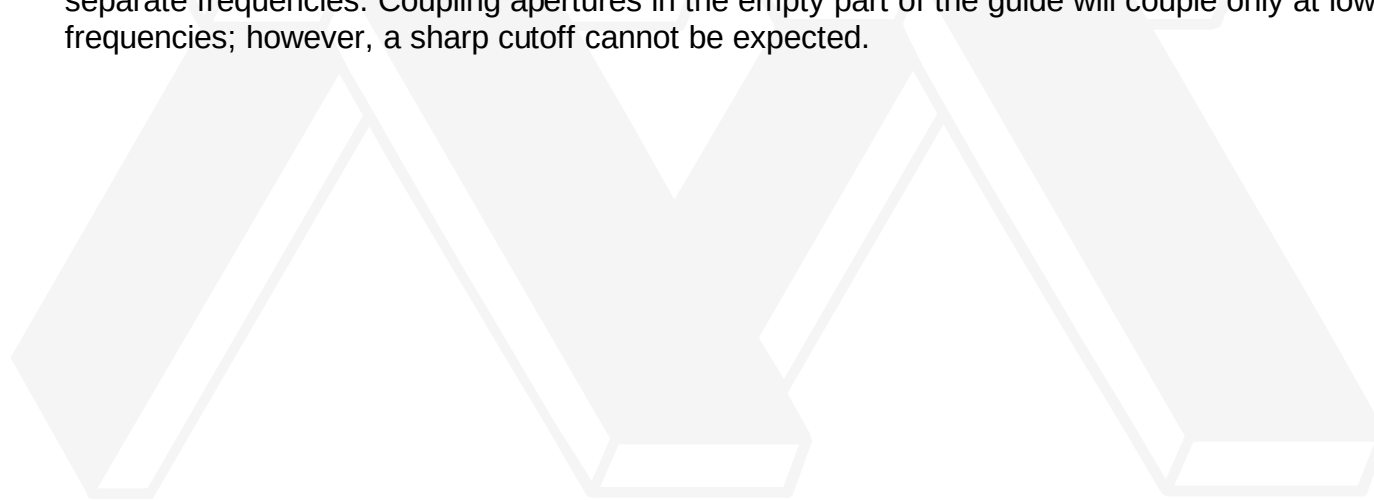
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The Field Displacement Filter - A New Family of Dissipative Waveguide Filters

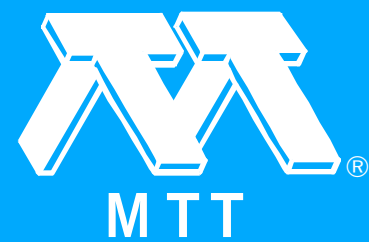
N. Eberhardt. "The Field Displacement Filter - A New Family of Dissipative Waveguide Filters." 1966 G-MTT International Microwave Symposium Digest 66.1 (1966 [MWSYM]): 90-93.

Rectangular waveguides with a full-height dielectric slab, as pictured in Figure 1, are frequently used in isolators and phase shifters. Numerical solutions to the fields have been obtained for the slab centrally located. It is found that with increasing frequency the power flow is more and more confined to the dielectric slab. The electric field distribution is plotted in Figure 1 with frequency as a parameter. According to a suggestion by H. Seidel this effect can be used to separate frequencies. Coupling apertures in the empty part of the guide will couple only at low frequencies; however, a sharp cutoff cannot be expected.



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Theoretical and Practical Applications of Capacitance Matrix Transformations to TEM Network Design (1966 [MWSYM])

R.J. Wenzel. "Theoretical and Practical Applications of Capacitance Matrix Transformations to TEM Network Design (1966 [MWSYM])." 1966 G-MTT International Microwave Symposium Digest 66.1 (1966 [MWSYM]): 94-100.

An important aspect of TEM quarter-wave network synthesis and design is the multiplicity of physical configurations that give identical response characteristics. Different network configurations are often, required to realize the same basic response for moderate changes in design parameters because of the small range of realizable impedance values. In most design procedures, practical circuit element values are obtained by application of suitable equivalent circuit relationships. In a previous paper a systematic method of obtaining equivalent circuits using transformations of the static capacitance matrix of a parallel coupled line array was introduced and applied to the exact design of interdigital bandpass filters. These transformations can also be used to give a simple physical interpretation to familiar transmission line identities and can be applied to the design of many TEM microwave devices.

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Optimal Design of Matching Networks for Microwave Transistor Amplifiers

F.E. Emery, M. O'Hagen and S.D. Nolte. "Optimal Design of Matching Networks for Microwave Transistor Amplifiers." 1966 G-MTT International Microwave Symposium Digest 66.1 (1966 [MWSYM]): 101-107.

The design of input and output matching networks for transistor microwave frequency amplifiers has been optimized by the use of an efficient computer program. Power amplifiers capable of 2.5 watts peak power output with a 400 MHz bandwidth at 2.25 GHz have been fabricated. The matching network problem was reduced to an equivalent non-linear programming problem by considering the filter elements as coordinates in an N-dimensional vector space. The optimal solution point in the vector space was found by the use of a "pattern search" routine which utilized randomly chosen orthogonal transformations of the search pattern to minimize an objective function. In this case, a suitable objective function was chosen to be the area under the curve of reflection coefficient versus frequency for the filter input. By use of multiple data input as many as six designs have been achieved in less than nine minutes on the 7044 computer.

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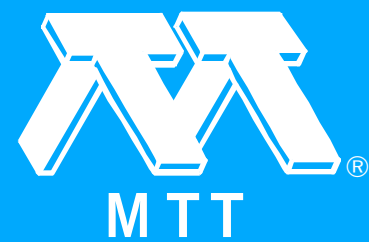
Filter Requirements for Nanosecond Diode Switching

R.V. Garver and T.H. Mak. "Filter Requirements for Nanosecond Diode Switching." 1966 G-MTT International Microwave Symposium Digest 66.1 (1966 [MWSYM]): 108-113.

In some applications of diode switches, such as in a switch-protected radar receiver, high speed switching is required in conjunction with a high degree of suppression of switching transients appearing at the rf terminals of the switch. The minimum switching time of a series or shunt diode switch is derived to be $1.24/f_{\text{switch}}$, where f_{switch} is the rf frequency being switched. The suppression of switching transients is derived, and it is found that suppression can be increased at the cost of increased filter complexity and switching time above the theoretical minimum. An example is presented utilizing the derived relationships.

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Coupled-Transmission-Line Directional Couplers with Coupled Lines of Unequal Characteristic Impedances (1966 [MWSYM])

E.G. Cristal. "Coupled-Transmission-Line Directional Couplers with Coupled Lines of Unequal Characteristic Impedances (1966 [MWSYM])." 1966 G-MTT International Microwave Symposium Digest 66.1 (1966 [MWSYM]): 114-119.

In the past, coupled-transmission-line directional couplers have been designed with coupled lines of equal characteristic impedances. These couplers are used in many applications: power samplers, reflectometers, directional detectors, directional filters, and multiplexer are several examples. In this paper a new class of coupled-transmission-line directional couplers, called nonsymmetrical directional couplers, is described. In contrast to conventional directional couplers, nonsymmetrical directional couplers use coupled lines of unequal characteristic impedances. The nomenclature "nonsymmetrical directional coupler" pertains to the side-by-side asymmetry of the directional couplers. It should not be confused with cascaded asymmetrical or cascaded symmetrical directional couplers, which use coupled lines of equal characteristic impedances and which have end-to-end asymmetry or symmetry, respectively.

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Abstracts

The Design and Construction of Broadband, High-Directivity 90° Couplers Using Non-Uniform Line Techniques (1966 [MWSYM])

C.P. Tresselt. "The Design and Construction of Broadband, High-Directivity 90° Couplers Using Non-Uniform Line Techniques (1966 [MWSYM])." 1966 G-MTT International Microwave Symposium Digest 66.1 (1966 [MWSYM]): 120-125.

It is presently possible to obtain multi-octave bandwidth from a single coupler which employs several cascaded quarter-wavelength sections of uniformly-coupled line. A comprehensive bibliography covering progress in this field may be found in Reference 1. Unfortunately, the physical junctions between various quarter-wave sections in the usually employed TEM conductor geometries contribute reactive discontinuities which significantly degrade coupler directivity.



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Abstracts

Survey of Integrated Circuits with Implications for Microwaves

R.L. Pritchard. "Survey of Integrated Circuits with Implications for Microwaves." 1966 G-MTT International Microwave Symposium Digest 66.1 (1966 [MWSYM]): 126-127.

There are two major, or classical, categories of integrated circuits based on the techniques employed: film circuits and semiconductor monolithic circuits. With the film technique one or more elements and/or components are deposited by one of several methods on a passive substrate, e. g., glass or ceramic, to form resistors, capacitors and electrical interconnections. Active elements, i. e., transistors and diodes, must be affixed separately to metallic connectors on the substrate. In the semiconductor monolithic approach the entire circuit containing resistors, capacitors, diodes and transistors is fabricated within a solid block of semiconductor material by using selected diffusion techniques. The advantage of the monolithic circuit, that of having all of the circuit elements as an integral part of the structure, is offset to some extent by the somewhat poorer characteristics of the resistors and capacitors relative to their film counterparts. Both types of integrated circuits have been used in a variety of applications, both digital and analog. Film circuits generally have been developed for specific needs by systems manufacturers, whereas monolithic circuits have been made available by a number of semiconductor device manufacturers throughout the world.



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Ceramic Microstrip for Microwave Hybrid Integrated Circuitry

B.T. Vincent, Jr.. "Ceramic Microstrip for Microwave Hybrid Integrated Circuitry." 1966 G-MTT International Microwave Symposium Digest 66.1 (1966 [MWSYM]): 128-134.

The basic microstrip, or non-symmetrical stripline geometry, has been investigated as a transmission line medium, and a number of types of transmission line components have been built utilizing microstrip construction. Microstrip has found only sporadic applications, however, as designers generally chose the more shielded and lower loss stripline, coaxial or waveguide modes of propagation, with the availability of microwave transistors and other semiconductor devices usable well into the microwave frequency range, the microstrip transmission line was reevaluated because of its compatibility with the fabrication and installation of passive components and active devices on the same substrate with the transmission line. Some of the ceramic materials appear particularly attractive as a substrate from performance and economic standpoints. This paper covers some of the characteristics of microstrip transmission lines on homogeneous ceramic dielectric substrates and on the two dielectric substrate as is the case in glazed ceramics, some of the considerations in component and circuit design utilizing this medium will be discussed along with some examples of incorporating semiconductor devices with ceramic microstrip components to accomplish high performance microwave hybrid integrated circuitry.

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Integrated Microwave Tunnel Diode Device

H.C. Okean. "Integrated Microwave Tunnel Diode Device." 1966 G-MTT International Microwave Symposium Digest 66.1 (1966 [MWSYM]): 135-141.

A microwave tunnel diode amplifier usually requires both a stabilizing network and one or more reactive tuning elements associated with the tunnel diode. The stabilizing network insures satisfaction of the appropriate stability criteria governing the given amplifier configuration at all frequencies within the active frequency range of the tunnel diode (dc to resistive cutoff frequency) and, in particular, those outside the operating band. Such networks generally take the form of band rejection filters which resistively terminate the diode outside the operating band and appear essentially reactive within it. The tuning element usually consists of a shunt inductor to resonate the generally capacitive parasitic reactance of the diode at the center frequency of the amplifier.

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Abstracts

Integrated Microwave Control Devices

W.J. Moroney and A. Botka. "Integrated Microwave Control Devices." 1966 G-MTT International Microwave Symposium Digest 66.1 (1966 [MWSYM]): 142-145.

Microwave integrated circuits are quickly becoming a reality. The initial results of this work are similar to the path followed by low frequency conventional microelectronics, that is, the first emerging of useable hybrid integrated circuits followed by monolithic circuits. Hybrid, in the case of microwave circuit, refers to the use of chips of silicon containing the active devices mounted in a microwave cavity or stripline with ceramic or an equivalent material used as the dielectric.



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Abstracts

A Low-Loss 1-Nanosecond 1-Watt X-Band Switch

R.W. Dawson, B.C. De Loach and B.C. De Loach, Jr.. "A Low-Loss 1-Nanosecond 1-Watt X-Band Switch." 1966 G-MTT International Microwave Symposium Digest 66.1 (1966 [MWSYM]): 146-150.

This paper discusses the operation of fast, moderate power microwave switches obtained through the utilization of PIN diodes.



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Abstracts

Integrated Balanced Mixers for S- and X-band

C.M. Howell. "Integrated Balanced Mixers for S- and X-band." 1966 G-MTT International Microwave Symposium Digest 66.1 (1966 [MWSYM]): 151-155.

This paper describes the approaches used and the results obtained in building integrated balanced microwave mixers at S- and X-band. It will describe the techniques used to make hybrid integrated circuits using "bilitic" Schottky diodes as the mixer diodes and discuss the merits of several mixer circuits.



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Abstracts

Guided-Wave Research in British Universities (Abstract)

P.J.B. Clarricoats. "Guided-Wave Research in British Universities (Abstract)." 1966 G-MTT International Microwave Symposium Digest 66.1 (1966 [MWSYM]): 156-156.

Following a brief resume of general microwave research in British Universities, topics in guided wave propagation will be discussed. These will include studies of both uniform and periodic inhomogeneously-filled waveguides containing either dielectric or ferrite, and homogeneously-filled waveguides of arbitrary cross-section.



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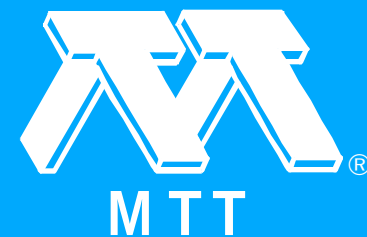


Abstracts

Microwaves at Japanese Universities (Abstract)

N. Kumagai. "Microwaves at Japanese Universities (Abstract)." 1966 G-MTT International Microwave Symposium Digest 66.1 (1966 [MWSYM]): 157-157.

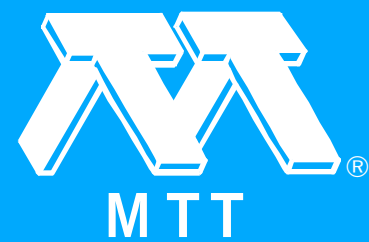
The present status of microwave research at Japanese Universities will be reviewed. Current topics at optical wavelengths will be included.



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Delay Spectra of Single Crystal Ferrimagnetics when Loaded by Polycrystalline Ferrites

J.H. Collins and B. Yazgan. "Delay Spectra of Single Crystal Ferrimagnetics when Loaded by Polycrystalline Ferrites." 1966 G-MTT International Microwave Symposium Digest 66.1 (1966 [MWSYM]): 158-161.

Magnetostatic, magnetoelastic and elastic wave propagation in magnetically saturated single crystal round and square cross-section rods of yttrium iron garnet (YIG), possessing non-ellipsoidal geometry, has been extensively studied. However, the resulting delay characteristics versus dc applied magnetic field and frequency are necessarily non-optimum for certain microwave applications. The object of this paper is to demonstrate the feasibility of polycrystalline ferrite loading for modifying and controlling magnetoelastic delay spectra. This technique has the advantage that sample geometry, which determines the internal magnetostatic field configuration, can be adjusted simply and cheaply without disturbing the single crystal specimens in which the magnetoelastic propagation takes place. Further, if necessary, experiments can be conducted on a minimal volume of single crystal material. The discussion is restricted to the axially magnetized arrangement shown in Figure 1. More sophisticated geometries are currently under consideration. Figure 1 A depicts a single crystal ferrimagnetic round rod, of saturation magnetization $4\pi M/\text{sub } 1/$, loaded with a polycrystalline sleeve, of saturation magnetization $4\pi M/\text{sub } 2/$. Figure 1 B depicts a single crystal rod ($4\pi M/\text{sub } 1/$) backed by a polycrystalline ferrite $4\pi M/\text{sub } 2/$ of identical cross-section.

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Abstracts

A Selective Survey of Microwaves in Scandinavia and Western Europe (Abstract)

M.M. Brady. "A Selective Survey of Microwaves in Scandinavia and Western Europe (Abstract)." 1966 G-MTT International Microwave Symposium Digest 66.1 (1966 [MWSYM]): 162-162.

With a few notable exceptions (like Philips of the Netherlands), the microwave industry in the smaller European countries is concentrated in small-by-US-standards companies. The bulk of microwave research is conducted in universities, technical institutes, or state-run research centers, for few companies can afford to sponsor their own research programs directly. Universities and industries often cooperate to establish research centers.



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Abstracts

Optical Transmission Media (no text)

E.A.J. Marcatili. "Optical Transmission Media (no text)." 1966 G-MTT International Microwave Symposium Digest 66.1 (1966 [MWSYM]): 163-163.



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Abstracts

Development Towards Practical Applications of TE/sub 01/-mode Circular Waveguides, Leaky Waveguides, and Beam Waveguides

T. Nakahara. "Development Towards Practical Applications of TE/sub 01/-mode Circular Waveguides, Leaky Waveguides, and Beam Waveguides." 1966 G-MTT International Microwave Symposium Digest 66.1 (1966 [MWSYM]): 164-169.

Recent developments on application of topical waveguides in Japan are reviewed. Continuous and concentrated efforts have been made to improve the TE/sub 01/ circular waveguide system for materialization of millimeter wave communication. Another feature of our developments is the practical application of such up-dated microwave techniques as leaky waveguides and beam waveguides to the vehicular communication or train control systems.



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Confocal Resonator Bandpass Filters (1966 [MWSYM])

J. Cohen and J.J. Taub. "Confocal Resonator Bandpass Filters (1966 [MWSYM])." 1966 G-MTT International Microwave Symposium Digest 66.1 (1966 [MWSYM]): 170-175.

Direct-coupled confocal resonators are considered for use as band-pass filters at millimeter wavelengths in this paper. In previous work on band-pass filters for millimeter wavelengths, two flat reflectors were used to form resonators; these resonators could not produce high unloaded Q values because of the critical tolerances of maintaining parallelism between reflectors. To overcome these difficulties, resonators with curved spherical surfaces have been used at millimeter wavelengths to achieve high Q /sub u /. Single-resonator Fabry-Perot interferometers and absorption wavemeters were considered (in these references), and the possibility of using them as band-pass filter elements was suggested. In this summary, one- and two-resonator band-pass filters are described together with experimental data. Emphasis is placed on types of coupling structures, reduction of spurious responses, and an extension to filters of arbitrary numbers of resonators.

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Submillimeter Broadband Power-Measuring Detector

M. Wang and F. Arams. "Submillimeter Broadband Power-Measuring Detector." 1966 G-MTT International Microwave Symposium Digest 66.1 (1966 [MWSYM]): 176-178.

A broadband thermal power-measuring detector has been developed for the 300 to 3000 GHz (1 mm to 100 micron) band, with indications that it is useful over a significantly larger frequency interval. Exploratory detector measurements have so far been made at frequencies from 50 GHz (6 mm) to 20, 000 GHz (15 microns).

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Perturbation of Optical Resonator Characteristics by an Inhomogeneous Focusing Medium

S.A. Harrison and W.K. Kahn. "Perturbation of Optical Resonator Characteristics by an Inhomogeneous Focusing Medium." 1966 G-MTT International Microwave Symposium Digest 66.1 (1966 [MWSYM]): 179-183.

The perturbation produced in the stability characteristics of an empty curved mirror optical resonator upon insertion of an inhomogeneous focusing medium has been examined in the general case wherein the space between mirrors is only partially occupied by such a medium. Stability of optical modes in a resonator is closely related to the behavior of paraxial rays. Such rays are either confined to the structure (termed "stable") or diverge from the structure ("unstable"). In the formulation presented here the significant parameters result directly from the multiplication of transfer matrices in a somewhat different form than that previously given by Kogelnik. The importance of the configuration analyzed is underlined by the experimental observations of Welling and others regarding the presence of refractive index gradients in flashed laser materials. The computed results suggest an experiment employing the losses of a resonator operating near the instability boundary as an independent indication of the refractive gradient.

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A Light Beam Waveguide Using Hyperbolic-Type Gas Lens (1966 [MWSYM])

Y. Suematsu, K. Iga and S. Ito. "A Light Beam Waveguide Using Hyperbolic-Type Gas Lens (1966 [MWSYM])." 1966 G-MTT International Microwave Symposium Digest 66.1 (1966 [MWSYM]): 184-189.

This paper is concerned with the optimum design of a light beam waveguide constructed with the proposed lens-like media which have hyperbolic temperature distribution. In such media, the temperature distribution is ideally quadratic in the transverse direction, and so mode conversion loss originating from higher-order variation of the dielectric constant is small. Moreover, this guide has the merits that the design procedure is clear, the mode matching at the input port is easy, and it can be constructed using ordinary air. This consideration can easily be extended to a guide with a curved configuration. It is shown that the experimental convergency of this gas lens is in agreement with theoretical considerations.

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Electromagnetic Momentum as a Tool in Microwave Analysis (Abstract)

J. Brown. "Electromagnetic Momentum as a Tool in Microwave Analysis (Abstract)." 1966 G-MTT International Microwave Symposium Digest 66.1 (1966 [MWSYM]): 190-190.

The relationship between electromagnetic momentum and mechanical forces has frequently been studied in relation to the design of wattmeters using radiation pressure, and to the possible steering of space craft using the same principle. The general theorem of conservation of momentum provides a powerful theoretical tool in mechanics, and the analysis reported in this paper is an attempt to use a similar momentum conservation principle in the analysis of waveguide problems. The basic theorem which is required was reported many years ago by Stratton, and this can be used to determine an upper limit for the value of the reflection coefficient at the junction between two dissimilar waveguides. Particular examples of such waveguide junctions may be solved exactly by using the Wiener-Hopf method for solving integral equations, and it appears that in such cases an exact expression for the magnitude of the reflection coefficient may be deduced relatively simply from momentum arguments.

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Abstracts

Sampling for Oscilloscopes and other RF Systems: DC Through X-Band (1966 [MWSYM])

W.M. Grove. "Sampling for Oscilloscopes and other RF Systems: DC Through X-Band (1966 [MWSYM])." 1966 G-MTT International Microwave Symposium Digest 66.1 (1966 [MWSYM]): 191-196.

Sampling techniques have long been used on periodic waveforms to achieve wide bandwidths in oscilloscopes and other applications. The sampling oscilloscope, which is the electrical equivalent of the optical stroboscope, operates by sampling the voltage amplitude at progressively later points on successive cycles of a repetitive waveform. The state-of-the-art in sampling is the 4 GHz bandwidth presently available in sampling oscilloscopes. The purpose of this paper is to present the design requirements for extending this broadband sampling technique through X-band and then to describe one solution to the problem.



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Abstracts

A Power Reflection Technique for Characterization of High Quality Varactor Diodes (1966 [MWSYM])

G.D. Vendelin and S.A. Robinson. "A Power Reflection Technique for Characterization of High Quality Varactor Diodes (1966 [MWSYM])." 1966 G-MTT International Microwave Symposium Digest 66.1 (1966 [MWSYM]): 197-201.

A new method for varactor diode characterization has been developed. As the quality of microwave varactors rapidly improves, a simple and accurate means of characterization has become increasingly important. The present methods for varactor characterization consist of either a "relative impedance" or a "transmission" technique. The commonly accepted varactor equivalent circuit is shown in Figure 1.



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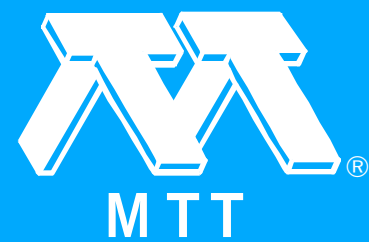
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Application of a Microwave Technique to the Measurement of Electron Density and Relaxation Time

S. Lederman and E.F. Dawson. "Application of a Microwave Technique to the Measurement of Electron Density and Relaxation Time." 1966 G-MTT International Microwave Symposium Digest 66.1 (1966 [MWSYM]): 202-207.

The measurement of ionization rate and electron densities in thermally ionized gases attracted the attention of many scientists and engineers working in the aerospace field. Determination of these parameters is of importance not only in the field of communication with reentering bodies, but is also of vital importance in understanding combustion and other rapid chemical reactions. Initial ionization is usually attributed to collisions between molecules, but as the electron density increases, collisions between electrons and neutral particles may also become important or even dominant in the ionization process. Depending on the efficiency of molecular collision processes, on the physical and chemical properties of the gas and its purity, a time lag or relaxation time will result between the heating of the neutral gas and the attainment of equilibrium electron density. Since in a shock tube, samples of gas can rapidly be heated to temperatures in excess of 10^4 °K without introducing an excess of impurities, this kind of device is ideally suited for the above-mentioned studies.

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Abstracts

Full-Band Matching of Waveguide Discontinuities

F.C. DeRonde. "Full-Band Matching of Waveguide Discontinuities." 1966 G-MTT International Microwave Symposium Digest 66.1 (1966 [MWSYM]): 208-209.

Almost all waveguide components consist of transitions, either continuous or discontinuous, because they are either of modified structure or filled with some material. Such transitions vary from simple types, such as transitions from one waveguide to another (like a flange coupling, E- or H-plane shift, E- or H-plane bend, twist, window, or in-guide detector), to more complicated types, where a change in mode also occurs, as in transitions from rectangular to circular or square waveguide, coaxial or strip line, etc. Another example of this latter more complicated type is the Magic Tee.



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Microwave Breakdown Technique for Measuring Ionization Rate of High Temperature Gases in a Shock Tube

J.B. Chown, W.C. Taylor and T. Morita. "Microwave Breakdown Technique for Measuring Ionization Rate of High Temperature Gases in a Shock Tube." 1966 G-MTT International Microwave Symposium Digest 66.1 (1966 [MWSYM]): 210-213.

In the design of antennas for use on hypersonic re-entry vehicles, the effect of high-temperature ionized gas surrounding the vehicle must be considered. Interaction of the fields of the antenna with adjacent ionized medium requires examination of parameters that are not involved in the usual RF plasma interaction. In the nonlinear case where the RF field is strong enough to produce additional ionization in the gas, breakdown occurs and proceeds catastrophically until the electron density is high enough that the plasma limits the strength of the field penetrating the plasma. The power-handling capability of the antenna depends upon the RF fields created and the electron production and loss rates in the flowing medium.

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Abstracts

Characteristics of a Periodic Type of Microwave Sampling Cavity

R.E. Post and A.G. Potter. "Characteristics of a Periodic Type of Microwave Sampling Cavity." 1966 G-MTT International Microwave Symposium Digest 66.1 (1966 [MWSYM]): 214-218.

For years, various properties of gaseous media have been measured using microwave cavities as the sampling device. Although extensive work has been done in this field with respect to the design of refractometers and microwave spectrometers, very little effort has been directed toward the determination of the variation of sampling cavity characteristics caused by opening it to the sampled medium. In this paper, a special type of spaced-ring cavity will be analyzed and the limits to which it may be opened to the sampled medium examined in detail.



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Abstracts

A Fast Millimeter Ferrite Latching Switch

R.A. Stern and J.P. Agrios. "A Fast Millimeter Ferrite Latching Switch." 1966 G-MTT International Microwave Symposium Digest 66.1 (1966 [MWSYM]): 219-223.

During the past few years considerable interest has been generated in remanent latching ferrite phase shifters, especially the non-reciprocal type as conceived by Silber, for phase array antennas. By utilizing the square loop properties of ferrites and operating them in the two remanant states, differential phase shift is obtained. These phase shifters possess the virtue of extreme compactness, ability to sustain high peak and average powers, are self-latching, that is require no holding power in either state, and can be switched rapidly with low energy.



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Circularly Polarized Phase Shifter for Use in Phased Array Antennas (1966 [MWSYM])

M.C. Mohr and S. Monaghan. "Circularly Polarized Phase Shifter for Use in Phased Array Antennas (1966 [MWSYM])." 1966 G-MTT International Microwave Symposium Digest 66.1 (1966 [MWSYM]): 224-229.

An X-band ferrite phase shifter has been developed for operational use, the size and electrical performance of which are favorably suited for use in a phased array antenna that requires minimum center-to-center element spacings of 0.537λ . The phase shifter has the same configuration as a Faraday rotator with a ferrite rod located at the center of a circular waveguide with an axially applied field. If a circularly polarized wave is passed through this geometry, a nonreciprocal phase versus current characteristic is obtained. The theory of operation of such a device is already well understood, so further elaboration is not necessary. Scharfman and others have described this type of phase shifter in the literature.

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Abstracts

A Slow Wave Digital Ferrite Strip Transmission Line Phase Shifter (1966 [MWSYM])

R.R. Jones. "A Slow Wave Digital Ferrite Strip Transmission Line Phase Shifter (1966 [MWSYM])." 1966 G-MTT International Microwave Symposium Digest 66.1 (1966 [MWSYM]): 230-234.

During the past several years, microwave device development has been oriented toward the generation of compact, lightweight, rapid switching components. Devices which utilize toroidal or closed loop ferrimagnetic structures have proven invaluable in numerous phased array applications. However, such devices usually lack the compact size and light weight characteristics desired.



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Abstracts

A Miniaturized C-Band Digital Latching Phase Shifter (1966 [MWSYM])

J.K. Parks, B.R. Savage, L.J. Lavedan and J. Brown, Jr.. "A Miniaturized C-Band Digital Latching Phase Shifter (1966 [MWSYM])." 1966 G-MTT International Microwave Symposium Digest 66.1 (1966 [MWSYM]): 235-240.

Recent developments in rectangular waveguide latching phase shifters have been directed primarily toward achieving good electrical performance with reduced size as a secondary objective. Miniaturization efforts have concentrated chiefly on strip line and coaxial structures. While these designs have achieved moderately good low power electrical performance and some reduction in physical size, they have exhibited inherent frequency dependence not associated with rectangular waveguide phase shifters.



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Abstracts

A Reciprocal TEM Latching Ferrite Phase Shifter

J.W. Simon, W.K. Alverson and J.E. Pippin. "A Reciprocal TEM Latching Ferrite Phase Shifter." 1966 G-MTT International Microwave Symposium Digest 66.1 (1966 [MWSYM]): 241-247.

Considerable work has been done previously on latching ferrite phase shifters of the nonreciprocal variety. However, the requirement herein for reciprocity imposes new design problems and demands new thinking about switching techniques



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Abstracts

Microwave Ferrites for Phase Shifting Applications

J.J. Green. "Microwave Ferrites for Phase Shifting Applications." 1966 G-MTT International Microwave Symposium Digest 66.1 (1966 [MWSYM]): 248-249.

Because of the trend in modern radars to the phased array type, a great deal of activity exists in the field of ferrite phase shifters. The desired high level of antenna performance has put stringent requirements on the phase shifting elements. Low insertion loss, ability to handle high peak and average power, temperature stability, and low switching time and switching energy are desired. Due to the large number of elements there are also considerations on cost, size, and reproducibility. These requirements lead to specifications which are an extensive test of the ingenuity of the element designer and frequently tax the state of the art in ferrite materials.



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A Coupled-Mode Description of the Reggia-Spencer Phase Shifter

C.R. Boyd. "A Coupled-Mode Description of the Reggia-Spencer Phase Shifter." 1966 G-MTT International Microwave Symposium Digest 66.1 (1966 [MWSYM]): 250-255.

Although Reggia-Spencer phase shifters have been built for many years, no completely satisfactory description of the principle of operation of this type of device has appeared in the literature. Of the many theories advanced to explain the phase shifter operation, two have retained some measure of vogue. Button and Lax have postulated that the basic mechanism is the change in effective permeability with applied field, enhanced by the dielectric loading effects of the ferrite. Their view is supported by J. A. Weiss, who identified frequency-periodic resonances as the onset of Faraday rotation in a rectangular guide structure. Rizzi suggested that the ferrite rod acts as a "dielectric waveguide" and that the phase shift results from Faraday rotation of the r-f fields with applied field. Subsequent computations by Tompkins, Reggia, and Joseph have tended to verify this point of view.

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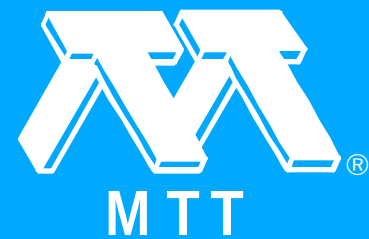
Reciprocal Latching Ferrite Phase Shifter

E. Schlomann, M. Harris and J.J. Green. "Reciprocal Latching Ferrite Phase Shifter." 1966 G-MTT International Microwave Symposium Digest 66.1 (1966 [MWSYM]): 256-260.

In a latching ferrite phase shifter the magnetic material is used in sample shapes such as toroids in which the magnetic flux can be closed onto itself. This has the advantage that in the operation of the device no holding current is required. The switching is performed by means of current pulses. According to their direction, these current pulses either reverse the direction of the magnetization or leave it unchanged.

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Theoretical Aspects of 3-Port Junction Circulators

H. Bosma. "Theoretical Aspects of 3-Port Junction Circulators." 1966 G-MTT International Microwave Symposium Digest 66.1 (1966 [MWSYM]): 261-263.

Analysis of scattering matrices of lossless 3-port junctions with 3-fold rotational symmetry shows that circulators are obtained when the eigenvalues, which have unit magnitude, make angles of 120 degrees. Zero reflection, zero insertion loss, and infinite isolation coincide at the same values of device parameters such as frequency, saturation magnetization, and size of ferrite.

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Phased-Array Digital Time Delay Phaser Using Latching Ferrite Switches

P.C. Goodman. "Phased-Array Digital Time Delay Phaser Using Latching Ferrite Switches." 1966 G-MTT International Microwave Symposium Digest 66.1 (1966 [MWSYM]): 264-269.

Recent developments in latching ferrite phase shifters permit phase control within 360 degrees at microsecond switching times for phased-array antenna elements. When an array antenna must handle large instantaneous signal bandwidths, the simple modulo 2π phase control provided by these phase shifters must be supplemented by real time delays of several nanoseconds. The time delay phaser described below provides four-bit digital subdivision of an 8.7-nanosecond total time delay in increments of 0.58 nanosecond.

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A 35 GHz Latching Switch (1966 [MWSYM])

W.C. Passaro and J.W. McManus. "A 35 GHz Latching Switch (1966 [MWSYM])." 1966 G-MTT International Microwave Symposium Digest 66.1 (1966 [MWSYM]): 270-274.

This paper describes the development of a lightweight fast-switching 35 GHz latching ferrite circulator, with an instantaneous bandwidth of 5%, and a switching time of less than 0.30 microseconds. The device is designed for use over the temperature range of -60° C to +100° C under dynamic operating conditions. It is particularly well suited for use as a switching element in those applications where high reliability, small size and weight, and fast switching time are required. Total weight of the device (excluding electronic driver) is less than 0.6 ounces, and total volume is less than 0.75 cubic inch. The unit is pictured in Figure 1.

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Abstracts

A Switching Circulator: S-Band; Stripline; Remanent; 10 Kw; 10 Microsecond; Temperature-Stable

F. Betts, D.H. Temme and J.A. Weiss. "A Switching Circulator: S-Band; Stripline; Remanent; 10 Kw; 10 Microsecond; Temperature-Stable." 1966 G-MTT International Microwave Symposium Digest 66.1 (1966 [MWSYM]): 275-280.

This paper reports the development of a ferrite circulator-switch suitable for time delay switching applications in phased array radars. The requirements are high speed and minimum switching energy, combined with good isolation and match, and low insertion loss, over a moderate band. Stability of transmission phase against temperature variations is an important requirement, especially in large arrays. Data will be reported here on design considerations, performance, and methods of measurement.



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Theoretical Design of Static and Latching Ferrite 3-port and 4-port Symmetrical Waveguide Circulators

L.E. Davis. "Theoretical Design of Static and Latching Ferrite 3-port and 4-port Symmetrical Waveguide Circulators." 1966 G-MTT International Microwave Symposium Digest 66.1 (1966 [MWSYM]): 281-285.

Compact 3-port microwave ferrite circulators have become widely used since 1960, but they have generally been empirically designed and their operation is not well understood. The success of the experimental approach has resulted in less emphasis on the theoretical explanation of these devices, and this situation is now retarding the development of the more complicated 4-port circulators. However, extending the work of Auld and Davies, IBM 7040 computer programs have recently been written in this department that predict and display the swept-frequency performance of 3-port and 4-port waveguide circulators. There are several objectives in this work: (1) to extend these computer programs, and the associated theory, to predict the performance of static and latching ferrite circulators in order that the performance of various ferrite configurations can be assessed and compared before they are built; (2) to optimize the many variables to obtain broadband performance where possible; (3) to build some devices to check the theory; (4) to use the theory to gain some insight into the physical behavior of symmetrical waveguide circulators; (5) to investigate phase shift in these devices.

Click on title for a complete paper.



The Four-Port Single Junction Circulator in Strip Line

C.E. Fay and W.A. Dean. "The Four-Port Single Junction Circulator in Strip Line." 1966 G-MTT International Microwave Symposium Digest 66.1 (1966 [MWSYM]): 286-290.

The four-port single junction circulator in strip line offers the possibility of a more compact and less expensive structure than the heretofore required dual three-port units in tandem. One such four-port circulator has been described previously, although very little material has appeared in the literature on the theory of the device. Auld points out that an additional parameter is required for the four-port circulator compared to the three-port. Davies and Cohen have extended Bosma's circulation equations to the four-port case and have included the scattering matrix analysis. Fay and Comstock have indicated a possible combination of modes of a disc structure which could provide a four-port circulator.





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Analysis of a Grounded Junction Circulator

M. Omori. "Analysis of a Grounded Junction Circulator." 1966 G-MTT International Microwave Symposium Digest 66.1 (1966 [MWSYM]): 291-296.

The operation of a novel stripline circulator, which incorporates a single disk of yttrium aluminum iron garnet on one side of the center conductor and a large metallic short circuit on the other side, is described in terms of a resonance mode of the junction. The basic design of this circulator is shown in Figure 1. As seen in the figure the short circuit can be the magnet necessary to bias the garnet disk to the optimum point for circulation. Quarter wavelengths of low impedance line are used to couple the junction to the 50 ohm input lines. The performance of this circulator is typically 30 db of isolation and 0.2 db of insertion loss over an 1870 bandwidth.

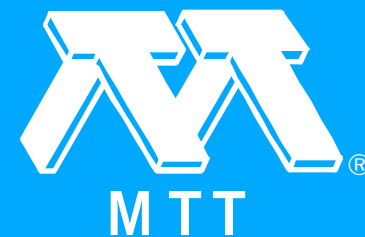
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Sylvania Electronic Systems (Advertisement) (1966 [MWSYM])

"Sylvania Electronic Systems (Advertisement) (1966 [MWSYM])." 1966 G-MTT International Microwave Symposium Digest 66.1 (1966 [MWSYM]): 298-298.



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Index, 1966 International Microwave Symposium

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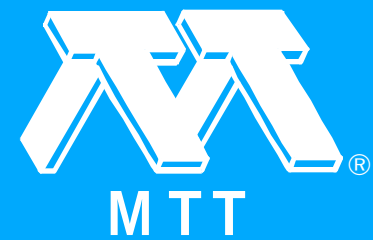
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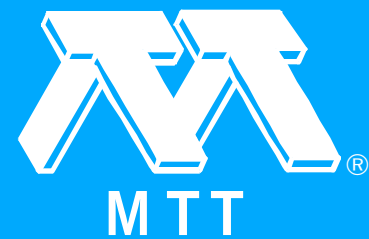
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Coupling of Waveguides by Resistive Films

G. Epprecht. "Coupling of Waveguides by Resistive Films." 1967 G-MTT International Microwave Symposium Program and Digest 67.1 (1967 [MWSYM]): 10-10.

This paper is concerned with the application of resistive coupling structures, particularly in form of films, in waveguide- coaxial- and stripline-technics. However, in our new class of applications to be discussed, resistive films are used in a position essentially perpendicular to the electric field. Extending first suggestions by M. Schneider (thesis 1959) such devices may be analyzed in the following manner: A rectangular waveguide, operated in ordinary H₁₀-mode be divided in two- in general unequal - parts by a plane parallel to the broad side. If the dividing plane is assumed to have infinite conductivity, the two independent waves traveling in the same direction may also be interpreted as a superposition of two modes, called homopolar and antipolar respectively.

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Attenuating Films in Rectangular Waveguides

A. Wexler. "Attenuating Films in Rectangular Waveguides." 1967 G-MTT International Microwave Symposium Program and Digest 67.1 (1967 [MWSYM]): 11-12.

The complete solution for normal modes in a resistive-film-loaded rectangular waveguide is due to H.L. Knudsen. He showed how to solve the boundary-value problem of a guide divided into homogeneous regions by a number of vanes (of various resistivities) parallel to the side walls. Solutions were found in terms of longitudinal-section electric (LSE) and magnetic (LSM) modes. Boundary conditions in the loaded guide are that electric field transverse to the film must be continuous across it and that the discontinuity in magnetic field along the film must equal the sheet conduction current.

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Abstracts

A Broadband Absorbing Wall for VHF Range Utilizing Thin Ferrite Tiles

K. Suetake. "A Broadband Absorbing Wall for VHF Range Utilizing Thin Ferrite Tiles." 1967 G-MTT International Microwave Symposium Program and Digest 67.1 (1967 [MWSYM]): 13-16.

In this paper, the author has presented a new idea for the synthesis method of the thin absorbing wall with ferrite plates for U.H.F. range anechoic chamber. It has been proved that the broadband absorbing wall made of dielectric material -such as foamed polystyrene capturing carbon powder or parallel resistive sheets -has the limit in its thickness, that is, the thickness of such type wall does not become shorter than $0.7\lambda_{\text{sub } o}$ where $\lambda_{\text{sub } o}$ is the wavelength in the free space of the lowest frequency.



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A New Class of Low Loss Reactive Wall Waveguides

R.P. Larsen and A.A. Oliner. "A New Class of Low Loss Reactive Wall Waveguides." 1967 G-MTT International Microwave Symposium Program and Digest 67.1 (1967 [MWSYM]): 17-22.

A novel approach is presented in this paper for achieving waveguides with especially low loss. This new class of waveguides employs "reactive walls", and has possible application to long waveguide runs in millimeter wave or high power systems. These reactive walls are designed by initially choosing them to be periodic structures, in the transverse directions, which are operated in their stop band or below cut-off condition. Because the transverse decay is high, the periodic structure can be truncated, and a simple, closed, final form results. The type of periodic structure chosen for investigation was an array of parallel dielectric slabs. Various practical low-loss reactive wall waveguides are then derived from this generic theoretical configuration.

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Abstracts

Computer Solution of Waveguide Discontinuity Problems

P.J.B. Clarricoats and K.R. Slinn. "Computer Solution of Waveguide Discontinuity Problems." 1967 G-MTT International Microwave Symposium Program and Digest 67.1 (1967 [MWSYM]): 23-27.

A technique has been developed which enables two important classes of waveguide discontinuity problem to be solved on a computer by simple numerical methods. The classes are: 1. Transverse discontinuities. 2. Longitudinal discontinuities.



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Electromagnetic Resonances of Free Dielectric Spheres (1967 [MWSYM])

M. Gastine, L. Courtois and J.L. Dormann. "Electromagnetic Resonances of Free Dielectric Spheres (1967 [MWSYM])." 1967 G-MTT International Microwave Symposium Program and Digest 67.1 (1967 [MWSYM]): 28-31.

The last few years have seen the publication of several studies of electromagnetic resonances of free dielectric samples. This is explained by the high Q factor that can be obtained with a little space-factor, when using high dielectric constant materials and a low dissipation factor ($\tan \delta$). The resonators used lend themselves to a number of different applications. However their use requires a good knowledge of their spectra and field configuration.

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Abstracts

Research on Millimeter Wave Communication in Japan

K.-I. Noda. "Research on Millimeter Wave Communication in Japan." 1967 G-MTT International Microwave Symposium Program and Digest 67.1 (1967 [MWSYM]): 32-34.

The present status of the research on millimeter wave communication in Japan is reviewed. This paper begins with a description of a millimeter-wave PCM transmitter assembly composed of an 12 GHz band diode switch and a quadrupler. This assembly was developed for the purpose of building an experimental PCM repeater for a long distance circular-electric-waveguide communication system. A repeater circuitry associated with this assembly is described. Germanium silber-bonded diode GSB3 generates above 0 dBm of millimeter continuous wave in the avalanche bias region. New components for repeater including this diode which would offer advantages in simplifying repeater, are also discussed.



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Oversized Rectangular Waveguide Components for mm Waves

H.J. Butterweck and F.C. de Ronde. "Oversized Rectangular Waveguide Components for mm Waves." 1967 G-MTT International Microwave Symposium Program and Digest 67.1 (1967 [MWSYM]): 35-38.

For mm- and sub-mm waves, standard-size rectangular waveguide has several drawbacks, which are more or less overcome by the use of oversized waveguide. The latter has the following advantages: 1) The broadband property (possibly one frequency decade) which is shared by the greater part of the components discussed in this paper. Also simultaneous transmission of several frequencies with large separations (multiplex) is possible. Other broadband transmission lines, e. g. coaxial- or strip line deserve no consideration due to their high losses. 2) The comparatively low value of the attenuation. 3) The large physical dimensions.



Abstracts

The Superconducting Resonator - A New Microwave Component

H. Zimmer. "The Superconducting Resonator - A New Microwave Component." 1967 G-MTT International Microwave Symposium Program and Digest 67.1 (1967 [MWSYM]): 39-39.

The surface conductance of superconductors in the frequency region of microwaves is by several orders of magnitude higher than that of normal conducting copper. This can be well understood from the two-fluid model of the superconductors and the non-local behaviour of the metallic electrons at low temperatures.



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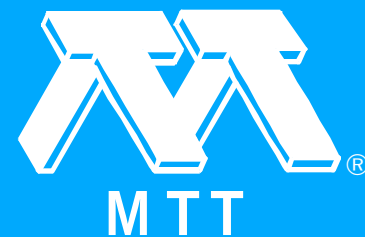


Abstracts

A Frequency Transformation for Commensurate Transmission-Line Networks (1967 [MWSYM])

E.G. Cristal. "A Frequency Transformation for Commensurate Transmission-Line Networks (1967 [MWSYM])." 1967 G-MTT International Microwave Symposium Program and Digest 67.1 (1967 [MWSYM]): 40-41.

Frequency transformations are commonly used in lumped-element network theory to convert a given filter network into a related filter network.



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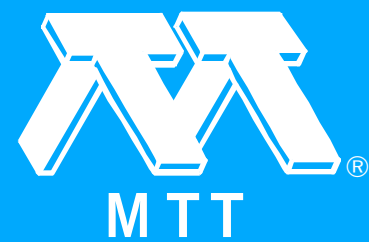
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Radial-Line Band Rejection Filters in Coaxial Waveguides (1967 [MWSYM])

D. Varon. "Radial-Line Band Rejection Filters in Coaxial Waveguides (1967 [MWSYM])." 1967 G-MTT International Microwave Symposium Program and Digest 67.1 (1967 [MWSYM]): 42-46.

Among the simplest and least expensive structures which serve as band rejections filters in the microwave region is the coaxial waveguide with a cylindrical cavity forming a discontinuity in the outer conductor. When the outer conductor of a coaxial waveguide is perturbed by a shorted radial transmission line, the structure acquires a zero of transmission for the TEM mode at a resonant frequency that depends on as many as six parameters. Experience indicates that in restricted regions certain approximate methods, in which one or several of the parameters are neglected, produce fairly accurate results. However, discrepancies of 5% or more are encountered in other regions where the same approximations ought to be valid. The approximations most frequently used correspond to either one of the following situations: (a) total disregard of the fringing fields caused by the two close discontinuities, in which case the cylindrical cavity is represented by a series impedance equal to the input impedance of a shorted radial transmission line; (b) consideration of the fringing fields associated with each discontinuity, but neglect of the interaction between the two. In the latter, the discontinuities are accounted for by equivalent shunt lumped reactive elements, however, they must be far enough apart so that the interaction is indeed negligible.



Abstracts

Wideband, High Selectivity Diplexers Utilizing Digital-Elliptic Filters

R.J. Wenzel. "Wideband, High Selectivity Diplexers Utilizing Digital-Elliptic Filters." 1967 G-MTT International Microwave Symposium Program and Digest 67.1 (1967 [MWSYM]): 47-50.

The high selectivity and compact form of digital-elliptic filters makes them attractive for use in wideband diplexers. The theory of diplexers has been described in several references where it is shown that a perfect match at the input of a diplexer requires the component filters to be complementary. Filters with equal-ripple response in both pass band and stop band can be designed to be complementary; however, it has been pointed out that this places an undesirable restriction on the isolation characteristic. The use of "pseudo-complementary" filters allows the achievement of equal-ripple designs with high isolation characteristics at the cost of a slight increase in input VSWR.



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Abstracts

A Computer Designed, 720 to 1 Microwave Compression Filter (1967 [MWSYM])

H.S. Hewitt. "A Computer Designed, 720 to 1 Microwave Compression Filter (1967 [MWSYM])." 1967 G-MTT International Microwave Symposium Program and Digest 67.1 (1967 [MWSYM]): 51-53.

An outgrowth of development work on rapid-scan receivers has been a broadband microwave linear-delay compression filter. This filter utilizes a folded-tape transmission line (FTML) between ground planes to achieve a time-bandwidth product (compression factor) of up to 1000 with bandwidths of 1 GHz or more. A filter has been constructed using the FTML technique for use in a Navy high-resolution radar techniques investigation; measurements on this filter are presented as experimental verification of the design technique.



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Optimal 3-Port Power Dividers Derived from Hybrid-T Prototypes

S. David and W.K. Kahn. "Optimal 3-Port Power Dividers Derived from Hybrid-T Prototypes." 1967 G-MTT International Microwave Symposium Program and Digest 67.1 (1967 [MWSYM]): 54-57.

This paper deals with 3-port power dividers which are optimal in the sense of excellent impedance match at all ports, low insertion loss in the normal mode of operation, and high isolation between the output ports. These optimal 3-port characteristics are in large measure common to those of 4-port hybrid-T junctions with a terminated sum or difference port; furthermore, the design of these optimal 3-ports may be derived from corresponding terminated hybrid-T prototypes. Their major advantages over the latter reside in relative compactness and/or simplicity of structure. The discussion here emphasizes a unified approach applicable to the design of a whole class of junctions; in fact, three such power dividers were designed, constructed, and tested.

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Electrically Short 90° Couplers Utilizing Lumped Capacitors

C.W. Gerst. "Electrically Short 90° Couplers Utilizing Lumped Capacitors." 1967 G-MTT International Microwave Symposium Program and Digest 67.1 (1967 [MWSYM]): 58-62.

The ultimate size of many microwave components such as beam-forming networks, switching trees, amplifiers, mixers, comb filters, etc., is related to the size of a 90° coupler. The cross-section of a coupler can be reduced by means of today's integrated circuit technology. This paper presents a method of reducing the length of a coupler over and above length reductions possible by means of the utilization of a high dielectric constant medium.

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Abstracts

A Stripline Directional Coupler Utilizing a Non-Homogeneous Dielectric Medium (1967 [MWSYM])

J.E. Dalley. "A Stripline Directional Coupler Utilizing a Non-Homogeneous Dielectric Medium (1967 [MWSYM])." 1967 G-MTT International Microwave Symposium Program and Digest 67.1 (1967 [MWSYM]): 63-65.

In the conventional 3 db directional coupler, shown schematically in Figure 1a, equal output signals appear at ports 2 and 3 when port 1 is used as the input. No signal appears at port 4. The effective dielectric constant for the even mode (ϵ_{re}) must be approximately equal to the effective dielectric constant for the odd mode (ϵ_{ro}) to assure equal propagation velocities which are essential for this type of coupler.



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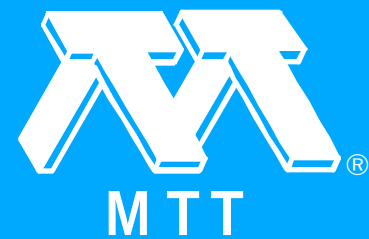
A Non-Reciprocal Ferrite Hybrid

M. Omori. "A Non-Reciprocal Ferrite Hybrid." 1967 G-MTT International Microwave Symposium Program and Digest 67.1 (1967 [MWSYM]): 66-69.

The paper reports a new type of ferrite device, a single junction, nonreciprocal hybrid. There are four symmetrical ports exiting from the junction any one of which may be considered the input. The input energy splits into the two side ports with the signals 90° out of phase from each other. The opposite port is isolated from the input. The phase shift between any two ports is nonreciprocal. Further, with shunts placed properly on the side ports, the device becomes a gyrator. First, the realizability of the device is shown by satisfying the unitary condition of the idealized scattering matrix. Then the operation of the hybrid is explained by the combination of two degenerate modes of the junction. Finally, the performance of an actual L-band model is shown.

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High Power UHF Y Junction Circulator

Y. Konishi. "High Power UHF Y Junction Circulator." 1967 G-MTT International Microwave Symposium Program and Digest 67.1 (1967 [MWSYM]): 70-72.

The nonlinearity and characteristics deviation of ferrite caused by rising temperature should be considered in a CW high power circulator. The nonlinearity of ferrite operated at above resonance occurs at a comparatively low power level in a polycrystal. Such a phenomena is not observed in a single crystal, as shown in Fig. 1(a), which shows the experimental results of low power simulation by a lumped element circulator. And the nonlinearity takes place only under CW power and not under pulsed power, as illustrated in Fig. 1(b). The above phenomena are supposedly caused by the local heating by the spin wave generation around pore regions of polycrystals where the internal DC field is below resonance by the demagnetizing and anisotropic field in their vicinities.

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Abstracts

S-Band Latching Circulator with 10-Nanosecond Switching Speed

P.C. Goodman and C.P. Tresselt. "S-Band Latching Circulator with 10-Nanosecond Switching Speed." 1967 G-MTT International Microwave Symposium Program and Digest 67.1 (1967 [MWSYM]): 73-76.

This paper discusses the development of an S-band latching circulator capable of being switched in 10 nanoseconds. The switch operates with good isolation and insertion loss characteristics and requires relatively low switching energy.



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Abstracts

A New Type of Latching, Switchable, Ferrite-Junction Circulator (1967 [MWSYM])

W.W. Sienkanowicz and W.A. Schilling. "A New Type of Latching, Switchable, Ferrite-Junction Circulator (1967 [MWSYM])." 1967 G-MTT International Microwave Symposium Program and Digest 67.1 (1967 [MWSYM]): 77-80.

For a long time, ferrite-junction circulators required an externally applied dc magnetic field provided by either permanent magnets or electromagnets. Recently, significant progress has been made in the development of switchable, latching, single-function, ferrite circulators in waveguide and stripline circuits. This paper presents approximate theoretical results and initial performance data on a new type of circulator, a three-part, strip-line, latching, switchable circulator illustrated schematically in Fig. 1. This circulator employs two latched ferrite elements placed between a central conductor and two ground planes. Each element provides a closed magnetic path through the ferrite cylinder and ring, and two ferrite or high-remanence metal discs. The ferrite operates at remanence after passage of a direct current pulse. Switching (i. e., reversal of transmitting and isolating parts) is achieved by reversal of the polarity of the pulse.



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Broadband Latching Waveguide Circulator

J.W. Simon, W.K. Alverson and J.E. Pippin. "Broadband Latching Waveguide Circulator." 1967 G-MTT International Microwave Symposium Program and Digest 67.1 (1967 [MWSYM]): 81-84.

There exist two basic approaches for the construction of a latching junction circulator in rectangular waveguide. The first of these utilizes a ferrite element having a closed magnetic path contained entirely within itself (that is, the entire ferrite toroid is contained within the region of microwave interaction). Structures of this type have been used previously to produce circulation over a bandwidth of approximately 15%. Devices of this type may be called internal return path circulators. The second approach requires that the magnetic return path be outside the microwave structure and shielded from the RF energy. Devices of this type are called external return path circulators.

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A High Power, Y Junction, E-Plane Circulator

J.W. McGowan and W.H. Wright, Jr.. "A High Power, Y Junction, E-Plane Circulator." 1967 G-MTT International Microwave Symposium Program and Digest 67.1 (1967 [MWSYM]): 85-87.

The need for a small, lightweight, high-power circulator for duplexer operation at 9375 MHz has led to the development of a symmetrical E plane, Y junction circulator capable of handling in excess of $\frac{1}{2}$ MW peak and 650W average power. This does not represent the ultimate, however, since equipment limitations allow tests only up to these powers. The circulator will perform adequately in the frequency range of 9.0 to 9.6 GHz. Figure 1 is a plot of insertion loss as a function of frequency at low power levels. A resonant absorption peak appeared in the frequency range; however, this peak can be moved from one frequency to another with only a slight field adjustment.

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Latching Ferrite Phase Shifter for Scanning Dielectric Lens

P.J. Meier and B.J. Musso. "Latching Ferrite Phase Shifter for Scanning Dielectric Lens." 1967 G-MTT International Microwave Symposium Program and Digest 67.1 (1967 [MWSYM]): 88-90.

In recent years, numerous latching ferrite phase shifters have been designed in rectangular and circular waveguide, stripline, and slow-wave structures. In all these devices, metal walls have surrounded the ferrite and played a major role in guiding the wave. A new device is now described in which no metal walls surround the phase shifter and the ferrite itself guides the wave. This unique device is intended for use in a scanning lens as shown in Figure 1. In Figure 1A we see a conventional optically-fed array in which a signal is radiated from a feed, captured by antennas at one face of the array, phase shifted in waveguide or coaxial devices, and reradiated by antennas at the opposite face. In Figure 1B the separate components of the conventional lens have been replaced by an array of ferrite tubes capped by dielectric impedance-matching elements. A wave is captured at one surface of the lens, guided by the ferrite, phase shifted according to the remanent magnetization of the ferrite, and reradiated at the opposite face. The latching wires which pass through the center of the ferrite are small enough to have a negligible effect on the RF propagation.

Click on title for a complete paper.



Polarization Insensitive Phase Shifter for Use in Phased Array Antennas

M.C. Mohr and S.R. Monaghan. "Polarization Insensitive Phase Shifter for Use in Phased Array Antennas." 1967 G-MTT International Microwave Symposium Program and Digest 67.1 (1967 [MWSYM]): 91-94.

Theory of Operation - The theory of operation of a non-reciprocal circularly polarized (CP) phase shifter has been described in a paper by the authors, and the PIP device is simply a modification. The CP phaser can be converted into a PIP device through the modification indicated in Figure 1. A second ferrite rod is placed in tandem with respect to the first, and a coil is wrapped around the second rod in the opposite direction so that the internal magnetization of the second rod opposes that of the first. Since the magnetic fields are reversed for the two rods, the phase-current characteristics for each rod are mirror images. For a given positive value of coil current (I_{coil}) and right-handed circular polarization input, rod No. 2 delivers a phase delay of $\phi/2$, and rod No. 1 delivers a phase advance of $\phi/2$. The total reciprocal phase shift through the device is, therefore, a phase delay of $\phi = |\phi/2| - |\phi/2|$. If left-handed circular polarization were applied to the phase shifter instead of right-handed, the first rod would give a phase delay, and the second would give a phase advance for the same direction of coil current. In other words, the roles of the two rods would be reversed, but the phase shift through the device would still be a phase delay of ϕ .

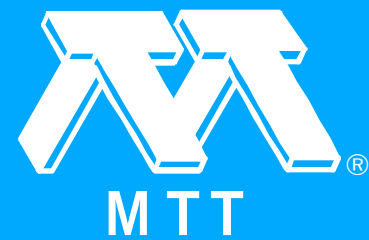


Abstracts

A General Theory for Spin-Wave Suppression in Ferrites

C.D. Hannaford and M.J. Howes. "A General Theory for Spin-Wave Suppression in Ferrites." 1967 G-MTT International Microwave Symposium Program and Digest 67.1 (1967 [MWSYM]): 95-99.

When the microwave magnetic field applied to a ferrite polarised by a static magnetic field set to a value below that required for resonance exceeds a certain threshold value, unstable spin waves cause absorption of energy in the ferrite. This effect, termed the subsidiary absorption, manifests itself in a ferrite component as a non-linear increase in attenuation above a critical power level and can far exceed the attenuation at low power levels. There are two ways of suppressing such non-linear loss. One is to reduce the grain size of the ferrite so as to break up the unstable spin waves; the other achieves the same result by frequency modulation of the microwave field or amplitude modulation of the applied static field. These modulation methods are discussed in this paper, and for reasons outlined later, only the parallel-pump instability is considered.



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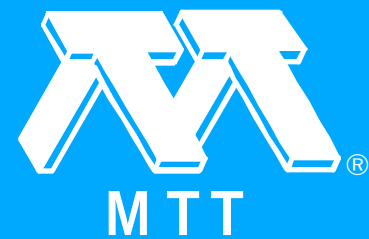
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Dependence of Peak Power Threshold Upon $\omega M / \omega$

J.J. Green, J.A. Hillier and J.H. Saunders. "Dependence of Peak Power Threshold Upon $\omega M / \omega$." 1967 G-MTT International Microwave Symposium Program and Digest 67.1 (1967 [MWSYM]): 100-102.

Recently it has been reported that a significant increase in peak power performance could be achieved in latching type ferrite phase shifters through the use of materials of low $\omega M / \omega$, $\omega M / \omega = \gamma 4 \pi M / \omega s$. Because of the obvious importance of such a possibility, we decided to examine the dependence of peak power threshold upon $\omega M / \omega$.

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Abstracts

Non-Linear Threshold in Remanent Ferrite

E. Stern. "Non-Linear Threshold in Remanent Ferrite." 1967 G-MTT International Microwave Symposium Program and Digest 67.1 (1967 [MWSYM]): 103-106.

The onset of non-linear loss in remanent ferrite devices is a complicated problem which has interested several workers in the past half decade. The essential difficulty with the problem is that ferrite in the remanent state possesses localized areas (domains) wherein the effective fields can be as low as the anisotropy field, H_{A} , and as high as $4\pi M_{\text{s}} + H_{\text{A}}$. Recently, Betts measured the threshold power in a helical phase shifter on a wide variety of substituted garnet materials. Betts observed non-linear thresholds which had escaped the notice of other workers by using measurement procedures sensitive to attenuation changes of .01 db. He was able to show that the threshold field varied roughly as m_{s}^{-2} even for m_{s} values of less than .35.



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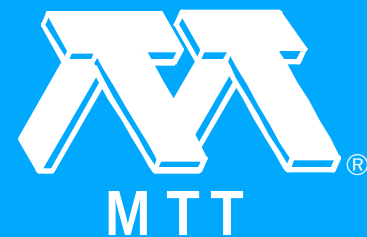


Abstracts

Operating Dynamics and Performance Limitations of Ferrite Digital Phase Shifters (1967 [MWSYM])

G.P. Rodrigue, J.L. Allen, L.J. Lavedan and D.R. Taft. "Operating Dynamics and Performance Limitations of Ferrite Digital Phase Shifters (1967 [MWSYM])." 1967 G-MTT International Microwave Symposium Program and Digest 67.1 (1967 [MWSYM]): 107-110.

Concerted efforts expended in the development of waveguide ferrite digital phase shifters have resulted in significant contributions to a precise understanding of these devices. The technology has now progressed to a point where rather definite performance capabilities and limitations can be discussed. Achievable phase shift and loss are normally restricted by constraints imposed by the intended application. Optimum performance clearly must be defined in the light of size, weight, and power handling ability requirements.



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Abstracts

Computer-Aided Analysis as a Quantitative Design Tool for Ferrite Phase Shifters and Resonance Isolators

J.L. Allen. "Computer-Aided Analysis as a Quantitative Design Tool for Ferrite Phase Shifters and Resonance Isolators." 1967 G-MTT International Microwave Symposium Program and Digest 67.1 (1967 [MWSYM]): 111-114.

The use of digital computers as a tool in the analysis of ferrite devices permits a significant change in design philosophy. It is becoming increasingly apparent that no longer is it necessary to restrict the role of the theoretical analysis of ferrite components to that of providing design guidelines. To be sure, providing general guidelines and developing meaningful physical and mathematical models is and will remain an important task of the analyst, especially in the investigation of new devices. In addition to this traditional role, however, through computer-aided analysis, precise design information can now in many cases be provided. Once the analysis programs for a basic configurational type are established, a few minutes of computation time can suffice to examine a variety of trial device configurations having different dimensions and/or material parameters. By taking advantage of this capability, a large portion of the experimental cut-and-try normally required to arrive at a satisfactory design can be replaced by a few runs on the computer.



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Non-Reciprocal Remanence Phase Phase Shifters in H-Guide

E. Stern. "Non-Reciprocal Remanence Phase Phase Shifters in H-Guide." 1967 G-MTT International Microwave Symposium Program and Digest 67.1 (1967 [MWSYM]): 115-116.

Considerable attention is being given to the development of miniature microwave components for phased array applications. The H-guide configuration shown schematically in Fig. 1 and in cross-section in Fig. 2 can be miniaturized readily by employing a dielectric rib with a high dielectric constant and by closing the magnetic flux path outside the microwave region with a composite magnetic circuit. By contrast, waveguide remanence phase shifters cannot be miniaturized as readily because a reduction of width increases the frequency sensitivity, and a reduction of height produces a loss of phase shift as a result of the corner effects.

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Ferrite Microstrip Propagation

D.C. Buck. "Ferrite Microstrip Propagation." 1967 G-MTT International Microwave Symposium Program and Digest 67.1 (1967 [MWSYM]): 117-120.

The object of this program has been to evaluate the utility of ferrite microstrip devices which use externally applied magnetic fields as opposed to latched remnant fields. Although the latched devices call for less average magnetic field current, devices with externally applied fields show promise of greater figure of merit. Since Reggia-Spencer devices can achieve figures of merit in excess of 1000° / dB, it was decided to investigate the potentialities of externally magnetized devices in an attempt to increase figure of merit and bandwidth, and to reduce size and weight compared to the Reggia-Spencer device.

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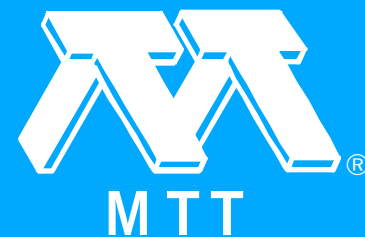


Abstracts

On Wave Propagation in Periodic Media Containing Ferrite

J.E. Goell. "On Wave Propagation in Periodic Media Containing Ferrite." 1967 G-MTT International Microwave Symposium Program and Digest 67.1 (1967 [MWSYM]): 121-124.

Periodic structures are used as filters and as interaction structures in microwave tubes. In this paper some of the effects of anisotropic loading are discussed. It is shown that plane structures can be used for separating modes and that proper loading of waveguide circuits with anisotropic media causes their omega - beta plots to be shifted. A ring circuit is discussed which has the nonreciprocal property that the phase shift from one port to another is the negative of the phase shift in the reverse direction. In all cases the medium is assumed to be lossless ferrite; however, the conclusions also apply to plasmas and optically active media.



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Abstracts

High Dielectric Substrates for Microwave Hybrid Integrated Circuitry

G.D. Vendelin. "High Dielectric Substrates for Microwave Hybrid Integrated Circuitry." 1967 G-MTT International Microwave Symposium Program and Digest 67.1 (1967 [MWSYM]): 125-128.

Microstrip transmission-line components are finding wide application in microwave integrated circuits. Properties of the microstrip structure have previously been investigated for semiconductor dielectrics, low-dielectric ($k < 10$) ceramics, sapphire, and Polyguide. This paper will present the properties of high-dielectric ($k > 10$) substrates in the microstrip configuration.



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Microstrip Transmission Lines on High Dielectric Constant Substrates for Hybrid Microwave Integrated Circuits

K.C. Wolters and P.L. Clar. "Microstrip Transmission Lines on High Dielectric Constant Substrates for Hybrid Microwave Integrated Circuits." 1967 G-MTT International Microwave Symposium Program and Digest 67.1 (1967 [MWSYM]): 129-131.

Among the various approaches to the design of microwave integrated circuits, thick film hybrids combine a relative ease of manufacturing with excellent performance at the lower portion of the microwave frequency spectrum where high performance semiconductor devices are now available in a wide variety. When using conventional ceramic substrates for such circuitry, limitations exist in solving the problem of obtaining maximum degree of compactness at very low impedance levels required for optimum power handling capability of active semiconductor devices. One approach to this problem discussed here is the utilization of microstrip transmission line circuits on substrates with very high dielectric constants ($\epsilon_r = 33$). A theoretical analysis of the microstrip transmission line structure, when based on conformal mapping techniques with the usual simplifying assumption of homogeneity throughout the entire field region, is entirely inaccurate when applied to high dielectric constants as considered here. A solution of this problem is presented which applied well known finite difference approximations of Laplace's equation in combination with a successive over-relaxation program on a digital Computer.



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Microstrip Circuitry for Integrated Transistor Amplifiers

R.F. Mayo, S.P. Knight and R. Ekholdt. "Microstrip Circuitry for Integrated Transistor Amplifiers." 1967 G-MTT International Microwave Symposium Program and Digest 67.1 (1967 [MWSYM]): 132-135.

Experimental and theoretical techniques are described which have been found useful in the development of integrated amplifiers for use at 1.2 Gc/sec and 2.0 Gc/sec. The three most important design objectives are that these amplifiers shall: (a) have adequate bandwidth. (b) be of small dimensions. (c) have low ohmic losses. These requirements often conflict and the design is usually a compromise. However, for the RCA developmental transistors which we have used, matching circuits giving 1 dB bandwidths of greater than 10% can be attained with combinations of two step transformers and open and shorted stubs.

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Microstrip Hybrid Couplers and Their Integration Into Balanced Mixers at X and K-Bands

R.E. Blight. "Microstrip Hybrid Couplers and Their Integration Into Balanced Mixers at X and K-Bands." 1967 G-MTT International Microwave Symposium Program and Digest 67.1 (1967 [MWSYM]): 136-138.

A number of 3 db couplers have been designed for microstrip transmission lines utilizing materials with dielectric constants between 9 and 11 for integration with other microstrip elements to form balanced mixers, power dividers, phase shifters, etc. Two- and three-arm branch-line couplers and the T.E.M. back coupler have been developed on alumina, gallium arsenide and sapphire between 8-18 GHz/s. For initial evaluation, the couplers were fabricated on small area substrates and housed in metal boxes to minimize the possibility of mode conversion and loss by radiation. Microstrip line lengths external to the couplers were quite small and measured loss values were primarily due to path lengths within the coupler. Measurements were made with coaxial equipment after matching the junction discontinuity that normally occurs between coaxial and microstrip lines.

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Abstracts

Lumped Elements in Microwave Integrated Circuits (1967 [MWSYM])

D.A. Daly, S.P. Knight, M. Caulton and R. Ekholdt. "Lumped Elements in Microwave Integrated Circuits (1967 [MWSYM])." 1967 G-MTT International Microwave Symposium Program and Digest 67.1 (1967 [MWSYM]): 139-141.

The cost of manufacturing an integrated circuit is inversely related to the number of circuits processed simultaneously on a single starting wafer. Most of the work on microwave integrated circuits reported to date has concentrated on applications using microstrip lines deposited on high-resistivity semiconducting and ceramic substrates. At X-band frequencies and above the overall size of the distributed microstrip circuits is relatively small, but at lower frequencies (L- and S-band) the circuits tend to become large enough so that it is difficult to process many on a single substrate. At L- and S-band, however, lumped elements may be used with a considerable size reduction. Circuits can be fabricated by low-frequency integrated circuit and device technology that are sufficiently small compared to a wavelength so that they behave as true lumped elements up to reasonably high frequencies. There are many applications in which the reduction in circuit Q for lumped elements due to the low volume for energy storage is out-weighed by the advantages of size reduction.



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All Garnet Microstrip Circulators for Integrated Circuits

B. Hershenov. "All Garnet Microstrip Circulators for Integrated Circuits." 1967 G-MTT International Microwave Symposium Program and Digest 67.1 (1967 [MWSYM]): 142-144.

In a recent report by the author results were presented for an X-band 3-port microstrip circulator. A YIG disc was embedded in a ceramic substrate and copper lines, disc, and ground plane were deposited on this composite substrate. Figure 1 is a photograph of a typical microstrip circulator. Unfortunately, cementing a YIG disc into a ceramic substrate is not an ideal approach to integrated microwave circuits. Ideally, an all garnet substrate would be more practical by combining simplicity of design with ease of fabrication. This paper reports the results obtained with all garnet substrate 3-port microstrip circulators. Results are reported using an electromagnet and a small permanent magnet. In addition, a latched version of a microstrip circulator was built and successfully tested. The latched version lends itself to simple mass production techniques.

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Abstracts

A Thin Film X-Band Varactor Quadrupler (1967 [MWSYM])

J.B. Horton. "A Thin Film X-Band Varactor Quadrupler (1967 [MWSYM])." 1967 G-MTT International Microwave Symposium Program and Digest 67.1 (1967 [MWSYM]): 145-146.

Microwave integrated circuit components continue to be reported and in many applications have exhibited performance equal to or exceeding existing conventional components. Most of these components fall into the category of single frequency band operation, as is normal for phase shifters, mixers, amplifiers, T-R switches, etc., and single values for wave propagation factor and transmission line loss are adequate for design parameters. Multiplier generation involves two or more frequency bands of operation and consequently poses the additional problems of treating the propagation medium and its microwave circuitry losses over a large frequency range. In microstrip transmission line this problem is particularly severe because of the variation of the velocity of propagation factor as a function of frequency as well as impedance. This effect has been characterized for ceramic substrate by Vincent, and results indicate that it can be minimized by choosing impedance of 50 ohms or greater. Circuit losses increase rapidly as a function of wavelength, however, and can be minimized only by keeping microstrip line lengths to a minimum. It follows from these considerations that multiplier designs, in particular the multifrequency circuits such as shorted stubs, etc., should contain microstrip lines of 50 ohm or greater where feasible, and should be of minimum length, especially for higher frequencies.



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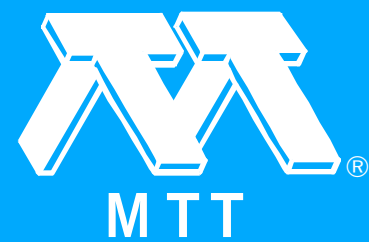
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Computer Analysis of Microwave Integrated Switches

H.E. Stinehelfer, Sr.. "Computer Analysis of Microwave Integrated Switches." 1967 G-MTT International Microwave Symposium Program and Digest 67.1 (1967 [MWSYM]): 147-149.

The circuit analysis of microwave networks composed of distributed transmission lines and lumped circuit elements soon become complex when the transmission lines employed have significant loss that must be considered. The many possible combinations of lumped circuit parameters and the use of shorted and open stubs to form resonant circuits useful for the control of microwave energy make it very necessary to use the computer to do the complex calculations for circuit analysis. Such a program must contain the possibility then for the user to specify not only the network numerical values but the way in which these network components are connected. In general the characteristics of a network can be computed from its ABCD matrix. The specification of a network is then broken down into its simplest form called a SECTION, each SECTION being specified by eleven parameter values or circuit TYPE designations. When each SECTION is so specified the computer calculates the transfer ABCD matrix for this section of the network and combines this matrix to the preceding SECTIONS by matrix multiplication before considering the next section of the network. A Flow Diagram for the computer program is shown in Fig. 1. After the first data card containing a name and number for identification is read the input data for the first case or problem is read. The computer then prints out the titles and input data so specified for the user to check the PARAMETER values and control TYPE numbers given in the data. The specified PARAMETER changes are made in the SECTIONS designated and a set of changes called the VARIABLE is made to the network. The VARIABLE becomes the horizontal axis for plotting the characteristics of the network and the PARAMETER changes generate a family of curves for the network analysis. After each change in the VARIABLE the ABCD matrix is calculated and/or stored in core for later plotting. After all changes in the VARIABLE and PARAMETER are complete, a tape is generated to control the plotting of the network characteristics by the High Speed Microfilm Recorder SC-4020.



Abstracts

Recent Advances in Bulk Semiconductor Microwave Devices in Japan

T. Okoshi. "Recent Advances in Bulk Semiconductor Microwave Devices in Japan." 1967 G-MTT International Microwave Symposium Program and Digest 67.1 (1967 [MWSYM]): 150-152.

Recent achievements and state-of-the-art in the bulk semiconductor microwave devices in Japan will be described. The discussions will be limited to GaAs Gunn oscillators unless otherwise stated. Devices other than Gunn oscillators will be discussed in the final section.



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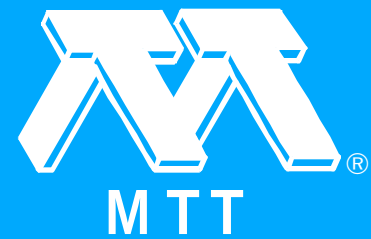


Abstracts

Status and Future of IMPATTS

B.C. De Loach. "Status and Future of IMPATTS." 1967 G-MTT International Microwave Symposium Program and Digest 67.1 (1967 [MWSYM]): 153-153.

The state of the art of the (IMPATT) Avalanche Transit Time Diodes will be discussed. A brief qualitative discussion of the operating principles of these devices will be followed by a detailed summary of the experimental and theoretical advances to date.



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Series Stacked Varactors for High Power, High Frequency Applications

W. Jann, T. Miles and J. DiBona. "Series Stacked Varactors for High Power, High Frequency Applications." 1967 G-MTT International Microwave Symposium Program and Digest 67.1 (1967 [MWSYM]): 154-156.

In 1965 Irwin and Swan of BTL, and also Varian Associates in February 1967, demonstrated that series-connecting of two or more varactors enables one to obtain on the order of five times increase in power handling capability of a varactor multiplier, compared to a single element device. They showed that the total BVR is the sum of the BVR's of the individual devices, the $C_{\text{sub } j}$ is the series sum of the capacitances, and the $f_{\text{sub } c}$ is approximately equal to that of the individual chips. If N devices are series-connected and if the capacitance of the assembly is to be kept constant, the individual chip can have a value of capacitance approximately N times as large as that of the series-connected assembly. This can provide a thermal resistance decreased by about the same ratio, provided adequate heat sinking is provided. The author of the above papers partially demonstrated the possible advantages of series connection of varactors by soldering two, three or four packaged varactors together, one on top of the other. They did not realize the full power dissipation capability of series-connected varactors, because, in their assemblies, only the bottom varactor which was attached to the heat sink, was efficiently cooled.

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Iterative Synthesis of Varactor-Multiplier Microwave Networks and a Doubler with 0.17 Watt Output at 47 GHz

D.H. Steinbrecher, M.E. Goff and A.H. Solomon. "Iterative Synthesis of Varactor-Multiplier Microwave Networks and a Doubler with 0.17 Watt Output at 47 GHz." 1967 G-MTT International Microwave Symposium Program and Digest 67.1 (1967 [MWSYM]): 157-160.

The use of dynamic impedance contours in the design and evaluation of microwave varactor circuits has been described by Kurokawa. His work was directed primarily toward parametric amplifiers. Kurokawa developed lossless circuit models to represent input and pump coupling networks for varactor diodes in microwave circuits. C. B. Swan used similar methods in the evaluation of a microwave varactor tripler. Swan included one component of circuit loss in his model and explained the characteristics of optimum dynamic impedance contours for a tripler. We present optimum contours for the input and output networks of all varactor multipliers and a simple calculation of overall circuit efficiency in the presence of lossy coupling networks. We also present the results for a varactor doubler designed for 23.5-47 GHz with an output power of 173 mW and an efficiency of 33%.

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Abstracts

YIG Tuned and Varactor Tuned L-Band Transistor Oscillator

K. Hunton. "YIG Tuned and Varactor Tuned L-Band Transistor Oscillator." 1967 G-MTT International Microwave Symposium Program and Digest 67.1 (1967 [MWSYM]): 161-164.

Voltage tunable oscillators covering the full octave range 1 to 2 GHz have been constructed using either a YIG resonator or a varactor diode as the variable element. It is the purpose of this paper to present a guide to the design of these oscillators and to compare their performance and their limitations.



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Frequency Modulation of Avalanche Transit Time Oscillators (1967 [MWSYM])

J.W. Amoss and K.E. Gsteiger. "Frequency Modulation of Avalanche Transit Time Oscillators (1967 [MWSYM])." 1967 G-MTT International Microwave Symposium Program and Digest 67.1 (1967 [MWSYM]): 165-167.

Electronic tuning of avalanche transit time oscillators has been treated explicitly by Gilden and Hines and both theoretically and experimentally by others. Since moderate output power from these devices is now being realized, the ease of electronic tunability suggests their use as transmitters in miniature solid state altimeters and low power communication systems. This paper presents experimental data taken to determine the frequency modulation characteristics of avalanche transit time oscillators.

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A High Speed Binary Pulse Regenerator in Microwave Frequencies

M. Sugiyama, Y. Matsuo and A. Saeki. "A High Speed Binary Pulse Regenerator in Microwave Frequencies." 1967 G-MTT International Microwave Symposium Program and Digest 67.1 (1967 [MWSYM]): 168-170.

In a long-distance communication system by means of pulse code modulation, repeaters are set along the route of transmission in order to regenerate pulses which have been degraded by several types of distortion due to noise, bandwidth limitations and other effects. Recently, a bit rate of PCM shows a extending tendency to much higher, for the transmission of television, picturephone and other broadband signals. Therefore, functions of the pulse regenerator are required to handle higher bit rate signals for the previously mentioned uses. The methods of regeneration and the experiments described here are concerned with regenerating high speed PCM-AM pulses directly at 10.6 GHz, using a hysteresis characteristic and a locking oscillation characteristic of an Esaki-diode oscillatar. Method of the regeneration

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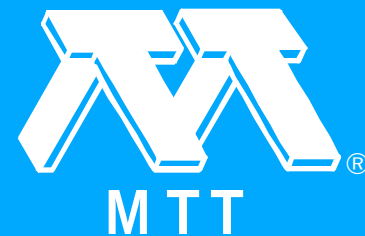


Abstracts

Microwave Propagation and Faraday Effect in a Solid State Plasma Waveguide

H.J. Kuno and W.D. Hershberger. "Microwave Propagation and Faraday Effect in a Solid State Plasma Waveguide." 1967 G-MTT International Microwave Symposium Program and Digest 67.1 (1967 [MWSYM]): 171-173.

The conductivity of a solid-state plasma which consists of free electrons and holes in a solid such as a semiconductor becomes a tensor quantity under a dc magnetic field.



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Abstracts

Varactor Linear Microwave Phase Modulator

R.V. Garver. "Varactor Linear Microwave Phase Modulator." 1967 G-MTT International Microwave Symposium Program and Digest 67.1 (1967 [MWSYM]): 174-176.

A continuous phase modulator can be made by placing a varactor diode on one terminal of a circulator. Power in the first port of the circulator is reflected by the diode on the second port, and emerges from the third port with a phase and amplitude dictated by the reflection coefficient of the diode. As the reverse bias voltage of the varactor is varied the reflection coefficient magnitude remains high and the phase changes. The modulator requires very little modulation power and responds quickly to changes in modulation voltage. The phase modulator typically has a non-linear voltage-phase relationship, insertion loss that varies with phase, and less than 180° modulation. For most applications the phase should be linear with voltage, the insertion loss should not vary and the modulator should be able to provide 360° modulation.



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A Subnanosecond X-Band Pulse Modulator

D.K. Adams, B.M. Schiffman and R.B. Larrick. "A Subnanosecond X-Band Pulse Modulator." 1967 G-MTT International Microwave Symposium Program and Digest 67.1 (1967 [MWSYM]): 177-179.

Step and impulse waveforms are serving an increasingly important role in modern microwave technology. Historically, radar has been the most important application for abruptly changing waveforms. An important new application is time-domain reflectometry; where abrupt baseband waveforms are used to resolve transmission line discontinuities. Baseband waveforms (those whose spectrum begins essentially at zero frequency) are particularly useful for observing discontinuities in characteristic impedance. When frequency sensitive discontinuities are observed, however, the resolution will depend on the amount of high-frequency energy available in the waveform.

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High Power, Octave Bandwidth, SPDT Microwave Switches

J.F. White and K.E. Mortenson. "High Power, Octave Bandwidth, SPDT Microwave Switches." 1967 G-MTT International Microwave Symposium Program and Digest 67.1 (1967 [MWSYM]): 180-182.

Previously, broadband SPDT switches used, principally, diodes in series with the transmission line -- sacrificing high power performance because of the difficulty with removal of the diodes' heat and compromising switching performance due to the inconvenience in tuning to maximize the isolation. Means for broadbanding the "on" state have been suggested, but hitherto undemonstrated is the effectiveness of the approach as well as the availability of a counterpart solution to the problem of broadbanding the "off", or isolation behaviour of a practical switch in which some parasitic series inductance is found. This paper presents: 1) data for a 1-2 Ghz, SPDT, 1.2 db max. loss and 40 db min. isolation, switch tested to 6 kw pk power at 1 μ sec. pulse length and 0.001 duty cycle 2) a design method to permit use of large diode capacity 3) a method for evaluating the effect of parasitic inductance on the "on" state 4) a criterion for minimizing diode ohmic losses 5) tuning requirements to achieve high isolation over broad bandwidths.

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High Power Pin Diode Limiting

P. Basken, K.E. Mortenson and N. Brown. "High Power Pin Diode Limiting." 1967 G-MTT International Microwave Symposium Program and Digest 67.1 (1967 [MWSYM]): 183-184.

Conventional high power diode limiters use a multiplicity of varactor diodes in various microwave circuit configurations. The higher power handling PIN diode is normally unsuitable as a passive limiter due to its slow speed of response. The I region thickness of this PIN ranges between one and five mils with a voltage breakdown range of 200 to 1000 volts. By reducing the I region thickness to less than 0.5 mils, a junction is achieved which will respond rapidly enough to limit effectively at frequencies up to the UHF range. The resulting reduction in junction breakdown voltage is not detrimental as the diode is in a low impedance state during application of high power.

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Ferroelectric Phase Shifters

R. Das. "Ferroelectric Phase Shifters." 1967 G-MTT International Microwave Symposium Program and Digest 67.1 (1967 [MWSYM]): 185-187.

A diagram of the microstrip ferroelectric phase shifter is shown in Fig. 1(a). The nominal thickness of the ferroelectric material is 10 mils. As the dielectric constant of the ferroelectric is very high, the impedance of the microstrip line (/spl sim/15 mils wide) is comparatively low. For matching purposes quarter-wave transformers of TiO/sub 2/ were used. A ceramic ferroelectric material containing 68.5 per cent SrTiO/sub 3/ and 31.5 per cent PbTiO/sub 3/ (PS 68.5) was used in the experiments. For a TEM-mode propagation the insertion phase of a transmission line of length 1 is given by beta 1. Fig. 2 shows the insertion phase of one of the units as measured with a phase discriminator. The total insertion phase at 3.05 Gc/S is 4.434 lambda. Subtracting the insertion phase of the connectors and the quarter-wave transformers the insertion phase of the ferroelectric material alone is 3.486 lambda. On the application of a biasing voltage, the differential phase shift is given by Delta phi=(beta1 - beta2) where beta1 and beta2 are the phase constants without and with bias respectively.





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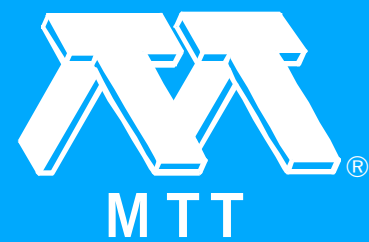
Plasma Varactor X-Band Phase Shifters

J.Y. Wada, R.C. Knechtli, B.J. Forman and A. Fafarman. "Plasma Varactor X-Band Phase Shifters." 1967 G-MTT International Microwave Symposium Program and Digest 67.1 (1967 [MWSYM]): 188-191.

A microwave phase shifter (x-band) which utilizes plasma varactors has been developed. It has demonstrated continuous phase shifting of 360 degrees with low rf loss, low noise and high average rf power handling capability heretofore unobtainable in previous microwave plasma devices or in solid state devices. The plasma varactor is a high Q variable microwave reactance produced by means of a low pressure and highly efficient electron injection mode of gas discharge. Overall rf losses, including the reflection, circuit and plasma losses, smaller than 0.5 dB have been obtained over a bandwidth of 12% at X-band for continuously variable phase angles up to more than 360°. An average power handling capability in excess of 200 W has been obtained from this device. Excess noise temperature of the phase shifter is smaller than 100°K for phase shifts up to 360° over the same frequency range. Extrapolations from the performance of this prototype indicate that the average rf power handling capability could be increased to the multi-KW level, without deterioration of the other characteristics.

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A Multikilowatt X Band Nanosecond Source (1967 [MWSYM])

H. Goldie. "A Multikilowatt X Band Nanosecond Source (1967 [MWSYM])." 1967 G-MTT International Microwave Symposium Program and Digest 67.1 (1967 [MWSYM]): 192-193.

We have recently investigated several possible methods of generating nanosecond pulses of relatively large amplitude. By employing a 25-kilowatt magnetron X-band pulser, a four-port circulator, and two thyatron waveguide switches, we have generated a 19-kilowatt output pulse (see figure 1) the half-power pulsewidth of which is 10 nanoseconds. The risetimes and falltimes are 2 and 4 nanoseconds, respectively. The width at -10, -13, -20, and -23 dB down from the peak value is 12.5, 15, 20, and 22 nanoseconds, respectively. Increasing the peak power level to 50 kW resulted in a narrower pulse (~7 nanoseconds) with a risetime of 1.5 nanoseconds. Though the experiment was limited by the maximum power output of the laboratory magnetron, theory indicates even shorter pulses with steeper skirts at higher power levels (~1/4 megawatt in X-band).

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Abstracts

Realization of Microwave Circuit Functions Using Acoustic Waves

E.A. Ash. "Realization of Microwave Circuit Functions Using Acoustic Waves." 1967 G-MTT International Microwave Symposium Program and Digest 67.1 (1967 [MWSYM]): 194-194.

The existence of materials having a very low acoustic loss per wavelength, and the recent marked advances in the performance of transducers at microwave frequencies, suggest that it might prove possible to construct microwave components using acoustic waves. The main attraction of this possibility is seen to lie in the size reduction, by a factor of $10/\sqrt{5}$, which is implied.



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Abstracts

Current Status of Microwave Delay Lines

H.J. Shaw. "Current Status of Microwave Delay Lines." 1967 G-MTT International Microwave Symposium Program and Digest 67.1 (1967 [MWSYM]): 195-195.

A number of approaches have been investigated or suggested which can delay and process microwave signals by using electromagnetic, acoustic and magnetic propagation in materials. Some of these approaches will be summarized and their capabilities and limitations will be discussed. Delay, delay variation, bandwidth, dispersion and attenuation will be considered, including their dependence on the available coherent of materials. Optical approaches involving coherent Brillouin scattering will be included in the discussion.



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Broadband, Fixed Tuned, Acoustic Delay Lines at L and S Band Frequencies

L.R. Whicker, P.F. Carcia and G.E. Evans. "Broadband, Fixed Tuned, Acoustic Delay Lines at L and S Band Frequencies." 1967 G-MTT International Microwave Symposium Program and Digest 67.1 (1967 [MWSYM]): 196-198.

This paper is concerned with the design and development of broadband, fixed tuned, non-dispersive delay lines. These delay lines utilize multi-layer transducers incorporating C dS thin films of the type used by deKlerk, sapphire delay media, and suitable electrical matching networks in either coaxial or strip transmission lines. The design of two broadband units are presented which operate at center frequencies of 1.80 GHz and exhibit 50 db bandwidths of approximately 50% with midband loss of approximately 40 db. The experimental data for these units are found to be in good agreement with theoretical values.



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Frequency Modulation and Translation with Magnetoelastic Waves in YIG

B.A. Auld, J.H. Collins and H.R. Zapp. "Frequency Modulation and Translation with Magnetoelastic Waves in YIG." 1967 G-MTT International Microwave Symposium Program and Digest 67.1 (1967 [MWSYM]): 199-201.

A magnetoelastic wave propagating in yttrium iron garnet (YIG) can be frequency translated or frequency modulated by pulsing the biasing magnetic field. Room temperature experiments of this kind are described here for a (100) rod of single crystal YIG, of 7.35 mm length and 2.94 mm diameter, axially biased into the magnetoelastic regime. Spatially orthogonal shorted fine wire couplers are utilized for excitation and detection. A coil wound along the specimen permits the application of a pulse of magnitude ΔH to the biasing field, with rise time short compared with the relaxation of the magnetoelastic waves.

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Two-Port UHF Pulse Compression Via Magnetostatic Waves in YIG Rods

G.E. Bennett and F.A. Olson. "Two-Port UHF Pulse Compression Via Magnetostatic Waves in YIG Rods." 1967 G-MTT International Microwave Symposium Program and Digest 67.1 (1967 [MWSYM]): 202-205.

Dispersive spin wave modes in low-loss single crystals of yttrium-iron-garnet (YIG) have been recognized for some time as candidates for microwave "matched filter" devices with pulse compression applications. In assessing magnetostatic modes for these applications, comparison with magnetoelastic modes is unavoidable. Recently, magnetoelastic pulse compression experiments have been carried out by several investigators. Although wide bandwidths and prospects for linear delay dispersion are evident, there are several delicate problems which must be satisfactorily resolved in any practical device, including magnetoelastic defocusing effects, amplitude fluctuations, satisfactory two-port configurations which take full advantage of the available bandwidths, and the onset of low-level spinwave nonlinearities. Conceding advantages of bandwidth and delay dispersion linearity to the magnetoelastic mode, magnetostatic dispersive lines may well be highly satisfactory where these considerations, are not of prime importance.

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Wideband Pulse Compression Using Magnetoelastic Waves in YIG Rods

H. van de Vaart and R.W. Damon. "Wideband Pulse Compression Using Magnetoelastic Waves in YIG Rods." 1967 G-MTT International Microwave Symposium Program and Digest 67.1 (1967 [MWSYM]): 206-209.

Single crystal YIG dispersive delay lines show great promise as pulse compression filters. Very large bandwidths can be obtained by using magnetoelastic waves in axially magnetized YIG rods. Bandwidths up to 250 MHz have recently been reported in the literature. The dispersion of a YIG rod is nonlinear, but it can be linearized by suitably shaping the internal magnetic field. By bonding YAG quarter-wave plates to the ends of the YIG rod, the filter can be changed from a reflection mode to a transmission mode of operation, with a substantial reduction of direct undelayed leakage. Theoretical and experimental results on these aspects of magnetoelastic pulse compression filters will be described in this paper.

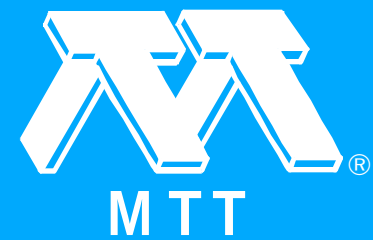
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